Biological Inventory of Rio Grande and Conejos Counties, Colorado
Volume II:
A Natural Heritage Inventory and Assessment of Wetlands and Riparian Areas in Rio Grande and Conejos Counties

Colorado Natural Heritage Program
College of Natural Resources, 254 General Services Building
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A Natural Heritage Inventory and Assessment of Wetlands and Riparian Areas in Rio Grande and Conejos Counties

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USER'S GUIDE

The Biological Inventory of Rio Grande and Conejos Counties, conducted by the Colorado Natural Heritage Program, consists of two essentially distinct projects that are highly integrated with respect to methodology and fieldwork. This report reflects the separate nature of the projects by being organized in a two-volume set. Both projects utilized the same Natural Heritage methodology that is used throughout North America, and both searched for and assessed the plants, animals, and plant communities on the Colorado Natural Heritage Program's list of rare and imperiled elements of biodiversity. Each volume prioritizes potential conservation areas 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 stand-alone and be used independently of the other.

Volume I presents *all* potential conservation areas identified in Rio Grande and Conejos counties that support rare and imperiled plants, animals, and significant plant communities, including wetland and riparian areas. Volume II focuses exclusively on wetland and riparian areas. Volume II also presents "sites of local significance". These sites are among the most important wetlands in Rio Grande and Conejos counties, but they did not support animals, plants or plant communities that are unique from a global or statewide perspective, therefore these sites did not receive a Biodiversity Rank. Additionally, Volume II presents an assessment of the restoration potential and the wetland functions performed by each site that was surveyed. Functional assessments are intended to provide the user with a more complete picture of the value wetlands and riparian areas provide to Rio Grande and Conejos county residents.

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EXECUTIVE SUMMARY

Rio Grande and Conejos counties lie in the southern part of Colorado encompassing parts of the San Juan Mountains and the San Luis Valley. The counties contain a diverse array of habitats including grasslands, shrublands, woodlands, riparian areas, wetlands, montane forests, and alpine tundra. With funding from Colorado Department of Natural Resources (CDNR) (through a grant from the Environmental Protection Agency (EPA), Region VIII) the Colorado Natural Heritage Program was contracted to inventory the counties for wetland and riparian areas of special biological significance. Wetlands and riparian areas occurring on private lands were given the highest priority for inventory. Such locations were identified by: (1) examining existing biological data for rare or imperiled plant and animal species, and significant plant communities (collectively called **elements**) from the Colorado Natural Heritage Program's database, (2) accumulating additional existing information on these elements and, (3) conducting extensive field surveys. Areas that were found to contain significant elements were delineated as "Potential Conservation Areas." These areas were prioritized by considering their biological urgency (the most rare or imperiled) and their ability to maintain viable populations of the elements (degree of threat), and are presented in this report. A functional assessment was conducted at most of the wetland and riparian areas visited using a modified version of the Montana Wetland Field Evaluation Form (Berglund 1996) and the hydrogeomorphic approach (HGM) (Brinson 1993). The restoration potential of each site was also noted.

The inventory documented new records for 38 biologically significant elements, including two plants, 18 plant communities, one mammal, three birds, and two fish. In addition, many older records were updated. Rio Grande and Conejos counties contain a diverse array of wetlands that support a wide variety of plants, animals, and plant communities. At least 48 major wetland/riparian plant communities, 15 birds, 10 plants, 3 fish, and 2 amphibians from the Colorado Natural Heritage Program's (CNHP) list of rare and imperiled plants, animals, and plant communities are known to occur in, or are associated with, wetlands in Rio Grande and Conejos counties.

Nineteen wetland and riparian sites of biodiversity significance are profiled in this report as PCAs. These sites represent the best examples of 48 types of wetland and riparian communities observed on the public and private lands visited. CNHP believes these sites include those wetlands that most merit conservation efforts, while emphasizing that protecting only these sites will, in no way, adequately protect all the values associated with wetlands in Rio Grande and Conejos counties. Additionally, two areas of local significance have been identified based on the local importance of their functions within these two counties. The delineation of PCA boundaries in this report does not confer any regulatory protection on recommended areas. They are intended to be used to support wise land use planning and decision making for the conservation of these significant areas.

Protection and/or proper management of the PCAs would help to conserve the biological integrity of Rio Grande and Conejos counties and Colorado. Of these sites, several stand out as very significant. These harbor some of the world's largest and healthiest populations of the globally imperiled slender spiderflower (*Cleome multicaulis*).

Of the 19 PCAs, we identified four *very significant* (B2), 13 *significant* (B3), two *moderate* (B4), and two sites of local significance. Overall, the concentration and quality of imperiled elements and habitats attest to the fact that conservation efforts in Rio Grande and Conejos counties will have both state and global significance.

Information from this effort can also be used to enhance the development of a program for hydrogeomorphic (HGM) wetland functional assessment by assisting in the identification of wetland subclasses and to better characterize the range of variation within a subclass. Additionally, several of the sites profiled in this report have the potential for use as reference sites, for the ongoing Colorado HGM Characterization Project and the Alamosa and Rio Grande Rivers Watershed Projects. Five sites were specifically identified as reference locations for restoration efforts along the Alamosa River.

In addition to providing important information for Rio Grande and Conejos counties, the data gathered on plant communities will be incorporated into CNHP's on-going Statewide Comprehensive Wetland Classification[1]. Of special note, a unique wetland type currently referred to as an iron fen was documented in Conejos County.

[1] The Statewide Classification is based on the U.S. National Vegetation Classification System (Anderson et al. 1998).

RECOMMENDATIONS

Specific protection and management needs are addressed under the descriptions of individual sites. However, some general recommendations for the conservation of biological diversity in Rio Grande and Conejos Counties are given here.

1. **Work with local, county, state, and federal agencies to develop and implement a plan for protecting the Potential Conservation Areas profiled in this report, with the emphasis directed toward those with biodiversity rank (B-rank) B2 and B3.** The sum of all the sites in this report represents the area CNHP recommends to be considered for conservation action to ensure that the counties' natural heritage is not compromised as the population and associated land uses change. The B2 and B3 sites have global significance and therefore should receive priority attention.

2. **Use this report in the review of proposed activities in or near Potential Conservation Areas to determine whether activities do or do not adversely affect elements of biodiversity.** All of the areas presented contain natural heritage elements of state or global significance. Certain land use activities in or near a site may affect the element(s) present there. Wetland and riparian areas are particularly susceptible to impacts from off-site activities if the activities affect water quality or hydrologic regimes. In addition, cumulative impacts from many small changes can have effects as profound and far-reaching as one large change. As proposed land use changes within Rio Grande and Conejos counties are considered, they should be compared to the maps presented herein. If a proposed project has the potential to impact a site, planning personnel should contact persons, organizations, or agencies with the appropriate biological expertise for input in the planning process. The Colorado Natural Heritage Program, Colorado Natural Areas Program, and Colorado Division of Wildlife routinely conduct environmental reviews statewide and should be considered as valuable resources. To contact CNHP's Environmental Review Coordinator call 970-491-7331.

3. **Develop and implement comprehensive programs to address loss of wetlands.** In conjunction with the information contained in this report, information regarding the degree and trend of loss for all wetland types (e.g., salt meadows, emergent marshes, rich fens, etc.) should be sought and utilized to design and implement a comprehensive approach to the management and protection of Rio Grande and Conejos county wetlands. Such an effort could provide a blueprint for wetland conservation in Rio Grande and Conejos counties.

4. **Increase efforts to protect biodiversity, promote cooperation and incentives among landowners, pertinent government agencies, and non-profit conservation organizations and increase public awareness of the benefits of protecting significant natural areas.** The long-term protection of natural diversity in Rio Grande and Conejos counties will be facilitated with the cooperation of many private landowners, government agencies, and non-government organizations. Efforts to

provide stronger ties among federal, state, local, and private interests involved in the protection or management of natural lands will increase the chance of success.

5. **Promote wise management of the biodiversity resources that exist within Rio Grande and Conejos counties, recognizing that delineation of potential conservation areas does not by itself guarantee protection of the plants, animals, and plant communities.** Development of a site specific conservation plan is a necessary component of the long-term protection of a Potential Conservation Area. Because some of the most serious impacts to Rio Grande and Conejos counties' ecosystems are at a large scale (altered hydrology, residential encroachment, and non-native species invasion), considering each area in the context of its surroundings is critical. Several organizations and agencies are available for consultation in the development of conservation plans, including the Colorado Natural Heritage Program, Colorado Natural Areas Program, the Colorado Division of Wildlife, the Natural Resources Conservation Service, and various academic institutions. With the rate of population growth in Colorado, rare and imperiled species will continue to decline if not given appropriate protection. Increasing the public's knowledge of the remaining significant areas will build support for the initiatives necessary to protect them, and allow proactive planning.

6. **Continue inventories where necessary, including inventories for species that cannot be surveyed adequately in one field season and inventories on lands that CNHP could not access in 1999.** Not all targeted inventory areas can be field surveyed in one year due to either lack of access, phenology of species, or time constraints. Because some species are ephemeral or migratory, completing an inventory in one field season is often difficult. Despite the best efforts during one field season, it is likely that some elements that are present were not documented during the inventory and other important sites have not been identified in this report.

7. **Discourage the introduction and/or sale of non-native species that are known to significantly impact natural areas.** These include, but are not limited to, purple loosestrife, wild chamomile, and non-native fish species. Natural area managers, public agencies, and private landowners should be encouraged to remove these species from their properties. Encourage the use of native species for revegetation and landscaping efforts. The Colorado Natural Areas Program has published a book entitled Native Plant Revegetation Guide for Colorado that describes appropriate species to be used for revegetation. This resource is available on the World Wide Web at http://parks.state.co.us/cnap/Revegetation_Guide/Reveg_index.html.

8. **Encourage and support statewide wetland protection efforts**. County governments are encouraged to support research efforts on wetlands. Countywide education of the importance of wetlands could be implemented through the county extension service or other local agencies. Cultivate communication and cooperation with landowners regarding protection of wetlands in Rio Grande and Conejos counties.

INTRODUCTION

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. Consequently, many wetlands across North America were purposefully drained. Kelly et al. (1993) states that wetlands in the United States are being lost at a rate of 260,000 acres/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 rate of wetland loss in Rio Grande and Conejos counties is difficult to quantify, it is clear that many wetlands, especially on the valley floor, have been lost or profoundly altered from their pre-settlement state. Agriculture, grazing, development, construction of reservoirs, water diversions, and mining have had many impacts on wetlands throughout the study area. Fertile soils and available water for irrigation make floodplains productive areas for agriculture. Since the nineteenth century, hydrological diversions and the installation of groundwater wells have been developed for irrigation and drinking water supplies. Such activities have eliminated or altered some wetlands, and created other wetlands that are very different from those in existence prior to European settlement. For example, many wetland complexes that historically occurred near perennial springs no longer exist because the springs no longer flow possibly due to localized groundwater pumping. The development of an extensive network of canals and irrigation agriculture has created irrigation-induced wetlands where none previously existed. It is clear that with the current rate of land use conversion and the lack of comprehensive wetland protection programs, wetlands will continue to be lost or dramatically altered.

Because of the profound hydrological alterations within Rio Grande and Conejos counties, restoring degraded wetlands and riparian areas to pre-settlement conditions is probably not realistic. However, by enacting a watershed level wetland protection and enhancement program, many of the beneficial functions and values performed by wetlands could be enhanced or restored. The Alamosa River Watershed Project and Rio Grande River Watershed Project are examples of such efforts.

Increasingly, local Colorado governments and federal agencies, particularly in rapidly growing parts of the state, are expressing a desire to better understand their natural heritage resources, including wetlands. The Colorado Natural Heritage Program approached this project with the intent of addressing this desire.

The wetland inventory of Rio Grande and Conejos counties, conducted by the Colorado Natural Heritage Program (CNHP), is a part of ongoing wetland inventories of Colorado counties by CNHP. To date, similar inventories have been conducted in all or parts of over eight counties. In 1997, CNHP began the San Luis Valley inventory with Saguache County (Sarr and Sanderson 1998). In upcoming years, we hope to continue and complete the wetland inventory of the San Luis Valley in Alamosa and Costilla counties.

In addition to the county inventories, a riparian vegetation classification study was conducted in the Rio Grande Basin in 1995 and 1998 (Kittel et al. 1999). The riparian study randomly selected sites throughout the basin, a number of which were located in Rio Grande and Conejos counties. Currently, CNHP is working on the Comprehensive Statewide Wetland Characterization and Classification Project. This project is compiling data from multiple sources, including CNHP's Riparian Classification, to produce a comprehensive wetland classification for the state of Colorado.

The primary objective of this project was to identify biologically significant wetlands within Rio Grande and Conejos counties with an emphasis on private lands in accordance with the EPA's mission to protect human health and safeguard the natural environment — air, water, and land — upon which life depends. The Biological Inventory of Wetlands and Riparian Areas in Rio Grande and Conejos Counties used the methodology that is used throughout Heritage Programs in North America. The primary focus was to identify the locations of the wetland plant and animal populations, and plant communities on CNHP's list of rare and imperiled elements of biodiversity, assess their conservation value, and to systematically prioritize these for conservation action. Wetland functions and restoration potential for each site visited was also assessed. Another objective was to identify wetland and riparian areas that could serve as reference sites to guide restoration efforts along the Alamosa River.

The locations of biologically significant wetlands were identified by:

- Examining existing biological data for rare or imperiled plant and animal species, and significant plant communities (collectively called **elements)**;
- Accumulating additional existing information;
- Conducting extensive field surveys.

Locations in the county with natural heritage significance (those places where elements have been documented) are presented in this report as potential conservation areas (PCAs). The goal is to identify a land area that can provide the habitat and ecological needs 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 to delineate PCA boundaries.

The PCA boundaries delineated in this report do not confer any regulatory protection of the site, nor do they automatically exclude all activity. It is hypothesized that some activities will prove degrading to the element(s) or the ecological processes on which they depend, while others will not. The boundaries represent the best professional estimate of the primary area supporting the long-term survival of the targeted species or plant communities and are presented 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 of natural heritage resources and sensitive species. Please note that these boundaries are based primarily on our understanding of the ecological systems. A thorough analysis of the human context and potential stresses was not conducted. 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.

CNHP uses the Heritage Ranking Methodology to prioritize conservation actions by identifying those areas that have the greatest chance of conservation success for the most imperiled elements. The sites are prioritized according to their **biodiversity significance rank**, or “B-rank,” which ranges from B1 (outstanding biodiversity significance) to B5 (general or statewide biodiversity significance). These ranks are based on the conservation (imperilment or rarity) ranks for each element and the element occurrence ranks (quality rank) for that particular location. Therefore, the highest quality occurrences (those with the greatest likelihood of long-term survival) of the most imperiled elements are the highest priority (receive the highest B-rank). See the section on Natural Heritage Ranking System for more details. The B1-B3 sites are the highest priorities for conservation actions. The sum of all the sites in this report represents the area CNHP recommends for protection in order to preserve the natural heritage of Rio Grande and Conejos counties’ wetlands.

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. By ranking the relative rareness or imperilment of a species, the quality of its populations, and the importance of associated proposed Conservation Areas, 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?

Protecting biological diversity has become an important management issue for many natural resource professionals. Biological diversity at its most basic level includes the full range of species on Earth, from species such as bacteria and protists, through multicellular kingdoms of plants, animals, and fungi. At finer levels of organization, biological diversity includes the genetic variation within species, both among geographically separated populations and among individuals within a single population. On a wider scale, diversity includes variations in the biological communities in which species live, the ecosystems in which communities exist, and the interactions among these levels. All levels are necessary for the continued survival of species and plant communities, and all are important for the well being of humans. It stands to reason that biological diversity should be of concern to all people.

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 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 that represent the range of species relationships and inter-dependence. 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, and connectedness of natural communities. A landscape consisting of a mosaic of natural communities may contain one multifaceted ecosystem, such as a wetland ecosystem. A landscape also may contain several distinct ecosystems, such as a riparian corridor meandering through 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 the results of their activities are integral parts of most landscapes.

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. We at the Colorado Natural Heritage Program 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 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 database can be accessed from a variety of angles, 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 CNHP to evaluate the significance of each location to the conservation of Colorado's, and indeed the nation's, natural biological diversity. By using species imperilment 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 is the size of the geographic range, the number of individuals, trends in population and distribution, identifiable threats, and the number of already protected occurrences.

Element imperilment 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. Definitions of Colorado Natural Heritage imperilment ranks.

Global imperilment ranks are based on the range-wide status of a species. State imperilment 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/state, 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 reliably 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.

Element Occurrence Ranking

Actual locations 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 the estimated viability or probability of persistence (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 three factors:

1. **Size** – a quantitative measure of the area and/or abundance of an occurrence such as area of occupancy, population abundance, population density, or population fluctuation.
2. **Condition** – an integrated measure of the quality of biotic and abiotic factors, structures, and processes within the occurrence, and the degree to which they affect the continued existence of the occurrence. Components may include reproduction and health, development/maturity for communities, ecological processes, species composition and structure, and abiotic physical or chemical factors.
3. **Landscape Context** – an integrated measure of the quality of biotic and abiotic factors, and processes surrounding the occurrence, and the degree to which they affect the continued existence of the occurrence. Components may include landscape structure and extent, genetic connectivity, and condition of the surrounding landscape.

Each of these factors is rated on a scale of A through D, with A representing an excellent grade and D representing a poor grade. These grades are then averaged to determine an appropriate EO-Rank for the occurrence. 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** Excellent estimated viability.
- **B** Good estimated viability.
- **C** Fair estimated viability.
- **D** Poor estimated viability.
- **E** Verified extant, but viability has not been assessed.
- **H** Historically known, but not verified for an extended period.

Potential Conservation Areas

In order to successfully protect populations or occurrences of rare or imperiled elements, it is necessary to recognize Proposed Conservation Areas. These PCAs focus on capturing the ecological processes that are necessary to support the continued existence of a particular element occurrence of natural heritage significance. Proposed Conservation Areas may include a single occurrence of a rare element or a suite of rare element occurrences or significant features.

Once the presence of rare or imperiled species or significant natural communities has been confirmed, the first step towards their 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 consider a number of factors that include, but are not limited to:

- 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 non-native 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 Potential Conservation Areas

One of the strongest ways that CNHP uses 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: good or fair occurrence of a G1 species, or excellent or good occurrence of a G2 species, or concentration of excellent or good occurrences of G3 species.
B3	High Significance: excellent example of a community type, excellent or good occurrence of a G3 species, or a fair occurrence of a G2 species.
B4	Moderate or Regional Significance: good example of a community type, excellent or good occurrence of state-rare species, or a large concentration of good occurrences 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 imperilment 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 Statute 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.

Federal Status:	
1. U.S. Fish and Wildlife Service (58 Federal Register 51147, 1993) and (61 Federal Register 7598, 1996)	
LE	Endangered; species 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 endangered or threatened; species formally proposed for listing as endangered or threatened
C	Candidate: species 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 DEFINITIONS, REGULATIONS, AND FUNCTIONAL ASSESSMENTS

Wetland Definitions

The federal regulatory definition of a jurisdictional wetland is found in the regulations used by the U.S. Army Corps of Engineers (Corps) for the implementation of a dredge and fill permit system required by Section 404 of the Clean Water Act Amendments (Mitsch and Gosselink 1993). According to the Corps, wetlands are "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstance do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." For Corps programs, a wetland boundary must be determined according to the mandatory technical criteria described in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987). In order for an area to be classified as a jurisdictional wetland (i.e., a wetland subject to federal regulations), it must have **all** three of the following criteria: (1) wetland plants; (2) wetland hydrology; and (3) hydric soils.

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/or (3) the substrate is non-soil 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.

CNHP 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 do not meet all three of the Corps criteria, should be included 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 Colorado

Wetlands in Colorado are currently regulated under the authority of the 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 a 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.

The U.S. Fish and Wildlife Service has conducted inventories of the extent and types of our nation's wetlands. The Cowardin et al. (1979) classification system provides the basic mapping units for the U.S. National Wetlands Inventory (NWI). The NWI drew maps for Rio Grande and Conejos counties, 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 1970s using black and white photos. Photo-interpretation and field reconnaissance was used to refine wetland boundaries according to the wetland classification system. The information is summarized on 1:24,000 and 1:100,000 maps.

The NWI maps provide important and accurate information regarding the location of wetlands. They can be used to gain an understanding of the general types of wetlands in the county and their distribution. The NWI maps cannot be used for federal regulatory programs that govern wetlands for two reasons. First, the U.S. Fish and Wildlife Service uses a definition for a wetland that differs slightly from Corps, 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.

Wetland Functions and Values

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:

- Groundwater recharge--the replenishing of below ground aquifers.
- Groundwater 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 adsorbed to these particles.
- Nutrient removal/transformation--the removal of excess nutrients from the water, in particular nitrogen and phosphorous. Phosphorous is often removed via

sedimentation; transformation includes converting inorganic forms of nutrients to organic forms and/or the conversion of one inorganic form to another inorganic form (e.g., NO_3^- converted to N_2O or N_2 via denitrification).

- Production export--supply organic material (dead leaves, soluble organic carbon, etc.) to the base of the food chain.
- Aquatic diversity/abundance--wetlands support fisheries and aquatic invertebrates.
- 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 or physical 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.

For this project, CNHP utilized a functional assessment based on the Montana Wetland Field Evaluation Form prepared by Morrison-Maierle Environmental Corporation (Berglund 1996). This functional assessment is discussed further under the Methods section.

Hydrogeomorphic (HGM) Approach to Wetland Functional Assessment

Few people disagree 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 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 (Colorado Geological Survey et al. 1998).

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 Colorado: riverine, slope, depression, and mineral soil flats (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.

Using the HGM method, wetland functions are evaluated or compared 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 provides little in the way of flood control, while wetlands along a major river perform important flood control functions but may not harbor rare plant species.

One of the fundamental goals of HGM is to create a system whereby every wetland is evaluated according to the same standard. In the past, wetland functional assessments typically were on a site by site basis, with little ability to compare functions or assessments between sites. HGM 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 reference wetlands is a *reference standard*, wetlands that correspond to the highest level of functioning of the ecosystem across a suite of functions (Brinson and Rheinhardt 1996).

HGM 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 these conditions, the structural components and physical, chemical, and biological processes in the wetland and surrounding landscape are assumed to be 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 locate reference wetlands is compatible 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 biological significance.

Table 3. Hydrogeomorphic wetland classes in Colorado (Cooper 1998 as cited in Colorado Geological Survey et al. 1998).

Class	**Geomorphic setting**	**Water Source**	**Water Movement**	**Subclass**	**Examples**
Riverine	In riparian areas along rivers and streams	Overbank flow from channel	One-directional and horizontal (downstream)	R1-steep gradient, low order streams	Herbaceous plant community in subalpine
				R2-moderate gradient, low to middle order	Hot Creek SWA
				R3-middle elevation, moderate gradient along small/mid-order stream	Rio Grande
				R4-low elevation canyons or plateaus	Yampa River in Dinosaur N.M.
				R5-low elev. Floodplains	McIntire Springs

Class	Geomorphic setting	Water Source	Water Movement	Subclass	Examples
Slope	At the base of slopes, e.g., along the base of the foothills; also, places where porous bedrock overlying a non-porous bedrock intercepts the ground surface.	Groundwater	One-directional, horizontal (to the surface from groundwater)	S1-alpine and subalpine fens on non-calcareous substrates. S2-subalpine and montane fens on calcareous substrates S3-wet meadows at middle elev. S4-low elevation meadows	Iron fens within Iron Creek drainage. High Creek fen Irrigated/ natural meadows Sedge meadows in Lower Rock Creek
Depressional	In depressions cause by glacial action (in the mountains) and oxbow ponds within floodplains. Lake, reservoir, and pond margins are also included.	Shallow ground water	Generally two-directional, vertical: flowing into and out of the wetland in the bottom and sides of the depression	D1-mid to high elevation basins with peat soils or lake fringe without peat D2-low elevation basins that are permanently or semi-permanently flooded D3-low elevation basin with seasonal flooding D4-low elevation basins that are temporarily flooded D5-low elevation basins that are intermittently flooded	Quaking fen in Government Park Pondweed wetland in Rio Grande SWA. Mishak Lakes in SLV Abandoned beaver ponds Playa lakes
Mineral Soil Flat	Topographically flat wetland	Precipitation and groundwater	Two directional	F1-low elevation with seasonal high water table	Salt meadows in the Monte Vista NWR.

PROJECT BACKGROUND

General Description of Study Area

Rio Grande and Conejos counties are located at the meeting of the San Juan Mountains and the San Luis Valley in south-central Colorado. The San Luis Valley is Colorado's largest and driest (climatically) montane valley and the San Juan Mountains are one of the largest mountain ranges in Colorado. The montane portions of both counties fall into the Southern Rocky Mountain Steppe ecoregional province (Bailey et al. 1994). The Valley floor is included in the Great Plains-Palouse Dry Steppe province. From its headwaters in the San Juan Mountains, the Rio Grande River flows in a eastward direction through Rio Grande County then takes a southerly route forming the boundary between Conejos and Costilla counties (Figure 1). Two other major drainages, the Alamosa and Conejos Rivers, flow eastward across Conejos County and empty into the Rio Grande River in the northeast corner of the county (Figure 1).

Of the 823,872 acres in Conejos County approximately 59% are federally owned, 7% state owned, <1% city and county owned, and 34% privately owned. Of the 584,512 acres in Rio Grande county 59% are federally owned, 2% state owned, <1% city and county owned, and 39% privately owned (Essington 1996). The majority of the private lands are located along the stream bottoms in the mountains and on the valley floor (Figure 1).

In order to facilitate the presentation of Potential Conservation Areas in an effective manner, the study area can be divided into several major physiographic sub-regions: the Alamosa Basin, San Luis Hills, and San Juan Mountains. Wetlands found within each sub-region share similar climate, geologic, and hydrologic attributes that are associated with the sub-region's geologic setting.

Climate

Cold winters, cool summers, and low precipitation characterize the study area. The San Juan Mountain sub-region is decidedly cooler and more moist, except during winter thermal inversions, which trap the coldest air at the valley floor (Alamosa Basin and San Luis Hills physiographic sub-regions). Precipitation occurs throughout the year at higher elevations but decreases rapidly with decreasing elevation. For example, within the Alamosa Basin and San Luis Hills sub-region, approximately 80 percent of annual precipitation (annual average is 8.75") occurs between April and October with July and August receiving the highest amount of precipitation (USDA 1980a; USDA 1980b) (Table 4). However, annual average precipitation in the San Juan Mountain sub-region is as high as 50 inches in the wettest areas such as Cumbres Pass and the Conejos River uplands (USDA Forest Service 1996) (Table 4). Climate data were obtained from the Western Regional Climate Center web-site (http://www.wrcc.dri.edu).

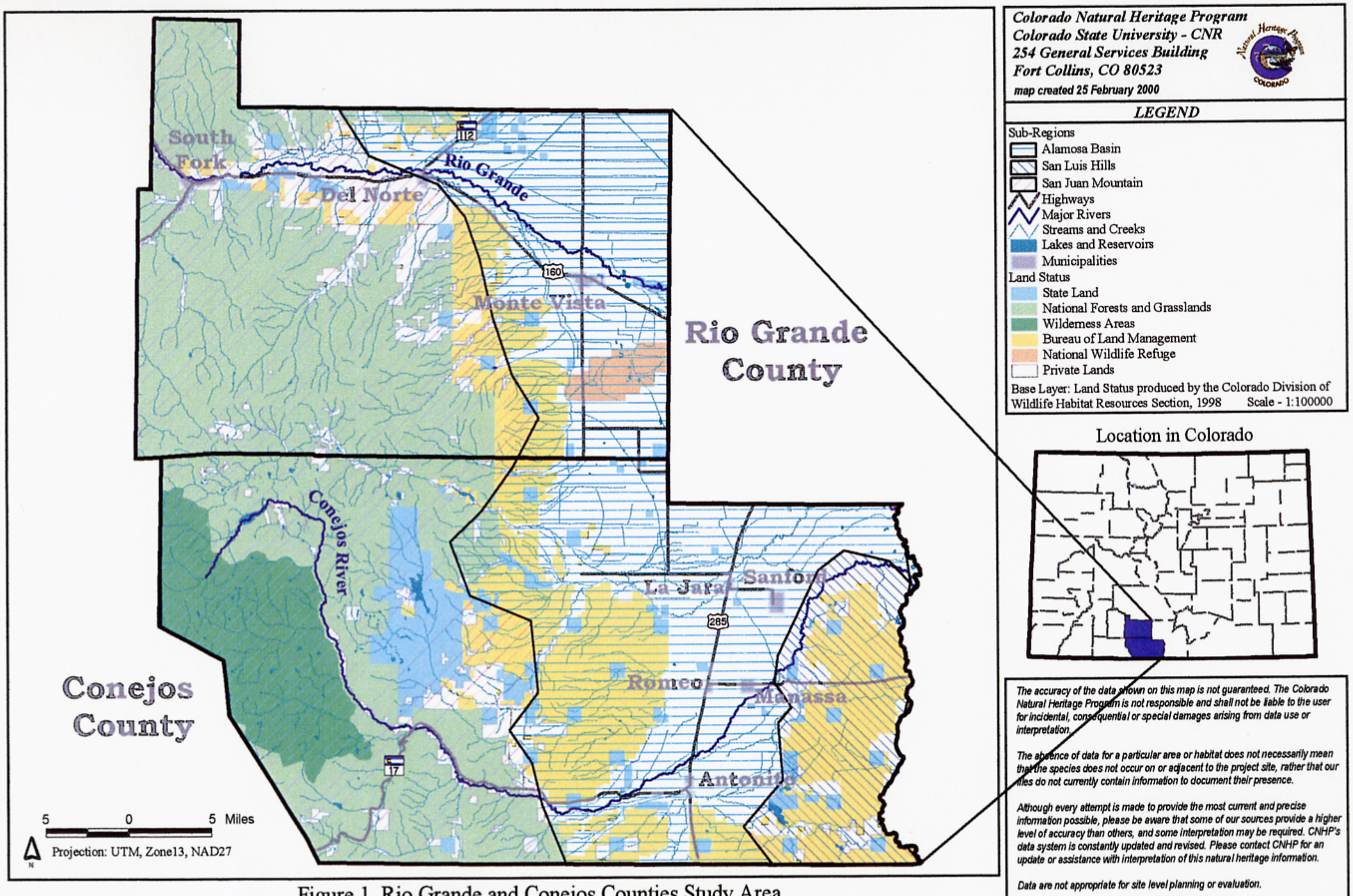


Figure 1. Rio Grande and Conejos Counties Study Area

Table 4. Climate data from selected weather stations in or near the study area.

Station (approximate elevation in feet) Physiographic sub-region	Avg. Annual Precipitation (in.)	Avg. Total Snowfall (in.)	Avg. Max. Temperature (degrees F)	Avg. Min. Temperature (degrees F)
Wolf Creek Pass (10,640) San Juan Mountains	45.16	441.4	45.9	21.4
Platoro (9990) San Juan Mountains	27.10	237.3	50.1	16.0
Del Norte (7880) Alamosa Basin	9.92	43.5	58.2	28.1
Monte Vista (7760) Alamosa Basin	7.50	22.1	58.4	24.3
Manassa (7690) San Luis Hills	7.54	23.9	59.7	24.8

Geology and Hydrology

San Juan Mountains: The Rio Grande, Alamosa, and Conejos Rivers all begin high in the San Juan Mountains. The San Juans gradually rise from the valley floor to the Continental Divide over a distance of 30-40 miles. These mountains were formed by volcanic activity in the Tertiary period (35 mya) and are composed of ash and lava deposits of Tertiary origin and basalts and tuffs of Pliocene/Miocene origin (Tweto 1979). Oxidized iron-bearing deposits exposed at the surface give some areas their striking red, yellow-orange and brown hues. Examples of these deposits can be found in the upper watershed of the Alamosa River. Artificial (i.e., mine drainage) drainage from these areas has led to high loads of heavy metals within the Alamosa River, while natural deposits support some unique plant communities along smaller drainages (e.g., iron fens along Iron Creek).

As was discussed above, precipitation is much higher in the San Juan Mountains than in the lower San Luis Valley. Snowmelt percolates through the shallow mountain soils to emerge as springs that feed riverine, slope, and depressional wetland types that support riparian and wetland plant communities. In addition to precipitation, beavers play an important role creating and maintaining montane wetlands by building dams that impound and store water. The creation of beaver ponds raises local groundwater tables and supports many different wetland plant communities.

Steep mountain streams and rivers deliver huge peak flows in high snowmelt years, rolling large rocks and gravel down their river beds and carrying large volumes of suspended sediment. Flooding rivers are constantly reworking their banks, then rebuilding them with material deposited as turbulent waters subside. Where a river's gradient moderates and the valley widens, coarse bedload is dropped and the river begins to create a new channel, meandering across the floodplain creating a mosaic of wetland and riparian plant communities. As water moves toward the valley floor, either via major river drainages or groundwater flow, it quickly infiltrates into the coarse and fine sediments of the valley floor, thereby recharging the confined and unconfined aquifer of the San Luis Valley floor.

Alamosa Basin: The Alamosa Basin is one of five physiographic subdivisions that make up the San Luis Valley: the Alamosa Basin, the San Luis Hills, the Taos Plateau, the Costilla Plains, and the Culebra Reentrant (Leonard and Watts 1989). The Alamosa Basin is geologically composed of Precambrian plutonic and metamorphic rocks overlain by valley-fill deposits from surrounding mountains (Leonard and Watts 1989) (Figure 2). These deposits are interbedded fine- to coarse-grained alluvial and lacustrine deposits, volcanic flows, and volcaniclastic rocks that are estimated to range in thickness from 5,000 ft. to 10,000 ft. within the study area (Leonard and Watts 1989). These deposits contain both confined and unconfined aquifers.

The San Luis Valley is a broad structural depression that was created by Cenozoic faulting of the Rio Grande Rift Zone. Along the eastern side, the valley was down faulted along the base of the Sangre de Cristo Mountains and hinged at the base of the San Juan Mountains in the west (Jodry and Stanford 1996). This activity left zones on either side of the valley where water from mountain drainages and/or groundwater flow moving toward the valley is able to infiltrate and recharge both confined and unconfined aquifers. The unconfined aquifer lies above the uppermost impermeable layer and is the hydrological source for many of the wetlands found on the valley floor (Figure 2). Wetlands are often found in areas where groundwater, from the unconfined aquifer, moves toward low-lying areas and surfaces on the landscape. Wetlands in the Alamosa Basin are also associated with major river drainages such as the Rio Grande, Alamosa, and Conejos Rivers and smaller tributaries of these river systems. Along these reaches, beavers, as in the higher elevations, play an important role creating and maintaining wetlands.

San Luis Hills: The San Luis Hills are basalt batholiths that form a physiographic, structural, and hydrologic divide that separates the Alamosa Basin from the southern part of the San Luis Valley (Leonard and Watts 1989). These basalt hills and mesas partly block southward flowing groundwater in the confined aquifer, forcing the water to leak and flow upward toward the surface (Powell and Mutz 1958). The numerous springs (McIntire, Sego, and Dexter Springs) found along the northern and western base of the San Luis Hills are the result of these upward flows. These springs support many different wetland plant communities and are an anomalous part of an otherwise arid landscape.

Soils

Soils in the counties are highly variable. Soils in the mountains are normally rocky and shallow, except in areas where groundwater discharge or slope wetlands occur. These areas often form organic soils (e.g., peat or muck) due to organic matter production, persistent soil saturation and thus anaerobic conditions, and cool year round temperatures. Along drainages, both in the mountains and on the valley floor, wetland plant communities occur on alluvium soils. Soils on the valley floor vary but are often characterized by high alkalinity. Although many of the soil patterns found in the high elevations are common in Colorado, the alkaline nature of soils in the valley floor and an extensive high groundwater table are unusual and is a significant determinant of natural vegetation patterns in the San Luis Valley. For more specific information, see "Soil

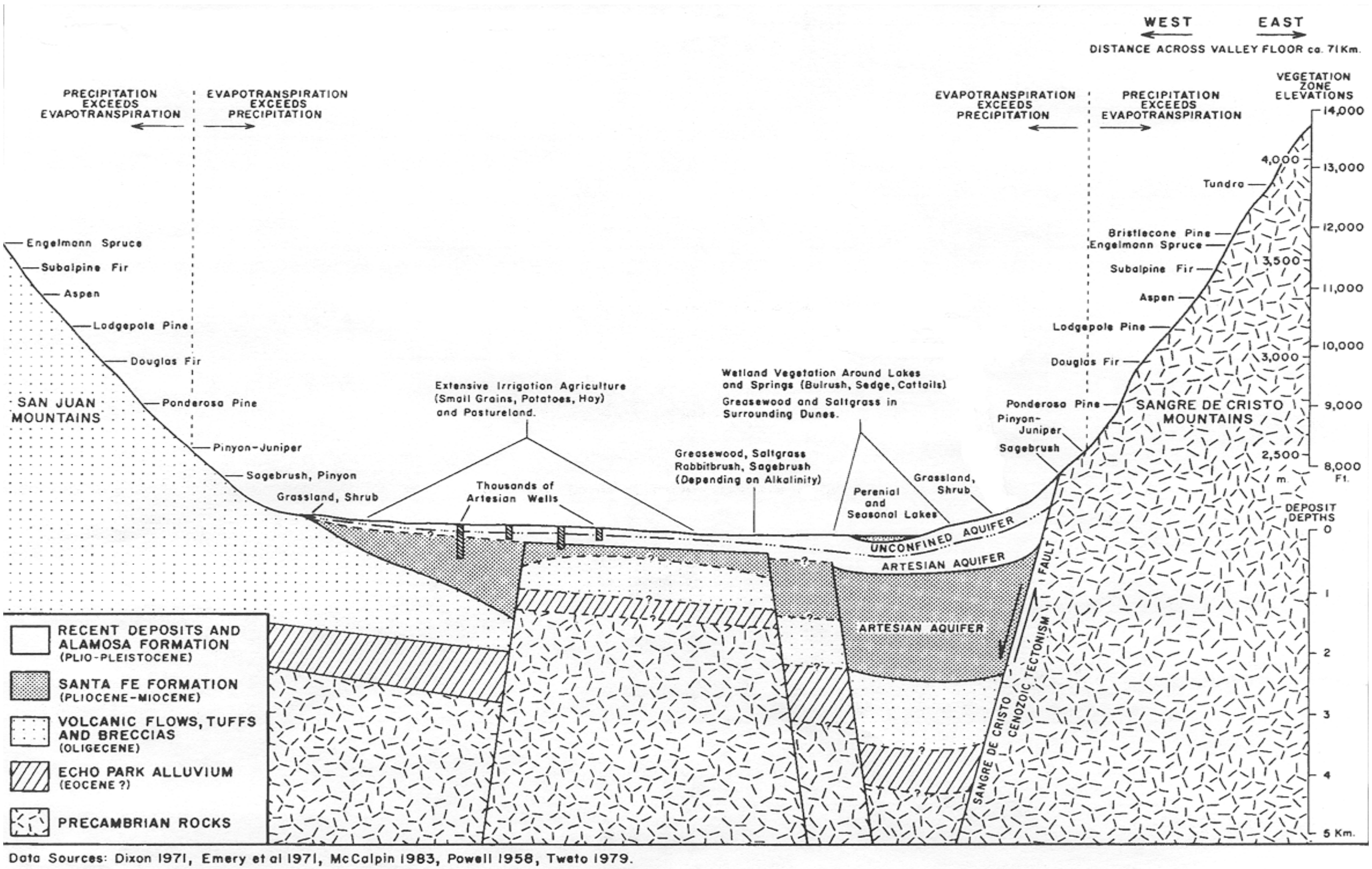


Figure 2. Generalized geologic cross-section of the San Luis Valley (from Jodry and Stanford 1996)

Survey for the Rio Grande County Area" and "Soil Survey for the Conejos County Area" which are both published by the USDA Natural Resources Conservation Service (NRCS).

Vegetation

The San Juan Mountains within Rio Grande and Conejos counties contain typical southern Rocky Mountain vegetation. Douglas fir (*Pseudotsuga menziesii*) and ponderosa pine (*Pinus ponderosa*) forests and woodlands occur at lower elevations with occasional stands of white fir (*Abies concolor*). Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) are the dominant species at higher elevations. Dry south-facing slopes at high elevations support open bristle-cone pine (*Pinus aristata*) woodlands. Aspen (*Populus tremuloides*) stands are abundant throughout the study area at elevations over 8,500 feet. Sub-alpine and alpine wetlands are largely vegetated with willows (e.g., *Salix planifolia, S. drummondiana, S. wolfii, S. geyeriana, S. bebbiana*), sedges (e.g., *Carex aquatilis, C. scopulorum, C. utriculata, C. simulata*), wetland grasses (e.g., *Calamagrostis canadensis*, *Deschampsia cespitosa*), and forbs such as marsh marigold (*Caltha leptosepala*) and bittercress (*Cardamine cordifolia*). Montane grasslands are abundant, especially above the Rio Grande. These grasslands are primarily dominated by Arizona fescue (*Festuca arizonica*), Thurber fescue (*Festuca thurberi*), and Parry's oatgrass (*Danthonia parryi*).

In the foothills of the San Juan Mountains, open ponderosa pine stands are common and grade into piñon pine (*Pinus edulis*) and juniper (*Juniperus scopulorum*) woodlands at the lower treeline. Piñon pine and juniper are also common in the San Luis Hills. Where the foothills descend down to the valley floor, shrublands dominated by winterfat (*Krascheninnikovia lanata*) and rabbitbrush (*Chrysothamnus* spp.) are common with various grasslands interspersed. The most common grassland dominants are blue grama (*Bouteloua gracilis*), squirreltail (*Elymus elymoides*), needle-and-thread (*Stipa comata*), and Indian ricegrass (*Oryzopsis hymenoides*). Narrowleaf cottonwood (*Populus angustifolia*), Colorado blue spruce (*Picea pungens*), mountain alder (*Alnus incana*), and chokecherry (*Prunus virginiana*) are common along large montane streams in the foothills while narrowleaf cottonwood (*Populus angustifolia*), coyote willow (*Salix exigua*), and mountain willow (*Salix monticola*) are common along riparian areas in the valley floor. Herbaceous wetlands in the valley floor are dominated by various sedges and rushes (e.g., *Carex utriculata*, *C. simulata*, *C. lanuginosa*, *Eleocharis palustris*, *Scirpus acutus*, and *Juncus balticus*), wetland grasses (e.g., *Calamagrostis canadensis*, *Agrostis gigantea*, *Poa pratensis*, *Glyceria grandis*, and *Beckmannia syzigachne*), and common wetland forbs (e.g., *Typha latifolia*, *Sagittaria cuneata*, *Argentina anserina*, and *Mentha arvense*). Alkaline wetlands are typically dominated by broom seepweed (*Suaeda calceoliformis*), saltgrass (*Distichlis spicata*), greasewood (*Sarcobatus vermiculatus*), wiregrass (*Juncus balticus*), various bulrushes (e.g., *Scirpus pungens*, *S. maritimus*, *S. nevadensis*), alkaline sacaton (*Sporobolus airoides*), scratchgrass muhly (*Muhlenbergia asperifolia*), and occasionally, the rare slender spiderflower (*Cleome multicaulis*).

METHODS

Survey Site Selection

Focusing on private lands, site selection was based on the objective of visiting every wetland type at various geomorphic positions and elevations within Rio Grande and Conejos counties. The highest quality occurrences of each wetland type were targeted during the field season. Wetland types were defined using plant associations. CNHP classifies wetland and riparian plant associations or communities, not wetland types. Plant communities reflect the broad nature of wetlands in the study area (i.e., willow carr, sedge meadow, cottonwood riparian forest, etc.), while also mirroring the local nature of wetlands in the watershed. Most other classifications applied to wetlands in Colorado, and across the nation, discriminate wetlands based primarily 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 Rio Grande and Conejos counties.

Target inventory areas (TIAs) with potential biodiversity significance were initially identified using color infrared aerial photographs, 7.5 minute topographic quadrangles, in conjunction with a review of CNHP's Biological and Conservation Data (BCD) system 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 vegetation, standing water, lack of disturbance) and concentrations of biological elements. Since private lands were a primary focus, many TIAs were located on private property. Field personnel requested permission to access these sites by contacting the owner either by telephone or in person at their residence. For various reasons, permission to access some TIAs was not obtained. Since CNHP placed the most effort on private lands, it should be noted that many locations within Rio Grande National Forest and on Bureau of Land Management property were not visited due to a lack of time. Thus, a thorough inventory and assessment of wetlands and riparian areas on these public lands is not represented in this report.

Site Assessment

Site assessments included assessments of the natural heritage elements at the site and a wetland functional 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. The road assessments determined the extent of human and livestock impacts on the TIA, which included ditching, adventive plant species, indicator plant species of intensive livestock use, stream bank destabilization, establishment of saplings on point bars, major hydrologic alterations, excessive cover of non-native plant species, or new

construction. Sites with one or more of these characteristics were generally excluded as potential conservation areas and no extensive data were gathered at these areas.

(2) **On-site assessments**. On-site assessment was the preferred method, as it is the only assessment technique that can yield high-confidence statements concerning the known or potential presence of rare and imperiled elements or excellent examples of common communities. On-site assessments are also the most resource intensive because of the effort required to contact landowners. In several cases where on-site assessments were desired, they could not be conducted because either field personnel were denied access to the property by the landowner, or CNHP was unable to contact the landowner during the time frame of this study.

The following information was collected for the sites in this report:

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 conservation area boundaries

General Wetland Information

- proposed HGM Class and Subclass
- Cowardin System and Subsystem
- water source
- hydroperiod
- flooding and inundation frequency
- general soils description (i.e., horizons, texture, color, cobble size, percent mottling)

Qualitative Functional Assessment

- hydrological functions (i.e., groundwater recharge/discharge, flood storage, shoreline anchoring)
- biogeochemical functions (i.e., sediment trapping, nutrient and toxicant retention/removal)
- biological functions (i.e., foodchain support, production export, fish and wildlife habitat, habitat diversity)

Restoration Potential

- cause of disturbances, if any (i.e., alteration of hydrology, peat removal, fill material, presence of non-native species, etc.)
- feasibility of rectifying the disturbance (re-establishing natural hydrological regime, remove fill material, plant native species, etc.)
- discussion of possible methods for restoration.

Plant Communities

Plant communities are very useful indicators of site conditions; therefore, the 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.

- 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 within CNHP's Statewide Wetland Classification. However, on rare occasions a plant association was encountered which could not be easily classified based on the stands that had been previously sampled..
- Vegetation data for each major plant association in the wetland were collected using visual 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 profile descriptions based on a shallow pit within each plot. Thickness, texture (via hand-texturing), color, mottling, gleization, 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.

Wetland Functional Assessment

CNHP utilized a functional assessment based on the Montana Wetland Field Evaluation Form (Berglund 1996). This technique is designed to provide rapid, economical, and repeatable wetland evaluation results. This form minimizes subjectivity and variability between evaluators, provides a means of assigning wetlands overall ratings, and incorporates some of the principles of the hydrogeomorphic (HGM) assessment method. It also classifies each wetland using the Cowardin et al. (1979) classification system. It is important to note that this method is intended to evaluate wetland functions, and is not to be used to delineate jurisdictional wetland boundaries (Berglund 1996).

The methodology assigns to each of the functions a value rating of "low", "moderate", or "high". The following functions are evaluated using the Montana Wetland Field Evaluation Form:

- Flood attenuation and storage
- Sediment/shoreline stabilization
- Groundwater discharge/recharge
- Dynamic surface water storage
- Sediment/nutrient/toxicant retention and removal
- Production export/food chain support
- Habitat diversity
- General wildlife habitat
- General fish habitat
- Uniqueness

Flood Attenuation and Storage

Many wetlands have a high capacity to store or delay floodwaters 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. This field assesses the capability of the wetland to detain moving water from in-channel flow or overbank flow for a short duration when the flow is outside of its channel.

Sediment/Shoreline Stabilization

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 sediment/shoreline anchoring.

Groundwater Discharge/Recharge

Groundwater recharge occurs when the water level in a wetland is higher than the surrounding water table resulting in the movement (usually downward) of surface water (e.g., floodwater retention). Groundwater discharge results when the groundwater level of a wetland is lower than the surrounding water table, resulting in the movement (usually laterally or upward) of surface water (e.g., springs, seeps, etc.). Ground water movement can greatly influence some wetlands, whereas in others it may have minimal effect (Carter and Novitzki 1988).

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 the presence of seeps and springs and wet slopes with no obvious source.

Dynamic Surface Water Storage

Dynamic surface water storage refers to the potential of the wetland to capture water from precipitation, upland surface (sheetflow) or subsurface (groundwater) flow. Sheetflow is nonchannelized flow that usually occurs during and immediately following rainfall or a spring thaw. Wetlands can also receive surface inflow from seasonal or episodic pulses of flood waters from adjacent streams and rivers that may otherwise not be hydrologically connected with a particular wetland (Mitsch and Gosselink 1993). Spring thaw and/or rainfall can also create a time-lagged increase in groundwater flow. Wetlands providing dynamic surface water storage are capable of releasing these episodic pulses of water at a slow, stable rate thus alleviating short term flooding from such events. This function is applicable to wetlands that are not subject to flooding from in-channel or overbank flow (see Flood Storage and Attenuation).

Sediment/Nutrient/Toxicant Retention and Removal
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. 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.

Nutrient retention/removal is the storing and/or transformation of nutrients within the sediment or vegetation. Inorganic nutrients can be transformed into an organic form and/or converted to another inorganic form via microbial respiration and redox reactions. For example, denitrification, which is a process that is mediated by microbial respiration, results in the transformation of nitrate (NO_3^-) to nitrous oxide (N_20) and/or molecular nitrogen (N_2). Nutrient retention/removal may help protect water quality by retaining or transforming nutrients before they 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 may be for long-term (greater than 5 years) as in peatlands or depressional marshes or short-term (30 days to 5 years) as in riverine wetlands.

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.

Habitat diversity
Habitat diversity refers to the number of Cowardin wetland classes present at each site. Thus, a site with emergent, scrub/shrub, and forested wetland habitat would have high habitat diversity. The presence of open water in these areas also increases the habitat diversity at a site.

General Wildlife and Fish 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. Wetland characteristics indicating good fish habitat include: deep, open, non-acidic water, no barriers to migration, well-mixed (high oxygen content) water, and highly vegetated. Wetland characteristics indicating good wildlife habitat are: good edge ratio, islands, high plant diversity, and a sinuous and irregular basin.

Production Export/Food Chain Support
Production export refers to the flushing of relatively large amounts of organic material (both particulate and dissolved organic carbon and detritus) from the wetland to downstream ecosystems. Production export emphasizes the production of organic substances within the wetland and the utilization of these substances by fish, aquatic invertebrates, and microbes. Food chain support is the direct or indirect use of nutrients, carbon, and even plant species (which provide cover and food for many invertebrates) by organisms which inhabit or periodically use wetland ecosystems. Indicators of wetlands that provide downstream food chain support are: an outlet, seasonally flooded hydrological regime, overhanging vegetation, and dense and diverse vegetation composition and structure.

Uniqueness
This value expresses the general uniqueness of the wetland in terms of relative abundance of similar sites occurring in the same watershed, size, geomorphic position, peat accumulation, mature forested areas, and the replacement potential.

Alamosa River Reference Sites

The Alamosa River once flowed through several large meanders on its way from the San Juan Mountains to its confluence with the Rio Grande. Today, the river has a much different appearance on the valley floor. Dating back to the 1930s and 1940s, landowners often straightened small stretches of the Alamosa River to prevent flooding and facilitate water drainage (Stern 1997). During the early 1970s, the U.S. Army Corps of Engineers straightened approximately two miles of the river near Capulin (Stern 1997). The result of these activities has caused the river to dig a deep channel which led to erosion of stream banks and draining of local water tables. Thus, many springs have dried up and numerous riparian and wetland plant communities are no longer able to regenerate and maintain viable populations. Landowners have also suffered, as irrigation headgates are no longer useful since the river has dug a new channel several feet below the headgates (Stern 1997). In response to both economic loss and environmental degradation, the Alamosa River watershed steering committee identified the following objective: “The ultimate goal is to restore the river, floodplain, and riparian corridor to a natural functioning system as much as possible within the constraints imposed by the water withdrawal system. We want a conceptual plan that, when implemented, will insure low maintenance into the future. The use of structures must be minimized and emphasis placed on vegetative, non-structural stabilization and restoration methods.” (Stern 1997). A restoration strategy has been identified by the watershed steering committee and a few structural pilot restoration projects have already been implemented (see Stern 1997 for more details). The target reach for these restoration efforts occurs from Gunbarrel Road on the west to Highway 285 on the east (about 11 miles) (Stern 1997).

A key tool for implementing a successful restoration project is the utilization of reference sites to guide restoration efforts. References sites can be defined as either biological or morphological (physical characteristics of a stream) in terms of the reference information that they provide (Federal Interagency Stream Restoration Working Group 1998). Thus, riparian areas that could potentially serve as a donor site (provide cuttings, donor soil, etc.) or provide an example of natural, relatively undisturbed plant community structure and species composition are defined as biological reference sites. Streams or rivers that exhibit natural physical characteristics similar to those believed to have historically occurred along the Alamosa River are defined as morphological reference sites. In this report, CNHP identified biological reference sites that may help guide restoration efforts along the Alamosa River. CNHP did not identify morphological reference sites. Since most sites of similar elevation and topography to the Alamosa River have been impacted by anthropogenic activities (e.g., water diversions, agriculture, grazing, etc.) it was difficult to identify a true natural reference condition. Thus, sites with similar elevation and topography to the stretch of the Alamosa River targeted for restoration, were chosen based on the following assumptions and criteria:

- Acknowledgement that a true natural reference condition was not likely to be encountered due to human-induced impacts.
- Non-native species composition was minimal or did not appear to affect ecosystem function.
- Hydrological regime was relatively natural and intact.
- Ecosystem processes were intact (e.g., beaver activity, fluvial processes, regeneration of plant species, etc.).
- Abundance of potential donor species was high (e.g., cottonwood and willow species) thus enabling cuttings to be taken without impacting the health of the donor population.

RESULTS

CNHP ecologists identified 40 wetland/riparian Targeted Inventory Areas (TIAs) that merited on-site investigation (Figures 3 & 4). Out of these TIAs, 19 (47.5%) sites are presented here as Potential Conservation Areas and 2 (5%) sites are presented as Sites of Local Significance (Figure 3).

Priority in TIA selection was given to wetlands occurring on private land. Of the 40 wetland TIAs, 10 (25%) were entirely located on private land and 15 (37.5%) were located on private and public land. Thus, 62.5 % of all TIAs were associated with private lands. CNHP was very successful in obtaining permission from landowners to conduct biological surveys on private property in Rio Grand and Conejos counties. CNHP staff were denied access to only 2 (5 %) sites and a portion of another TIA that was partially on private lands.

An effort was made to select sites that potentially had natural hydrology, native species composition, and vegetation structure intact. However, on-site inspection revealed that many of the wetland TIAs (22.5%) were heavily impacted by roads, buildings, non-native species, agriculture, and/or grazing and were dropped from the inventory (Figure 3). For reasons such as time limitation and the inability to contact landowners, 20% of the TIAs were not visited, most of these were located on U.S. Forest Service land (Figure 3).

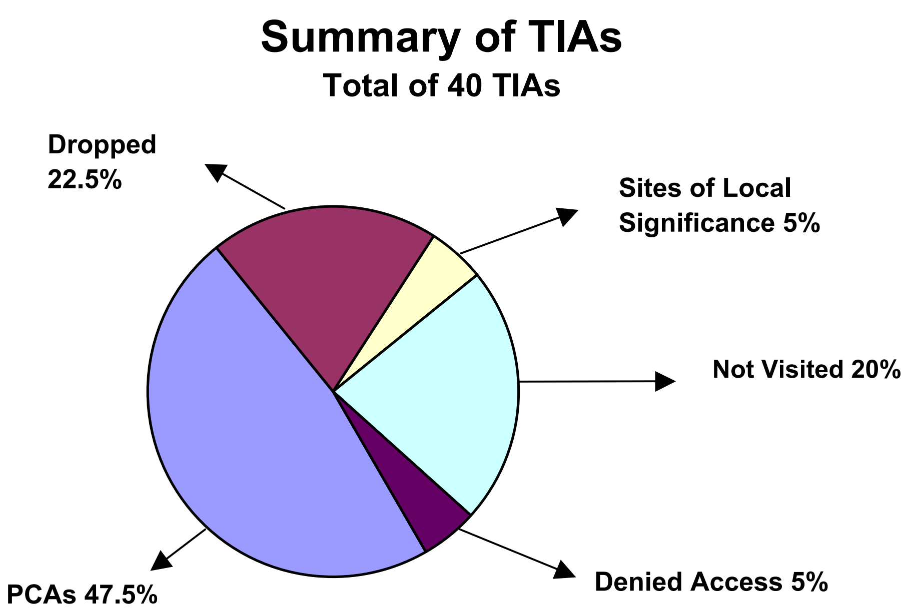


Figure 3. Summary of TIAs.

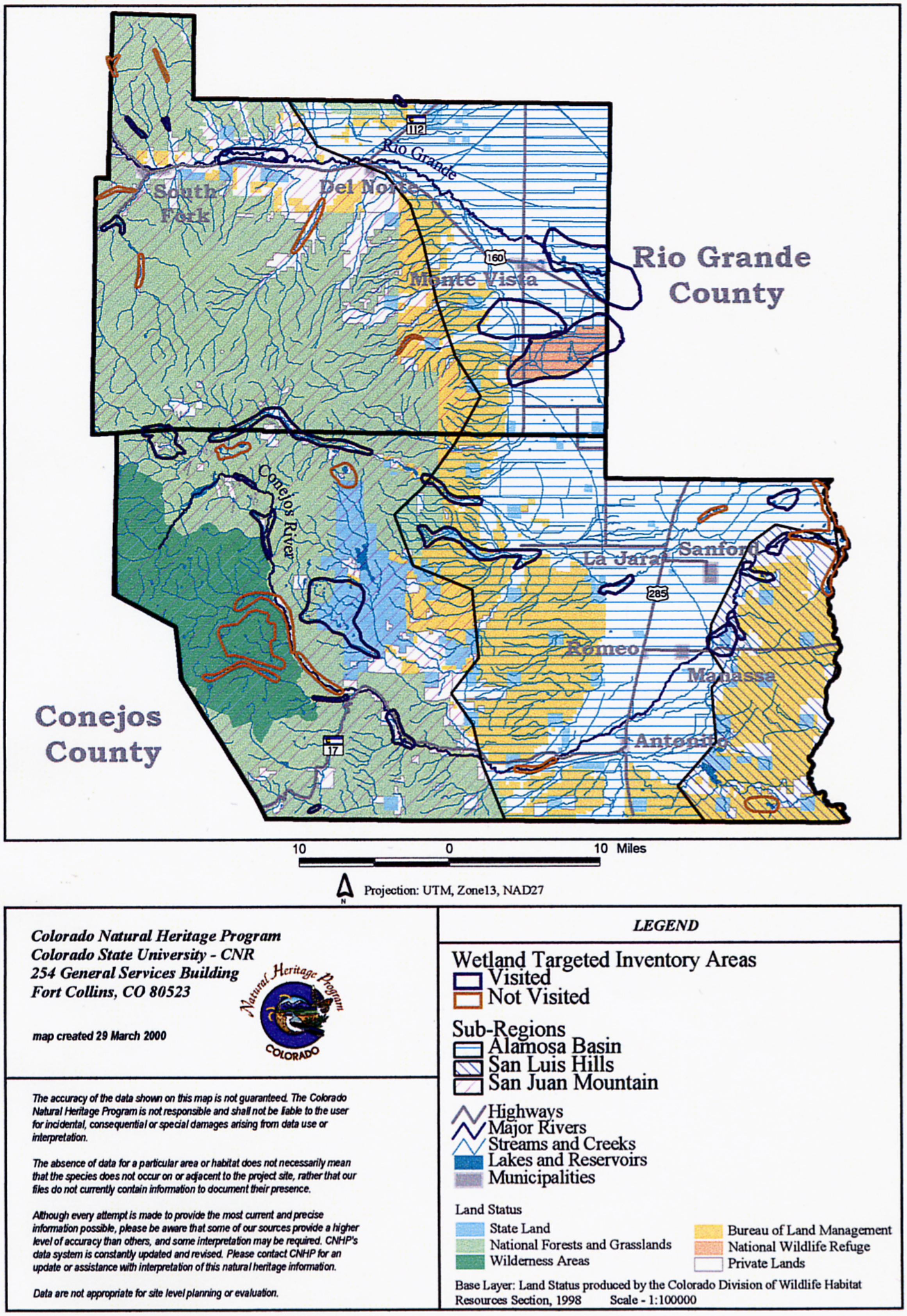


Figure 4. Wetland/RiparianTIAs

Significant Elements Associated with Wetlands and Riparian Areas

The following table presents CNHP elements of biological significance known to occur in or associated with wetlands and riparian areas in Rio Grande and Conejos counties. Occurrences of all elements are archived in CNHP's Biological Conservation Data System.

Table 5. List of known elements of concern for Rio Grande and Conejos counties by taxonomic group.

Elements with the highest global significance (G1-G3) are in bold type. Detailed description of all of the elements listed below can be found in Appendix A.

Element	Common Name	Global Rank	State Rank	Federal and State Status
Plants				
Carex limosa	mud sedge	G5	S2	
Cleome multicaulis	**slender spiderflower**	**G2G3**	**S2S3**	**BLM**
Comarum palustre	marsh cinquefoil	G5	S1S2	
Corydalis caseana ssp. *brandegeei*	Sierra corydalis	G5T3T4	S3S4	
Cystopteris montana	mountain bladder-fern	G5	S1	
Isoetes echinospora	spiny-spored quillwort	G5	S2	
Ligusticum tenuifolium	slender-leaf ligusticum	G5	S4	
Platanthera sparsiflora var. *ensifolia*	canyon bog-orchid	G4G5T3	S2	
Sisyrinchium demissum	blue-eyed grass	G5	S2	
Sparganium eurycarpum	giant bur-reed	G5	S2?	
Plant Communities				
Abies lasiocarpa-Picea engelmannii/Alnus incana	montane riparian forest	G5	S5	
Abies lasiocarpa-Picea engelmannii/Mertensia ciliata	montane riparian forest	G5	S5	
Abies lasiocarpa-Picea engelmannii/Salix drummondiana	montane riparian forest	G5	S4	
Alnus incana-mixed forbs	montane riparian shrubland	G3G4Q	S3	
Alnus incana-mixed graminoids	montane riparian shrubland	G5Q	S3	
Alnus incana*-mixed *Salix	**montane riparian shrubland**	**G3**	**S3**	
Alnus incana/Salix drummondiana	**montane riparian shrubland**	**G3**	**S3**	
Alnus incana/Cornus sericea	**thinleaf alder/red-osier dogwood riparian shrubland**	**G3G4**	**S3**	
Caltha leptosepala	subalpine wet meadow	G4	S4	
Cardamine cordifolia-Mertensia ciliata-Senecio triangularis	Alpine wetland	G4	S4	
Carex aquatilis	montane wet meadow	G5	S3S4	
Carex aquatilis-Carex utriculata	montane wet meadow	G4	S4	
Carex atherodes	montane wet meadow	G4	S2?	
Carex lanuginosa	**montane wet meadow**	**G3?**	**S3**	
Carex simulata	wet meadow	G4	S3	
Carex utriculata	beaked sedge montane wet meadow	G5	S4	
***Carex utriculata* perched wetland**	beaked sedge montane perched wetland	**G3?**	**S3**	

Element	Common Name	Global Rank	State Rank	Federal and State Status
Cornus sericea	foothills riparian shrubland	G4	S3	
Distichlis spicata	salt meadow	G5	S3	
Distichlis spicata-(Scirpus nevadensis)	salt meadow	G4	S3?	
Eleocharis palustris	spikerush emergent wetland	G5	S3S4	
Juncus balticus var. *balticus*	wet meadow	G5	S5	
Picea pungens/Cornus sericea	montane riparian forest	G4	S2	
Polygonum amphibium	water ladysthumb emergent wetland	G4	S3	
Populus angustifolia/Alnus incana	**montane riparian forest**	**G3?**	**S3**	
Populus angustifolia/Cornus sericea	cottonwood riparian forest	G4	S3	
Populus angustifolia/*mixed *Salix	**Cottonwood/mixed willow montane riparian forest**	**G3**	**S3**	
Populus angustifolia-Picea pungens/Alnus incana	montane riparian forest	G4	S4	
Populus angustifolia/Salix exigua	narrowleaf cottonwood riparian forest	G4	S4	
Potamogeton gramineus	montane floating/submergent wetland	G4?	S4?	
Pseudotsuga menziesii/Juniperus communis	lower montane forest	G5	S3	
Salix eriocephala* var. *ligulifolia	**montane willow carr**	**G2G3**	**S2S3**	
Salix exigua/mesic graminoid	coyote willow/mesic graminoids	G5	S5	
***Salix geyeriana-Salix monticola/*mesic graminoid**	**montane riparian willow carr**	**G3?**	**S3**	
Salix lucida* var. *caudata	**montane riparian shrubland**	**G3Q**	**SS2S3**	
Salix monticola/Calamagrostis canadensis	**montane willow carr**	**G3**	**S3**	
Salix monticola/Carex aquatilis	**montane riparian willow carr**	**G3**	**S3**	
***Salix monticola/*mesic forb**	**montane riparian willow carr**	**G3**	**S3**	
***Salix monticola*/mesic graminoid**	**montane riparian willow carr**	**G3**	**S3**	
Salix planifolia/Caltha leptosepala	subalpine willow carr	G4	S4	
Salix planifolia/Carex aquatilis	subalpine riparian willow carr	G5	S4	
Sarcobatus vermiculatus/Distichlis spicata	saline bottomland shrubland	G4	S1	
Sarcobatus vermiculatus/Sporobolus airoides	**saline bottomland shrubland**	**G3?**	**S3?**	
Scirpus acutus	hardstem bulrush emergent wetland	G5	S3?	
Scirpus maritimus	alkali bulrush emergent wetland	G4	S2	
Scirpus pungens	common threesquare emergent wetland	G3G4	S3	
Sparganium angustifolium	montane floating/submergent wetland	G4?	S2S3	
Sparganium eurycarpum	foothills floating/submergent wetland	G5	S2S3	
Amphibians				
Bufo boreas	**Boreal toad (Southern Rocky Mountain population)**	**G4T1Q**	**S1**	**FS, State - E**
Rana pipiens	Northern leopard frog	G5	S3	FS/BLM, SC
Birds				
Accipiter gentilis	Northern Goshawk	G5	S3B, SZN	FS/BLM
Asio flammeus	Short-eared Owl	G5	S2B, SZN	
Circus cyaneus	Northern Harrier	G5	S3B, SZ	
Cistothorus palustris	Marsh Wren	G5	S3B,SZN	
Cypseloides niger	Black Swift	G4	S3B	FS

Element	Common Name	Global Rank	State Rank	Federal and State Status
Egretta thula	Snowy Egret	G5	S2B,SZN	
Grus canadensis tabida	Greater Sandhill Crane	G4T4	S2B, S4N	FS, SC
Haliaeetus leucocephalus	Bald Eagle	G4	S1B, S3N	LT, State - T
Himantopus mexicanus	Black-necked Stilt	G5	S3B, SZN	
Numenius americanus	Long-billed Curlew	G5	S2B,SZN	FS/BLM, SC
Nycticorax nycticorax	Black-crowned Night-heron	G5	S3B,SZN	
Phalaropus tricolor	Wilson's Phalarope	G5	S4B, S4N	
Plegadis chihi	White-faced Ibis	G5	S2B,SZN	FS/BLM
Podiceps nigricollis	Eared Grebe	G5	S3B,SZN	
Sterna forsteri	Forster's Tern	G5	S2B,S4N	
Fish				
Catostomus plebeius	**Rio Grande sucker**	**G3G4**	**S1**	**State - E**
Gila pandora	**Rio Grande chub**	**G3**	**S1?**	**BLM, SC**
Oncorhynchus clarki virginalis	Rio Grande cutthroat	G4T3	S3	SC, FS
Invertebrates				
Euphilotes spaldingi	Spalding's blue	G3G4	S2	
Speyeria nokomis nokomis	Great Basin silverspot butterfly	G4T2	S1	BLM
Valvata sincera	Mossy valvata	G3?	S3	
Mammals				
Thomomys bottae pervagus	Valley pocket gopher	G5T3	S3	

Observations on Major Threats to Wetland Biodiversity

General threats to a particular species or site are identified in the Potential Conservation Areas profiles. The following table lists only those threats that were observed at or near the Potential Conservation Areas and were thought to potentially impact the elements of concern. Some general threats to biodiversity were not observed specifically at PCAs in Rio Grande and Conejos counties but rather have an effect on biodiversity on a larger landscape-level scale. These threats are discussed in the following text.

Table 6. Threats observed at the Potential Conservation Areas.

Potential Conservation Area	B –rank	Hydrologic Modification	Residential Development	Mining	Incompatible Grazing	Logging	Recreation	Roads	Non-native Species
Alamosa River at Government Park	B2				X		X		X
Hot Creek	B2							X	X
Lasauses	B2				X				X
Spring Creek at Greenie Mountain	B2	X							X
Alamosa River at De la Luz Cemetery	B3	X							X
Conejos River at Menkhaven Ranch	B3		X						X
Conejos River at Platoro	B3	X					X		X
Elephant Rocks	B3						X		
Highway Spring	B3						X		
Hot Creek/La Jara Creek Confluence	B3								X

Potential Conservation Area	B –rank	Hydrologic Modification	Residential Development	Mining	Incompatible Grazing	Logging	Recreation	Roads	Non-native Species
Iron Creek	B3	X		X					
La Manga Creek	B3							X	
Lower Rock Creek	B3	X							
McIntire Springs	B3								X
Rio Grande at Monte Vista	B3	X							X
West Alder Creek	B3								X
Rio Grande at Embargo Creek	B4								X
Rito Gato	B4							X	
Sego Springs	B4								X

Hydrological Modifications

River impoundment in the form of lakes and reservoirs and irrigation ditches or canals can affect aquatic dependent plants and animals (Chien 1985). Annual flooding is a natural ecological process that has been severely altered by the construction of dams and reservoirs. These actions have altered the normal high peak flows that were once a part of the natural hydrological regime of many large rivers such as the Rio Grande, Alamosa, and Conejos Rivers, and many of their smaller tributaries. These natural flows are necessary for continued viability of most riparian vegetation. For example, many plants can only reproduce with flooding events, e.g., cottonwood trees (Rood and Mahoney 1993). As plant composition changes in response to alterations in the flooding regime, the composition of the aquatic and terrestrial fauna may also change.

In addition to river impoundment, rivers have also been altered by stream bank stabilization projects (i.e., channelization) (Rosgen 1996). Most streams and rivers are dynamic and inherently move across the land. Stabilizing or channelizing stream banks forces the river to stay in one place and often leads to changes in riparian ecology and more serious destruction downstream. It is also well known that different plant communities require different geomorphologic settings, e.g., point bars are required for some species of willows to regenerate, terraces are required for mature cottonwood/shrubland forests, and old oxbow reaches may eventually provide habitat for many wetland communities. By stabilizing a river, the creation of these geomorphic settings is often eliminated. Thus, the plant communities that require such fluvial processes are no longer able to regenerate or survive. In general, the cumulative effects from dams, reservoirs, and channelization on plant communities, has caused a gradual shift from diverse multi-aged riparian woodlands to mature single aged forest canopies.

Many wetlands, not associated with fluvial processes, have been altered by irrigation practices, water diversions, and well pumping. The growth of irrigated agriculture in Rio Grande and Conejos counties inadvertently created many new wetlands in areas where wetlands never existed. For example, seepage from hundreds of miles of unlined canals and earthen ditches and much of the water applied in irrigation contributes to groundwater and surface water runoff. As a result, many areas have developed wetland characteristics where none existed prior to irrigation. Conversely, many historical wetlands have dried up due to the installation of thousands of artesian wells in the San Luis Valley. For example, the springs that once provided flow for Spring Creek on the Monte Vista National Wildlife Refuge are believed to have supported an extensive peatland. However, when numerous wells were installed in nearby areas, the springs dried up and today wetland vegetation no longer exists. Thus, as the quality and extent of historical wetlands diminished, some of the habitat loss was offset by irrigation-induced wetlands. It is debatable whether the biodiversity significance of an integrated network of river bottom wetlands, sinuous marshy streams, extensive saline meadows and shrublands, and peatlands can be equated to the dispersed pattern of irrigation-induced wetlands across an agricultural landscape. However, local wildlife and many of the plant species and communities observed during this survey are now dependent upon irrigation-induced wetlands for their survival since much of their natural habitats have been altered or destroyed. For example, in the Uncompahgre River valley an estimated 72% of all reptiles, 77% of all amphibians, 80% of all mammals, and 90% of all bird species that generally occur here commonly use irrigated wetlands and riparian areas (Adamus 1993). Although it is not known what percentage of these species use irrigation-induced wetlands in the San Luis valley, the numbers are likely similar. In addition to providing valuable wildlife habitat, irrigation-induced wetlands may be acting to remove nitrate, pesticides, and sediments from agricultural tail waters before entering major rivers and local aquifers.

Development

Although growth rates in the San Luis Valley have been lower than most other Colorado regions, residential development is a localized but increasing threat in Rio Grande and Conejos counties. Development creates a number of stresses, including habitat loss and fragmentation, introduction of non-native species, fire suppression, and domestic animals (dogs and cats) (Oxley et al. 1974; Coleman and Temple 1994). Habitat loss to development is considered irreversible and should therefore be channeled to areas with less biological significance. Since development tends to occur adjacent to watercourses, wetland and riparian habitats are highly susceptible to development.

Mining

Mining has been a traditional industry in Rio Grande and Conejos counties for over a century. Poorly planned or managed mining operations have the potential to impact biodiversity for decades after the activity has ceased. For example, the fishery that once existed within the main stem of the Alamosa River downstream of Wightman Fork was wiped out in 1990 due to contamination from the Summitville Mine (Stern 1997).

Stresses from mining activities can include habitat loss and fragmentation, water pollution by acid mine drainage and excessive sedimentation of streams. Aquatic systems are the most threatened by these stresses, but wetland and riparian communities can be impacted as well.

Livestock Grazing

Domestic livestock grazing, another traditional industry of Rio Grande and Conejos counties has left a broad and often subtle impact on the landscape. Historic livestock grazing probably had a large influence on the composition of nonforested communities on the Rio Grande National Forest (USDA Forest Service 1996). As early as 1820, there were records of cattle being brought into the San Luis Valley. By the close of the century, and through the early part of the 20th century, there were high numbers of livestock grazing in the valley. It appears that by 1929, stocking rates began to dramatically decline due to documented overuse of resources (USDA Forest Service 1996).

Today, many riparian areas in the San Luis Valley are utilized for rangeland. Lush forests and meadows in the San Juan Mountains serve as summer pasture for sheep and cattle. In such rugged terrain, livestock tend to concentrate in the valley bottoms and meadows where the terrain is gentler and vegetation is more abundant. On the valley floor, livestock tend to congregate near wetland and riparian areas for shade, lush browse, and access to water. Long-term, improper livestock use of wetland and riparian areas could potentially erode stream banks, cause streams to downcut, lower the water table, alter channel morphology, impair plant regeneration, establish non-native species, shift community structure and composition, degrade water quality, and diminish general riparian and wetland functions (Windell et al. 1986). Depending on grazing practices and local environmental conditions, impacts can be minimal and largely reversible (slight shifts in species composition) to severe and irreversible (extensive gullying, introduction of non-native forage species).

Logging
For the past 45 years, the annual volume of timber sold from the Rio Grande National Forest, predominantly Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*), has averaged 19.7 million board feet (USDA Forest Service 1996). The volume of live timber sold annually during the 10 years from 1985 to 1994 ranged from 24.9 million board feet to 32.9 million board feet. Most logging operations require a large network of roads. The impacts from roads can result in threats to biodiversity (see "Roads" below for more detailed discussion). The Forest Service monitors logging closely, nonetheless, problems can still occur (e.g., a buffer zone intended to protect a pond with boreal toads was logged in 1998) - (Husung and Alves 1998).

Recreation
Recreation, once very local and perhaps even unnoticeable, is increasing and becoming a threat to natural ecosystems in Rio Grande and Conejos counties. Different types of recreation (i.e., motorized versus non-motorized activities) typically have different effects on ecosystem processes. All terrain vehicles (ATV's) are becoming increasingly popular and the Rio Grande National Forest is a favorite area for ATV use (especially for big-game retrieval). ATV's 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. ATV's have also be identified as a vector for the invasion of non-native plant species.

Non-motorized recreation, mostly hikers but also some mountain biking, presents a different set of problems (Cole and Knight 1990; Knight and Cole 1991). Wildlife behavior can be significantly altered by repeat visits of hikers/bicyclists. Alpine areas, mountain lakes, and riparian zones are routes and destinations for many established trails. Thus, impacts to native vegetation (mainly trampling) in these areas could potentially be high.

Roads

There is a complex, dense network of roads in many parts of the San Luis Valley and Rio Grande National Forest due to agricultural activities, past timber harvests, and mining operations. Expansion of the existing road network in some areas will detrimentally affect the natural heritage values of the region. Roads are associated with a wide variety of impacts to natural communities, including invasion by non-native plant species, increased depredation and parasitism of bird nests, increased impacts of pets, fragmentation of habitats, erosion, pollution, and road mortality (Noss et al. 1997).

Roads function as conduits, barriers, habitats, sources, and sinks for species and populations of species (Forman 1995). Road networks crossing landscapes can increase erosion and alter local hydrological regimes. Runoff from roads may impact local vegetation via contribution of heavy metals and sediments. Road networks interrupt horizontal ecological flows, alter landscape spatial pattern, and therefore inhibit important interior species (Forman and Alexander 1998).

Effects on wildlife can be attributed to road avoidance (a species avoids crossing a road) and occasionally roadkill. Traffic noise appears to be the most important variable in road avoidance, although visual disturbance, pollutants, and predators moving along a road are alternative hypotheses as to the cause of avoidance (Forman and Alexander 1998). Songbirds appear to be sensitive to remarkably low noise levels, even to noise levels similar to that of a library reading room (Reijnen et al. 1995).

Non-native Species

Although non-native species are mentioned repeatedly as stresses in the above discussions, because they may be introduced through so many activities they are included here as a general threat as well. Non-native plants or animals can have wide-ranging impacts. Non-native plants can increase dramatically under the right conditions and essentially dominate a previously natural area (e.g., scraped roadsides). This can generate secondary effects on animals (particularly invertebrates) that depend on native plant species for forage, cover, or propagation. Canadian thistle (*Cirsium arvense*) and whitetop (*Cardaria* ssp.) are probably the most troublesome non-native plant species found in wetland and riparian areas in Rio Grande and Conejos counties. Smooth brome (*Bromus inermis*), dandelion (*Taraxacum officinale*), redtop (*Agrostis gigantea* and *A. stolonifera*) and Kentucky bluegrass (*Poa pratensis*) are also common in these areas. Effects of non-native fishes include competition that can lead to local extinctions of native fishes and hybridization that corrupts the genetic stock of the native fishes.

Fragmentation and Edge Effects

Edges are simply the outer boundary of an ecosystem that abruptly grades into another type of habitat (i.e., edge of a conifer forest adjacent to a meadow) (Forman and Godron 1986). Edges are often created by naturally occurring processes such as floods, fires, and wind and will recover naturally over time. Edges can also be created by human activities such as roads, timber harvesting, agricultural practices, rangeland, etc. Human induced edges are often dominated by plant species that are adapted to disturbance. As the landscape is increasingly fragmented by large-scale, rapid anthropogenic conversion, these edges become increasingly abundant. The overall reduction of large landscapes jeopardizes the existence of specialist species, may increase non-native species, and limits the mobility of species that require large landscapes or a diversity of landscapes for their survival (i.e., large mammals or migratory waterbirds).

Sites of Biodiversity Significance

The 19 most important wetland sites in Rio Grande and Conejos counties are profiled in this section as Potential Conservation Areas (PCAs) with biodiversity ranks (Figure 5). These PCAs include the wetlands with the highest biodiversity significance, as well as the best examples of wetland types present in the study area. Two site of local significance are also profiled. These sites were chosen based on the local importance of their functions within Rio Grande and Conejos counties. Sites of Local Significance did not receive B-ranks.

The PCAs and Sites of Local Significance are organized by the following major sub-regions: the **Alamosa Basin, San Luis Hills,** and the **San Juan Mountains**. Wetlands and riparian areas that occur within each of these major sub-regions share a similar geomorphology, geology, climate, regional hydrology, and land use history.

Site Profile Explanation

Each Potential Conservation Area (PCA) is described in a standard site profile report that reflects data fields in CNHP's Biological and Conservation Data (BCD) System. The contents of the profile report are outlined and explained below:

Biodiversity Rank: B#

The overall significance of the site in terms of rarity of the Natural Heritage resources and the quality (condition, abundance, etc.) of the occurrences. Please see *The Natural Heritage Ranking System* section for more details.

Protection and Management Issues:

A summary of major land ownership and management issues that may affect the long-term viability of the site and the element(s).

Biodiversity Rank Justification: A synopsis of the rare species and significant plant communities that occur within the proposed conservation area. A table within the area profile lists each element occurrence found in the site, global and state ranks of these elements, the occurrence ranks and federal and state agency special designations. See Table 1 for explanations of ranks and Table 2 for legal designations.

Location: General location and legal description using a U.S.G.S. 7.5-minute Quadrangle name and Township Range Section(s).

General Description: A brief narrative picture of the topography, hydrology, vegetation, and current use of the proposed conservation site. Common names are used along with the scientific names. The approximate acreage included within the proposed conservation area boundary for the site is reported.

Boundary Justification: Justification for the location of the proposed conservation area boundary delineated in this report, which includes all known occurrences of natural heritage resources and, in some cases, adjacent lands required for their protection.

Protection and Management Comments: Discussion of major land ownership and management issues that may affect the long-term viability of the site and the element(s).

Soils Description: Soil profile descriptions were generally conducted at each site. When these profile descriptions were found to match the mapped soil type found in the county soil surveys, then reference is only given to that particular soil series and no profile description is provided. However, if a profile description did not match the mapped soil type, then profile descriptions are presented. Classification of these soils was conducted, when possible, using *Keys to Soil Taxonomy*.

Restoration Potential: A brief summary describing the feasibility of restoring ecosystem function(s) at each site.

Wetland Functional Assessment: A summary of the functions and the proposed HGM classification and Cowardin system for the wetlands occurring within each Potential Conservation Area and Site of Local Significance. Each function is ranked (i.e., none, low, moderate, high, or exceptional) according to how well the wetland is performing each particular function. (Note: A wetland functional assessment was conducted for all but three sites (Sego Springs, Rio Grande at Embargo Creek, and Rito Gato). CNHP ecologists did not feel that enough time was spent at these three locations to merit an objective evaluation of their wetland functions.)

Table 6 displays all 19 PCAs and two Sites of Local Significance in the Rio Grande and Conejos counties study area. All of these sites merit protection, but available resources should be directed first toward the higher B-ranked sites (e.g., B2 & B3 sites). These sites alone do not represent a complete wetland conservation program; they represent only the rare and imperiled elements. In addition, as was discussed above, inventory efforts were focused on private lands and due to time limitations, a comprehensive inventory of public lands (i.e., U.S. Forest Service and BLM) was not conducted. However, the Monte Vista National Wildlife Refuge was thoroughly inventoried.

Table 7. Sites of biodiversity significance in Rio Grande and Conejos counties, arranged by sub-region and biodiversity rank (B-rank).

Site Name	Biodiversity Rank
Alamosa Basin	
Hot Creek	B2
Spring Creek at Greenie Mountain	B2
Alamosa River at De la Luz Cemetery	B3
Elephant Rocks	B3
Hot Creek/La Jara Creek Confluence	B3
Lower Rock Creek	B3
Rio Grande at Monte Vista	B3
Rd. 24 Wetland	Local Significance
Diamond Springs	Local Significance
San Luis Hills	
Lasauses	B2
McIntire Springs	B3
Sego Springs	B3
San Juan Mountains	
Alamosa River at Government Park	B2
Conejos River at Menkhaven Ranch	B3
Conejos River at Platoro	B3
Highway Spring	B3
Iron Creek	B3
La Manga Creek	B3
West Alder Creek	B3
Rio Grande at Embargo Creek	B4
Rito Gato	B4

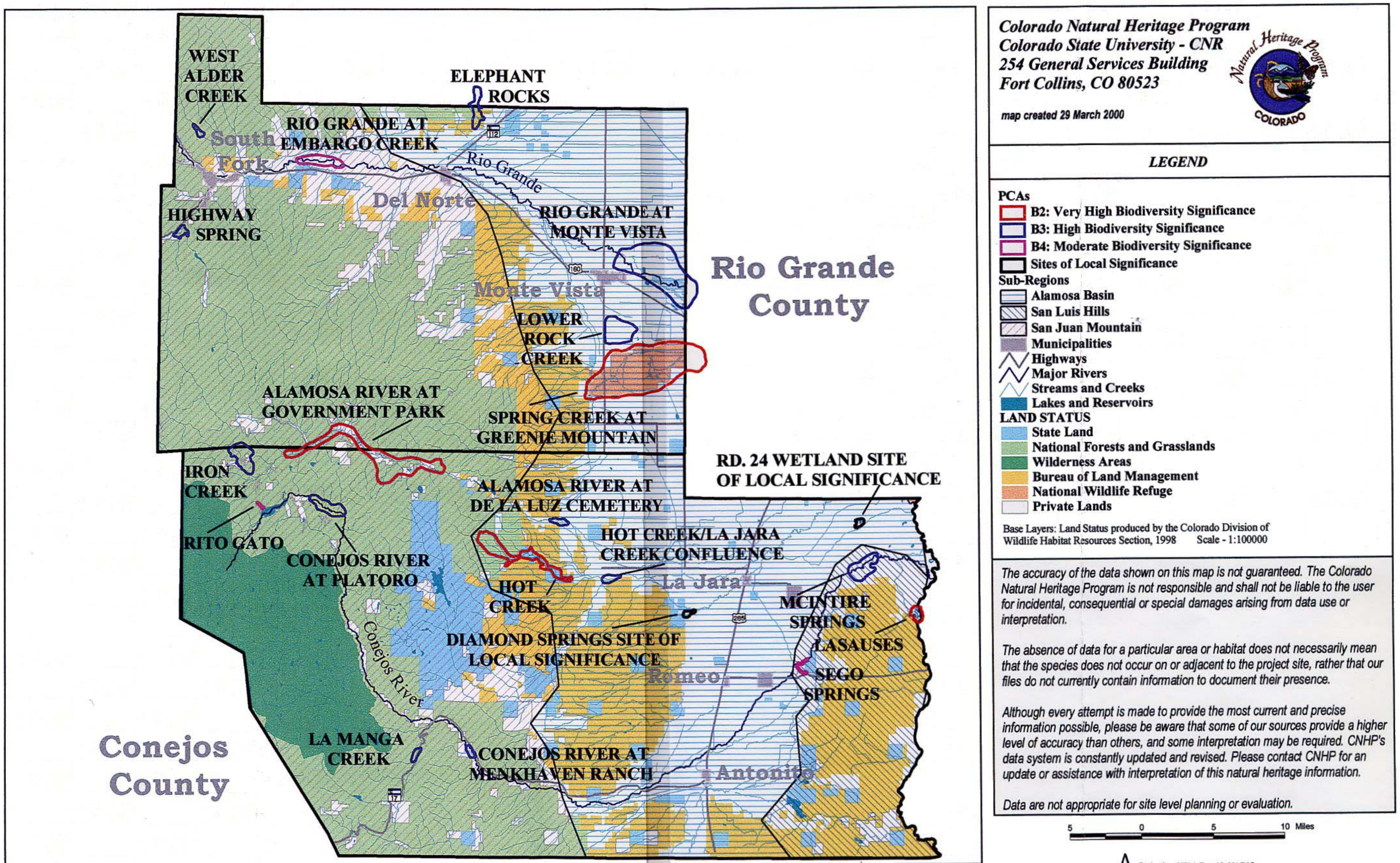


Figure 5. PCAs and Sites of Local Significance in the Rio Grande and Conejos Counties Study Area

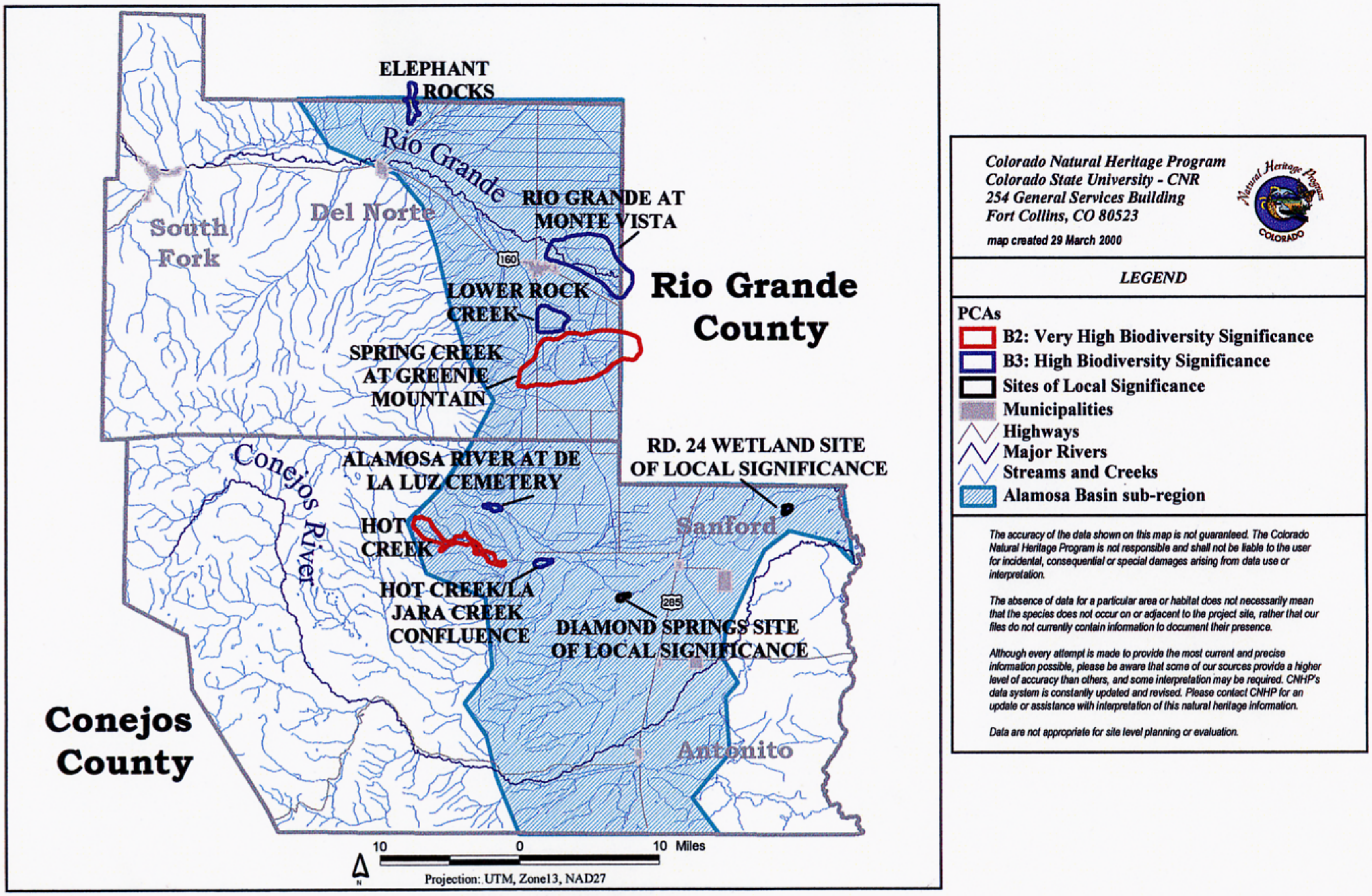


Figure 6. Location of PCAs in the Alamosa Basin sub-region

Hot Creek Potential Conservation Area

Biodiversity Rank: B2 (Very high significance)
The site contains excellent occurrences of two fish species and one plant species vulnerable on a global scale, a fair occurrence of a butterfly subspecies imperiled on a global scale, excellent occurrences of two mammal subspecies vulnerable on a global scale, a poor occurrence of a plant vulnerable on a global scale, a good occurrence of a plant community vulnerable on a global scale, and three excellent or good occurrences of common plant communities.

Protection and Management Issues: The site is located on public land managed mainly by the Colorado Division of Wildlife and the Forest Service, with smaller amounts owned by private individuals. Part of the site is contained in the Forest Service Hot Creek Research Natural Area.

Biodiversity Rank Justification: The site contains excellent occurrences of two fish species the Rio Grande chub (*Gila pandora)* and Rio Grande sucker (*Catostomus plebeius*) and one plant species, the rock-loving neoparrya (*Neoparrya lithophila),* vulnerable on a global scale, excellent occurrences of two mammal subspecies vulnerable on a global scale, the silky pocket mouse subspecies (*Perognathus flavus sanluisi)* and Botta's pocket gopher subspecies (*Thomomys bottae pervagus*). Also within the site is a fair occurrence of a butterfly subspecies imperiled on a global scale, the Nokomis fritillary (*Speyeria nokomis nokomis*), a poor occurrence of a plant species vulnerable on a global scale, Ripley milkvetch (*Astragalus ripleyi*), and a good occurrence of a plant community vulnerable on a global scale, beaked sedge (*Carex utriculata)* perched wetland. Three excellent or good occurrences of fairly common plant communities occur within the site.

Once widely distributed throughout the Rio Grande and Mimbres watersheds, the range of the Rio Grande sucker has been greatly reduced. By 1985 only two native populations existed, and in 1993 it was listed as endangered by the state of Colorado. Today, Hot Creek harbors the only native population of Rio Grande sucker in Colorado (Swift-Miller et al. 1999).

The site also contains an excellent occurrence of the Rio Grande chub. The Rio Grande chub was once widespread in creeks of the upper Rio Grande and Pecos watersheds of New Mexico and the upper Rio Grande watershed of southern Colorado (Lee et al. 1980). Populations are reported to be stable in New Mexico but are declining in Colorado.

This silky pocket mouse subspecies is geographically restricted to the San Luis Valley in Colorado and northern New Mexico (Hall 1981). Although believed to be more common in the southern part of its range, in Colorado, capture rates from 1-6 per 1000 trapnights is usually the range of trapping success (Fitzgerald et al. 1994). Little is known about the abundance in any locations.

Similar to the silky pocket mouse, this Botta's pocket gopher subspecies is restricted to the San Luis Valley in Colorado and northern New Mexico (Hall 1981). Pocket gophers, because they are strictly fossorial and have relatively insular genetic groups, are prone to microevolution and genetic isolation (Fitzgerald et al. 1994). There are nearly 300 subspecies of 18 species of pocket gophers in North America. Because of their burrowing habits and sedentary lives, many of the subspecific distinctions have arisen because geographic features such as mountain ridges or soil changes can lead to focussed evolutionary pressure, and thus, isolated evolutionary differences.

The Nokomis fritillary butterfly is only known from Utah and southwest Colorado and is restricted to protected seeps and sloughs in desert landscapes (Ferris and Brown 1981). Although population numbers among colonies can be variable, this species has strict habitat requirements, and is rare over the major portion of its range (Britten et al. 1994, Ferris and Brown 1981).

This site also supports an excellent occurrence of the rock-loving neoparrya, which is only known from south-central Colorado and is on the Forest Service and BLM list of sensitive species. Several of the largest populations of the rock-loving neoparrya are located in Rio Grande and Conejos counties. This population is very large and occurs in good habitat in an area somewhat isolated from disturbance by the steep cliffs.

Ripley milkvetch (*Astragalus ripleyi*) is only known from foothills of the San Juan Mountains in Conejos County and Taos and Rio Arriba counties, New Mexico. It is on the Forest Service and BLM list of sensitive species.

The beaked sedge (*Carex utriculata*) perched wetland plant community is vulnerable throughout its range. The ponderosa pine/Arizona fescue (*Pinus ponderosa*/*Festuca arizonica*) plant community is common globally but this location supports an excellent condition old-growth stand, which is very uncommon. The blue spruce/dogwood (*Picea pungens*/*Cornus sericea*) plant community is in excellent condition. The alder/mesic forb (*Alnus incana*/mesic forb) plant community is in good condition.

Table 8. Natural Heritage element occurrences at Hot Creek PCA.

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank
Fish					
Gila pandora	Rio Grande chub	G3	S1?	SC, BLM	A
Catostomus plebeius	Rio Grande sucker	G3G4	S1	E	A
Plants					
Astragalus ripleyi	Ripley milkvetch	G3	S2	FS, BLM	D
Neoparrya lithophila	Rock-loving neoparrya	G3	S3	FS, BLM	A
Invertebrates					
Speyeria nokomis nokomis	Nokomis fritillary	G4T2	S1	BLM	C
Mammals					
Perognathus flavus sanluisi	Silky pocket mouse subspecies	G5T3	S3		A

Scientific Name	**Common Name**	**Global Rank**	**State Rank**	**Federal and State Status**	**EO* Rank**
Thomomys bottae pervagus	Botta's pocket gopher subspecies	G5T3	S3		A
Plant communities					
Carex utriculata perched wetland	Beaked sedge perched wetland	G3?	S3		B
Alnus incana./mesic forb	Thinleaf alder/Mesic forb riparian shrubland	G3G4Q	S3		B
Picea pungens./Cornus sericea	Blue spruce/red-osier dogwood riparian forest	G4	S2		A
Pinus ponderosa/ Festuca arizonica	Ponderosa pine/ Arizona fescue woodland	G4G5	S4		A
Pseudotsuga menziesii./Juniperus communis	Douglas-fir/ common juniper forest	G5	SU		--

*EO=Element Occurrence

Location: This site is located approximately 5 miles west of Centro in Conejos County.
U.S.G.S. 7.5 minute quadrangle: Centro, Terrace Reservoir
Legal Description: T35N, R7E S 5, 6, 7, 8, 9, 15, 16, 17
T35N, R6E S 2, 3, 4, 10, 11, 12, 13, 14
Elevation: 7,980-9,400 ft. Approximate Size: 2,710 acres

General Description: The site encompasses a variety of habitats from arid shrublands at the lower end of the site to ponderosa pine woodlands at the higher elevations. At the downstream end of the site, steep cliffs rise above the Hot Creek floodplain. At the upper elevations exposed bedrock is common and ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) occur among the rock. There are several riparian and wetland plant communities along Hot Creek, scattered piñon pine (*Pinus edulis*) and juniper (*Juniperus scopulorum*) on steep slopes and rock outcrops, and open grasslands dominated by blue grama (*Bouteloua gracilis*) and low shrubs such as winterfat (*Krascheninnikovia lanata*) and rabbitbrush (*Chrysothamnus greenei*).

Beaver dams are present in the creek. There is good vegetation cover along the banks and some undercut banks, which offer protection for the fish. The hydrology of the perched wetland is supported by groundwater seepage from nearby slopes to the north. Near the center of the seep discharge cattails (*Typha latifolia*) dominate. Beaked sedge (*Carex utriculata*) occurs in the next zone away from the center followed by Baltic rush (*Juncus balticus*) furthest from the water discharge.

Numerous non-native species occur along the Ojito Creek drainage near Hot Creek where the following species were observed: Canada thistle (*Cirsium arvense*), Kentucky bluegrass (*Poa pratensis*), redtop (*Agrostis stolonifera*), kochia (*Kochia* sp.), smooth brome (*Bromus inermis*), clover (*Medicago lupulinus*), and knapweed (possibly *Centaurea diffusa*).

Boundary Justification: The main threat to the rock-loving neoparrya would be physical disturbance of the habitat. The boundary was delineated to include the known extent of the plant population and enough of the adjacent area to incorporate portions of other habitat types. This additional habitat was included based on the assumption that pollinators of the rock-loving neoparrya may also require other types of habitat. The pollinators are unknown, consequently we are not certain that the amount of adjacent habitat is sufficient to support those species. With more information, these boundaries may change.

The boundary also encompasses the location of the Ripley milkvetch and some adjacent suitable habitat. Seed dispersal mechanisms considered important for this species are small mammals (presumably kangaroo rats) caching the seed pods and precipitation events washing the seeds downhill (Julie Burt - pers. comm.). The suspected pollinator of this plant is a common bee that could nectar on species other than Ripley milkvetch in the same habitat. This boundary is intended to allow some seed dispersal into currently unoccupied but apparently suitable habitat and provide habitat for plant pollinators.

The site encompasses the highest quality parts of the upland plant communities. The natural fire regime is thought to remain intact here (Colorado Natural Areas Program 1997b), helping to support the plant communities.

Much of the upstream watershed of Hot Creek is incorporated within the site. Proper management within this site should allow natural hydrologic regimes and help support the imperiled fish, butterfly, and wetland and riparian plant communities.

Protection and Management Comments: The site occurs mainly on public land managed by the Forest Service and Colorado Division of Wildlife. There is some land managed by the Bureau of Land Management and several small privately owned parcels in the site. Most of the watershed above the site occurs on Forest Service land, part of which is designated as the Hot Creek Research Natural Area.

Any management activities that impact the hydrology of Hot Creek could impact the fish and riparian/wetland plant communities at the site. A two-track road runs along the creek at the site. Numerous non-native plant species occur in the riparian area already, and the road may serve as a corridor for more invasive species or other impacts in the future. Knapweed species (*Centaurea* spp.) are known to be highly invasive and should be controlled before the area becomes increasingly infested. A weed monitoring and management plan for the site would help protect the imperiled elements.

The Nokomis fritillary is sought by collectors for commercial sale. Because of the specific habitat needed by this species, and the limited amount of this habitat, it would be relatively simple for collectors to find this colony and potentially impact it. Patrolling the area when the species is newly emerged (usually August) would help to prevent impacts from collectors.

Soils Description: Soil profile descriptions were taken only for the perched wetland. Soils along the main channel of Hot Creek are mostly mapped as the Shawa series, which are Fine-loamy, mixed Pachic Haploborolls (USDA 1980a). The Shawa series are moderately to well-drained soils that formed in alluvium. Soil texture typically ranges from loam to clay loam. The accumulation of organic matter is occurring in areas where the soils are persistently saturated and are not scoured by seasonal flooding. This is especially apparent for the perched beaked sedge wetland, which had approximately 10 inches of fibric peat over a sandy clay layer, which rested on bedrock. The classification of this soil is a Histic Cryaquolls.

<u>Soil Profile (perched wetland) – Histic Cryaquolls</u>
Oi – 10 inches to 0, fibric
Cg –0 10-22 inches; very dark grey (2.5 Y 3/1); sandy clay
Bedrock

Restoration Potential: The access road into the State Wildlife Area crosses Hot Creek via an old cement bridge. The bridge has cracked into two large pieces, which still provides safe access across Hot Creek, but has disrupted natural flow in the creek. Presently, this does not appear to have negatively affected the site, however installation of a new vehicular crossing at this location may prevent further hydrological disruption. Decreasing the abundance of non-native species would also greatly benefit ecosystem processes. Most ecosystem processes appear to be intact.

Wetland Functional Assessment for the Hot Creek PCA:

Proposed HGM Class: Riverine. Subclass: R2. (Riverine wetland with many areas under permanent saturation from numerous beaver ponds along the creek).
Cowardin System: Palustrine. Subsystem: Emergent and Scrub/Shrub.

Table 9. Wetland functional assessment for the riverine wetland at the Hot Creek site.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	High	Large area with high scrub-shrub and herbaceous vegetative cover yields a high capability to detain moving water from in-channel or overbank flow.
Sediment/Shoreline Stabilization	High	High vegetative cover and numerous beaver ponds along this stretch of Hot Creek results in a high ability to dissipate flow and stabilize stream banks thereby, reducing erosion.
Groundwater Discharge/ Recharge	High	The impoundment of water behind the beaver dams and the presence of moderate to well drained soils allows recharge of local groundwater tables to occur. The site may also provide crucial recharge to Valley floor sediments thereby recharging the underlying aquifers.
Dynamic Surface Water Storage	N/A	Flooding is due to stream flows and not groundwater.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	Moderate	There is high vegetative cover, soils rich in organic matter, many small beaver ponds where particulates could settle out of solution, and a lush growth of vegetation. The wetland is not receiving an excessive sediment/nutrient load from upstream sources but is likely performing important biogeochemical functions for downstream ecosystems.
Biological Functions		
Habitat Diversity	Exceptional	The wetland site consists of emergent, scrub-shrub, and aquatic bed habitats with open water areas also present.
General Wildlife Habitat	High	Elk, deer, beaver, bats, various songbirds, and aquatic/semi aquatic birds are suspected to utilize the area. Invertebrate populations are also likely diverse due to the diversity of habitat and plant species present.
General Fish/Aquatic Habitat	High	Hot Creek supports populations of the Rio Grande sucker and the Rio Grande chub.
Production Export/Food Chain Support	High	A large wetland with a diverse array of habitats, the presence of an outlet and perennial surface water yields a high potential to produce and export a diverse composition of litter, particulate organic matter, and nutrients to downstream ecosystems.
Uniqueness	Moderate	Wetland systems similar to this site are very common at higher elevations. However, water diversions and intensive grazing has impacted sites similar to Hot Creek at comparable elevations.

Proposed HGM Class: Slope. Subclass: S3. (Includes the perched wetland).
Cowardin System: Palustrine. Subsystem: Emergent.

Table 10. Wetland functional assessment for slope wetland at the Hot Creek PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	N/A	Doesn't flood from overbank or in-channel flow.
Sediment/Shoreline Stabilization	N/A	Doesn't occur along a natural surface drainage.
Groundwater Discharge/ Recharge	High	The wetland is obviously supported by seepage derived from slopes to the north. The seep discharges near the middle of the perched wetland (the wetland sits well above surrounding areas on three sides – the fourth side being the slope in which seepage is occurring).
Dynamic Surface Water Storage	High	The presence of a thick histic epipedon (organic soil horizon) and perennial groundwater discharge allows this site to store large quantities of surface water.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	Moderate	High vegetative cover and the presence of organic and sandy clay soil horizons provide many potential pathways for nutrient and toxicant transformation. However, the wetland is not receiving an excessive sediment/nutrient load from upstream sources.
Biological Functions		
Habitat Diversity	Low	The wetland basically consists of emergent and wet meadow vegetation and no open water.
General Wildlife Habitat	Moderate	Elk and deer may browse in the wetland and songbirds also may frequent the area. The site also provides crucial habitat for the Great Basin silverspot butterfly.
General Fish/Aquatic Habitat	N/A	Doesn't occur along a natural surface drainage.
Production Export/Food Chain Support	Low	The wetland does not have high species and habitat diversity and does not contain an obvious outlet.
Uniqueness	High	Although the site has yet to accumulate enough peat to be considered a fen, it does have a thick organic soil horizon and is in a unique geomorphic setting.

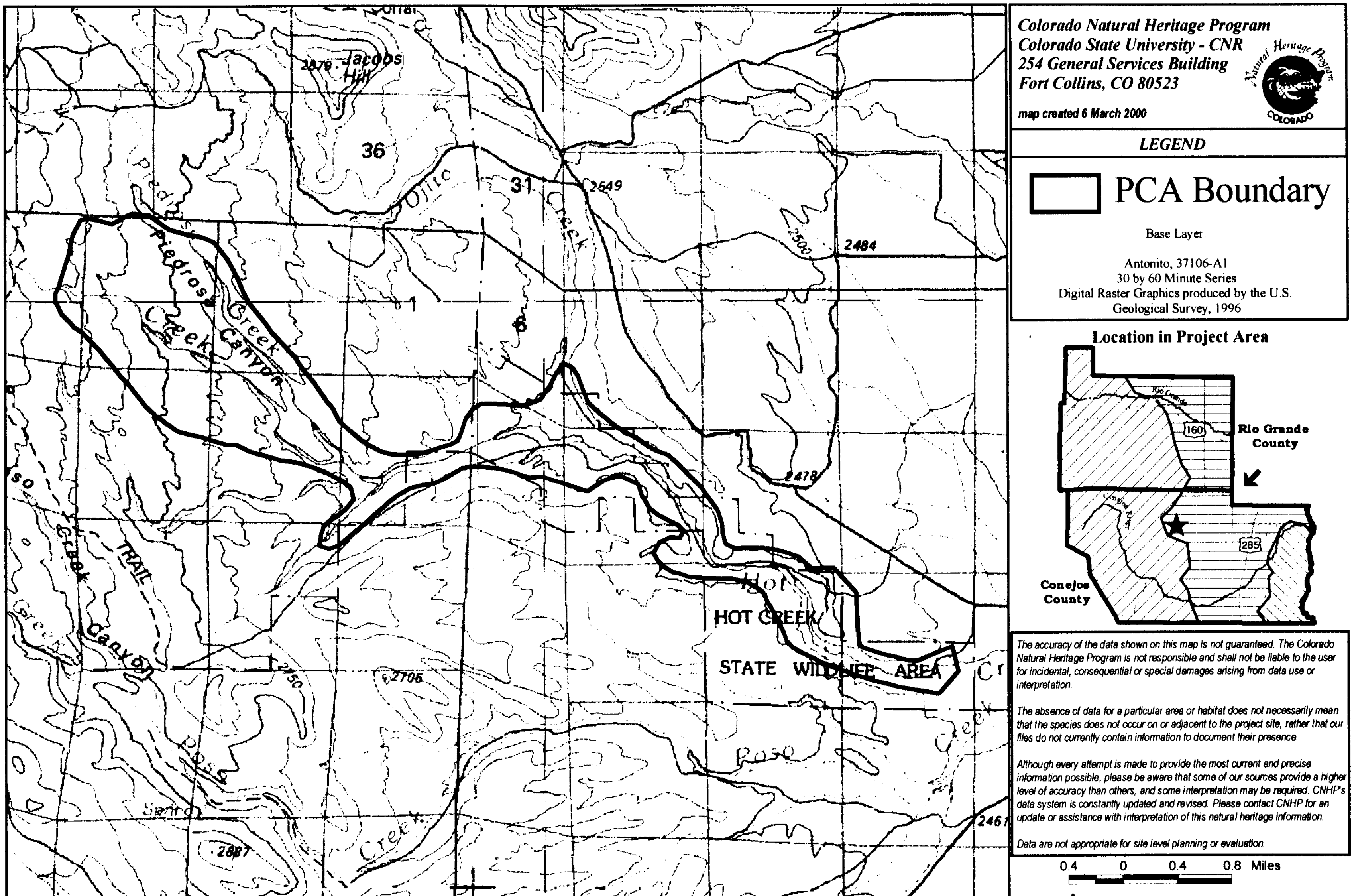


Figure 7. Hot Creek PCA

Spring Creek at Greenie Mountain Potential Conservation Area

Biodiversity Rank: B2 (Very high significance)
This site supports good examples of a plant species imperiled on a global scale and a state vulnerable plant species, fair to good examples of three plant communities vulnerable on a global scale, six good examples of widespread to abundant plant communities, five excellent occurrences of waterbirds, and one excellent example of a mouse sub-species vulnerable on a global scale.

Protection and Management Issues: The majority of the site lies within the Monte Vista National Wildlife Refuge (the remaining portion is located on private land) and currently has adequate protection. However, any alterations in the current hydrological regime could potentially affect the elements. Also of concern are current populations of non-native species, whitetop (*Cardaria* spp.) and Canada thistle (*Cirsium arvense*).

Biodiversity Rank Justification: This site contains 14 elements of concern at 16 locations. The large population of the globally imperiled slender spiderflower (*Cleome multicaulis*) found throughout the site is the primary reason for the high biodiversity rank. The slender spiderflower has a global range from southern Wyoming to central Mexico. In spite of its large range, populations of this plant have decreased dramatically in the last 100 years, especially in the southwestern states. No occurrences of this species have been documented in New Mexico or Arizona since the 1940's. There are some occurrences in Texas and Mexico while Wyoming only has one. The San Luis Valley contains the most numerous, largest, and healthiest populations in the world. There are approximately 35 occurrences of this species in Colorado. Slender spiderflower is limited by very specific habitat requirements including moist alkaline soils and some form of soil disturbance. These discriminating habitat requirements limit the slender spiderflower to the edges of alkaline wet meadows and playas.

In addition to the slender spiderflower, a population of the state imperiled giant bur-reed (*Sparganium eurycarpum*), which is mainly found on the eastern plains and in the San Luis Valley, is also supported by the site. Nine significant wetland plant communities were located at this site: small flowered sedge wet meadow (*Carex simulata*), two types of salt meadows (*Distichlis spicata* and *Distichlis spicata*-(*Scirpus nevadensis*)), three types of emergent marsh (*Eleocharis palustris*, *Scirpus acutus*, *S. maritimus*), two types of wet meadows (*Juncus balticus* var. *montanus* and *Scirpus pungens*), and saline bottomland shrublands *(Sarcobatus vermiculatus*/*Sporobolus airoides*).

Several animal species imperiled in Colorado are also represented at this site: two bird species, Snowy Egret (*Egretta thula*) and White-faced Ibis (*Plegadis chihi*) and one imperiled mammal subspecies, the silky pocket mouse (*Perognathus flavescens sanluisi*). Other state imperiled bird species that are known to use the site include the short-eared owl (*Asio flammeus*) and the Greater Sandhill Crane (*Grus canadensis tabida*).

Table 11. Natural Heritage element occurrences at Spring Creek at Greenie Mountain PCA.

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank
Plants					
Cleome multicaulis	Slender spiderflower	G2G3	S2S3	BLM	B
Sparganium eurycarpum	Giant bur-reed	G5	S2?		B
Plant Communities					
Carex simulata	wet meadow	G3	S3		B
Distichlis spicata	Salt meadows	G5	S3		B
Distichlis spicata-(Scirpus nevadensis)	Salt meadows	G4	S?		B
Eleocharis palustris	Spikerush emergent wetland	G5	S4		B
Juncus balticus var. *montanus*	Western slope wet meadows	G5	S5		B
Sarcobatus vermiculatus/ Sporobolus airoides	Saline bottomland shrublands	G3?	S3		B
Scirpus acutus	Hardstem bulrush emergent wetland	G5	S3?		B
Scirpus maritimus	Alkali bulrush emergent wetland	G4	S2		B
Scirpus pungens	Common threesquare emergent wetland/wet meadow	G3G4	S3		B
Birds					
Asio flammeus	Short-eared owl	G5	S2B, SZN		
Egretta thula	Snowy Egret	G5	S2B, SZN		A
Egretta thula	Snowy Egret	G5	S2B, SZN		A
Grus canadensis tabida	Greater sandhill crane	G5T4	S2B, S4N	SC	
Plegadis chihi	White-Faced Ibis	G5	S2B, SZN	FS, BLM	A
Plegadis chihi	White-Faced Ibis	G5	S2B, SZN	FS, BLM	A
Vertebrates					
Perognathus flavus sanluisi	Silky pocket mouse subsp.	G5T3	S3		A

*EO=Element Occurrence. Multiple listings represent separate locations.

Location: Approximately 5 air miles southeast of Monte Vista in Rio Grande County. Much of the refuge is only open to the public by special permission from the refuge manager.

U.S.G.S. 7.5-min. quadrangle: Homelake, Monte Vista, Waverly, and Fulcher Gulch

Legal Description: T37N, R07E S 1, 11, 12, 13, 14
T37N, R08E S 1-12, 17, 18
T37N, R09E S 5, 6
T38N, R08E S 25, 26, 27, 28, 29, 30, 31, 32, 33
T38N, R09E S 29, 30, 31, 32

Elevation: 7,580-7,800 ft. Approximate Size: over 15,000 acres

General Description: This site contains a diverse assemblage of open water, emergent marsh, saline wet meadows, peatland, riparian communities, and some uplands. Historically, much of the site received flow from Spring Creek and possibly from groundwater discharge. The natural hydrology of the site has been altered due to groundwater pumping and water diversions for local irrigation and for habitat management on the Monte Vista National Wildlife Refuge (Refuge). Remnants of a large fen occur near the headwaters of Spring Creek. Most of the Refuge's cultural resources occur in this area suggesting that the site used to support large populations of wildlife and was a predominant feature on the landscape (Mike Blenden - pers. comm.). The fen is almost entirely dry, as the series of springs have not exhibited flow since the late 1970's possibly due to the development of large wells in the area. The remaining portion of the PCA is heavily managed for waterbird use. Water is conveyed via numerous ditches and canals to waterbird management units to inundate these areas during seasonal use. Spring Creek has also been channelized for much of its length through the site.

Although the hydrology within the PCA does not likely represent natural historic conditions, current hydrologic management supports all of the elements found at the site. For instance, seepage from canals, ditches, and ponds supplement natural groundwater discharge is supporting sedge meadows (*Carex simulata*, *C. atherodes*, and *Scirpus pungens*) and emergent marshes (*Scirpus maritimus*, *S. acutus*, *Eleocharis palustris*, *Typha latifolia*, and *Sparganium eurycarpum*) whereas open water areas within the habitat management units support floating/submergent species (*Ranunculus aquatilis* and *Potamogeton* spp.).

It has been speculated that much of the refuge, prior to European settlement, was dominated by greasewood (*Sarcobatus vermiculatus*), saltgrass (*Distichlis spicata*), alkali sacaton (*Sporobolus airoides*), and rabbitbrush (*Chrysothamnus* spp.). There are still some very large tracts of land dominated by such species within the site. Exact species composition varies with the degree of soil moisture and salinity. For example, in areas where seasonal soil moisture is high, salt crusts may develop on the soil surface, limiting species composition to those tolerable of saline and/or alkaline soils. This occurs when the soil solution (soil water and its constituents (nutrients, salts, etc.)) becomes concentrated due to evaporation. This increase in concentration limits the solubility of calcium sulfate, calcium carbonate, and magnesium carbonate, which, as evaporation increases, eventually precipitate out of the soil solution and form salt crusts. This process also increases the proportion of soluble sodium in the soil solution, thus creating a saline soil environment (United States Salinity Laboratory Staff 1954). Often areas with thick salt crusts are void of any vegetation, however pickleweed (*Salicornia rubra*) is sometimes found in these areas and is the most saline tolerant species in the area. However, no pickleweed was located at this site. Broom seepweed (*Suaeda calceoliformis*), saltgrass, and Nevada bulrush (*Scirpus nevadensis*) occupy slightly less saline areas. Decreasing salinity and moisture allows greasewood (*Sarcobatus vermiculatus*), alkali sacaton (*Sporobolus airoides*), and Baltic rush (*Juncus balticus*) to establish. Thus, a consistent pattern of species distribution is conspicuous on the landscape: the lowest areas of saline bottomland meadows and shrublands were typically void of vegetation; saltgrass occupied bands of slightly less saline soils whereas Baltic rush and greasewood occurred on sporadic knolls. Slender spiderflower was typically found growing around the base of these knolls, occupying a very narrow band between the more saline saltgrass community and the less saline areas of Baltic rush and greasewood. Near the northeastern edge of the site, a large stand of greasewood and alkali sacaton occupies slightly drier areas than those dominated by greasewood and Baltic rush.

In addition to Spring Creek, it has also been suggested that Cat Creek and potentially Rock Creek used to flow through portions of what is now the Refuge and that most natural wetlands probably occurred along these drainages (Mike Blenden - pers. comm.). Examples of which species these wetlands may have been comprised of can still be found along Spring Creek, where the creek has not been channelized. A nice example of this occurs just east of where Spring Creek crosses Colorado Highway 15. Here, the creek exhibits a slow, meandering flow allowing productive stands of sedges (*Carex* spp.), rushes (*Juncus* spp.), and slough grass (*Beckmannia syzigachne*) to establish across a relatively broad floodplain. Early explorers who came to the Valley in the late 1800's noted that the Alamosa River, which is just south of this site, was a sinuous, marshy stream with cottonwoods and willows only occurring in periodic patches (Essington 1996). Early records also indicate that marshy areas along the Conejos River were more frequent than they are today (Essington 1996). This area along Spring Creek, although small in extent, may best represent what freshwater marshes were like in the western portion of the San Luis Valley prior to European settlement.

Boundary Justification: The boundary is drawn to encompass the ecological processes believed necessary for long term viability of the majority of the elements. The source of Spring Creek (the historic fen) is captured to ensure natural surface water flow through the site and also to allow future restoration efforts of the fen. Much of the Refuge was encompassed in order to provide rare and imperiled bird species the area, and ability to move freely in this area to find necessary resources. This also provides many source areas for seed dispersal for the plant and plant community elements. Such areas are extremely important to buffer long-term population fluctuations of the elements. Although the boundary does encompass the source of surface water input to the site, it is difficult to account for areas that contribute groundwater discharge. Thus, it is important to note that any changes in the current status of groundwater pumping and water diversions from water bodies that recharge groundwater would likely affect the elements (both positively and negatively depending on the element). Also, although the silky pocket mouse occurrence is encompassed within this site, it should be noted that site boundaries were not drawn to account for the ecological processes necessary for the viability of this element.

Protection and Management Comments: The site is mostly within the boundaries of the Monte Vista National Wildlife Refuge. A small portion of the site occurs on privately owned land. No development threats are foreseen in the immediate future, however the private lands have no formal protection.

Changes in water management could impact the integrity of the elements on this site. In addition, whitetop (*Cardaria* spp.) and Canada thistle (*Cirsium arvense*), introduced and highly aggressive species, are found within the site occupying wet meadows and irrigated areas.

Soils Description: Soils types are variable within this site, however most are derived from alluvium material and have high alkalinity. Alamosa, Arena, and Hooper are the most common soil series found in association with the wetland plant communities at this site (USDA 1980b). The Alamosa is a Fine-loamy, mixed, frigid Typic Argiaquolls. The Arena is a Fine-loamy, mixed, frigid Aquentic Durorthids. Both of these soils are poorly drained and were formed in loamy alluvium in old floodplains. The Hooper is a Clayey over sandy or sandy-skeletal, montmorillonitic, frigid Typic Natrargids (USDA 1980b). The Hooper is well drained and was also formed in alluvium on old floodplains. Soil profile descriptions were found to match mapped soil types except for a small fen, dominated by short beaked sedge, found along Spring Creek (just west of County Rd. 3E). This area had a dense fibric mat of peat overlying highly sapric material. These organic horizons appear to have formed above an impermeable layer. The water table depth was found to be at the soil surface.

<u>Soil Profile (perched wetland) – Histic Cryaquolls</u>
Oi – 22 inches to12, fibric
Oa – 12 inches to 0; highly sapric with substantial graininess
C – 17 inches to ?; extremely hard surface; no sample was taken
pH of soil water in the soil pit was 7.8.

Restoration Potential: Hydrologic restoration of Spring Creek Fen and potentially restoring natural meanders to Spring Creek are long-term projects that the Refuge would like to implement (Mike Blenden pers. comm. Jan. 11, 2000). True restoration of hydrology in this area would entail capping or stopping production of numerous wells located in the area to reestablish natural groundwater flow to the series of springs. As this is likely not feasible, restoration may occur via water diversions to a recharge area thereby returning flow to the springs. This would artificially restore hydrology and would enhance functions such as wildlife habitat, plant community diversity, and stop further degradation (decomposition) of the remaining organic soils at Spring Creek Fen. Restoring natural meanders to Spring Creek would also increase the abundance of native wetland plant communities and increase functions such as sediment/shoreline stabilization, flood attenuation and storage, and sediment/nutrient/toxicant retention and removal. Restoring natural meanders to Spring Creek would require some type of hydrological enhancement/restoration of Spring Creek Fen, since the latter serves as the headwaters of Spring Creek. A nice reference reach for channel restoration exists along Spring Creek just east of Colorado Highway 15. In this area, the creek still exhibits what is believed to be its natural meandering pattern. This area could provide a reference for calculating target meander geometry patterns and other morphological characteristics necessary for channel restoration (Federal Interagency Stream Restoration Working Group 1998).

Wetland Functional Assessment for the Spring Creek at Greenie Mountain PCA:

Proposed HGM Class: Mineral Soil Flats. Subclass: F1. (Includes saline wet meadows and shrublands).
Cowardin System: Palustrine. Subsystem: Emergent and Scrub/Shrub.

Table 12. Wetland functional assessment for mineral soil flat wetlands at the Spring Creek at Greenie Mountain PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	N/A	Doesn't flood via overbank or in-channel flow.
Sediment/Shoreline Stabilization	N/A	Doesn't occur along a natural surface drainage.
Groundwater Discharge/ Recharge	High	All of these wetlands on the site are supported by groundwater discharge as indicated by saturated areas during the dry season and the accumulation of salt crusts on the soil surface.
Dynamic Surface Water Storage	Low	There are no extensive areas of open water in these wetlands, most are saturated.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	Moderate	The wetlands likely receive return water from agricultural fields, hay meadows, and rangeland, and fine textured soils are present, however, some areas are sparsely vegetated and very little ponded water is found in these areas. The latter two limit the capability of these wetlands to perform this function.
Biological Functions		
Habitat Diversity	Moderate	The wetland site consists of salt meadows and saline shrublands with no open water.
General Wildlife Habitat	Moderate	Avocets, avocet nests w/eggs, White-faced ibis, a marsh hawk, and a few butterflies were observed in the area. Coyotes are also likely users of the area.
General Fish/Aquatic Habitat	N/A	Doesn't occur along a natural surface drainage.
Production Export/Food Chain Support	Low	Sparse growth of vegetation (due to saline/alkaline soils), low habitat and species diversity, and ephemeral surface water limits the export of organic matter and nutrients. The site does, however provide food chain support for some species (avocets, and potentially the San Luis Valley sand hills skipper, which uses saltgrass as a host plant).
Uniqueness	Moderate	Salt meadows and saline bottomland shrublands were likely more prevalent in Rio Grande and Conejos counties than they currently are due to conversion to agricultural lands and hay meadows.

Proposed HGM Class: Depression. Subclass: D2. (Wetlands are either permanently flooded (open water areas) or semi-permanently flooded (emergent marshes).
Cowardin System: Palustrine. Subsystem: Emergent and Aquatic Bed.

Table 13. Wetland functional assessment for depressional wetlands at the Spring Creek at Greenie Mountain PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	N/A	Do not flood via overbank or in-channel flow.
Sediment/Shoreline Stabilization	N/A	Do not occur along a natural surface drainage.
Groundwater Discharge/ Recharge	Moderate	Seeps and groundwater discharge support most of these wetlands, however some are supported by managed water regimes and seepage from such areas. Thus, it is difficult to discern how much is natural groundwater discharge versus seepage from waterbird management units, hence the moderate rating.
Dynamic Surface Water Storage	High	There are extensive areas of open water in these wetlands. Whether from a natural origin or not, large quantities of water can be retained in these wetlands.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	High	These wetlands likely receive return water from agricultural fields, hay meadows, and rangeland, extensive areas of open water are in the area, and vegetation cover is high.
Biological Functions		
Habitat Diversity	High	Emergent and aquatic bed vegetation occur in these areas with open water areas.
General Wildlife Habitat	High	Avocets, White-Faced Ibis, Wilson's Phalaropes, various duck species, Greater Sandhill Cranes, Common Snipe, and a weasel-like mammal were observed in the area. High plant species diversity likely supports diverse invertebrate populations.
General Fish/Aquatic Habitat	N/A	Doesn't occur along a natural surface drainage.
Production Export/Food Chain Support	High	Plant species diversity is high, vegetation cover is high, permanent and semi-permanent water is present, and organic soil horizons are present in many of these areas. All these attributes provide for excellent food chain support and exportation of various organic substrates.
Uniqueness	Low	These freshwater wetlands are common throughout the area.

Proposed HGM Class: Riverine. Subclass: R3. (Channelized stream whose herbaceous, rather than woody, species dominate the banks and floodplain).
Cowardin System: Palustrine. Subsystem: Emergent.

Table 14. Wetland functional assessment for the riverine wetland (Spring Creek) at the Spring Creek at Greenie Mountain PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	Low	Lack of woody vegetation, unrestricted outlet, and decreased flood volumes/frequency (due to water diversions, groundwater pumping, and channelization) impair the ability of this area to attenuate and store floodwaters. Restoration may improve the ability to perform this function.
Sediment/Shoreline Stabilization	High	Although Spring Creek has been channelized, it has not been severely incised. Emergent vegetation is growing within the channel and on the stream banks.
Groundwater Discharge/ Recharge	High	Inputs from irrigation water, seepage from waterbird management units, and natural groundwater discharge likely make Spring Creek a gaining stream.
Dynamic Surface Water Storage	N/A	Flooding is due to stream flows and not groundwater.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	High	Inputs from irrigation water and seepage from waterbird management units likely contribute excess nutrient loads as indicated by the extensive mats of algae occasionally encountered within the stream channel. High vegetation cover and fine textured soils provide many potential pathways for nutrient and toxicant transformation. The presence of the algal mats, however, suggests that the wetland areas are not able to retain or remove enough of the excess nutrient load to avoid eutrophication problems.
Biological Functions		
Habitat Diversity	High	The wetland site consists of emergent and aquatic bed habitats with some open water areas.
General Wildlife Habitat	High	Cattle Egrets were observed along the stream channel and marsh hawks were observed hunting in the area. Also, an unknown Rail (Sora?) was heard but could not be identified. Coyotes and other small mammals likely use the stream and adjacent floodplain for food/cover.
General Fish/Aquatic Habitat	Low to Moderate	Did not observe any fish. Adequate stream flow and plenty of vegetative cover suggest potential fish habitat. However, extensive mats of algae were observed within the stream channel, which may indicate eutrophication is occurring.
Production Export/Food Chain Support	High	High vegetative cover both within the stream channel and on adjacent floodplain areas contribute to organic matter export. These areas also likely support a diverse invertebrate population thereby providing food chain support.
Uniqueness	Moderate	The reach of Spring Creek near CO Hwy. 15, where the stream has not been channelized and is upstream from major water diversions, is very unique. This area probably best represents what many streams in the Valley looked like prior to European settlement. The remaining stretch of Spring Creek has very little unique value due to the multitude of disturbances it has suffered.

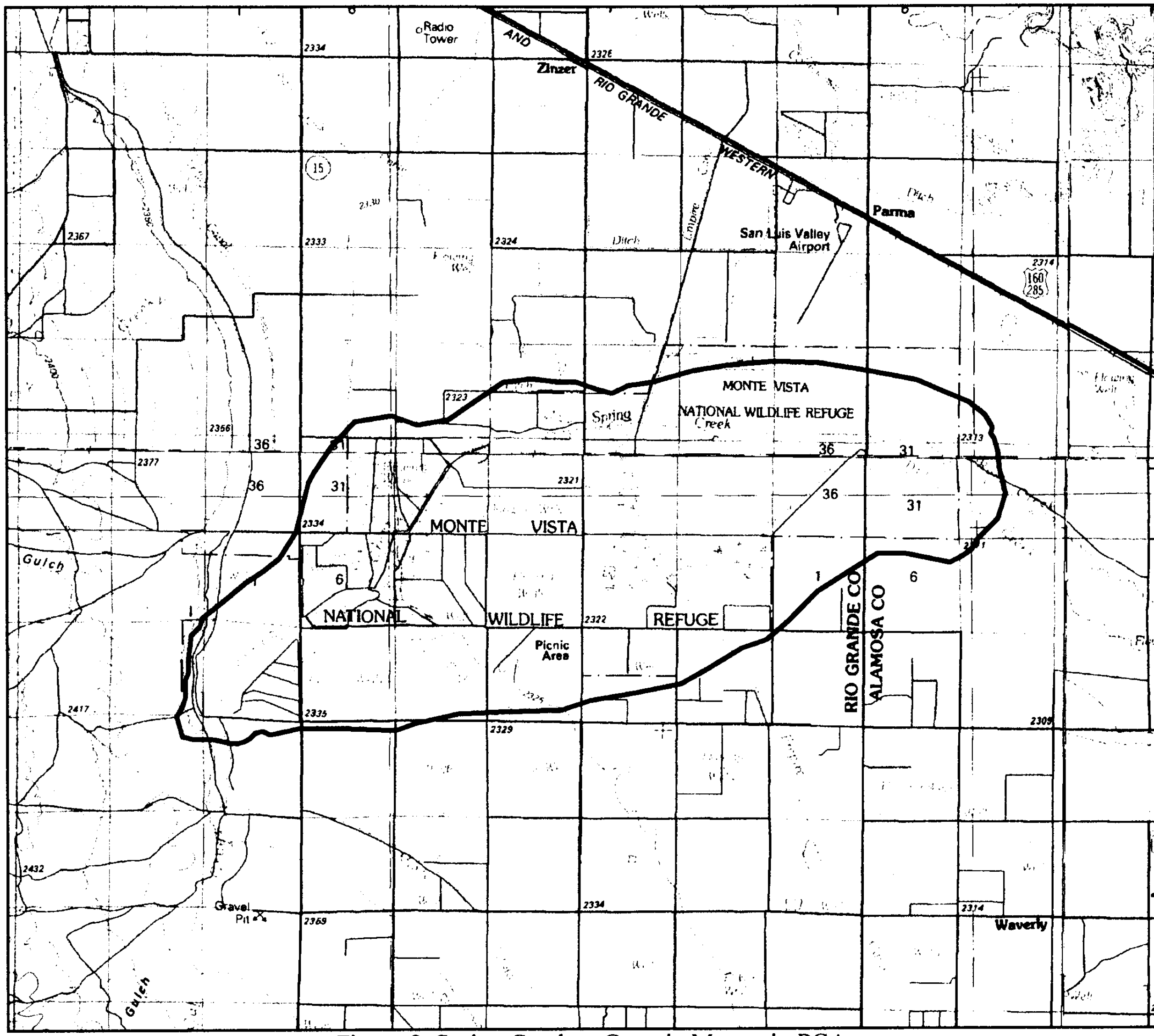


Figure 8. Spring Creek at Greenie Mountain PCA

Colorado Natural Heritage Program
Colorado State University - CNR
254 General Services Building
Fort Collins, CO 80523

map created 9 March 2000

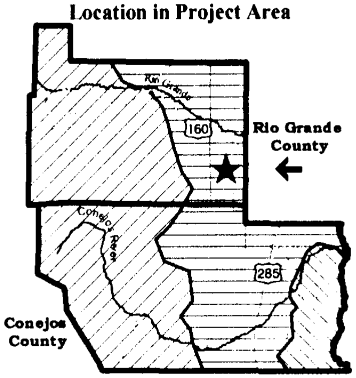
LEGEND

PCA Boundary

Base Layers:

Antonito, 37106-A1
Del Norte, 37106-E1
30 by 60 Minute Series
Digital Raster Graphics produced by the U.S. Geological Survey, 1996

Location in Project Area



The accuracy of the data shown on this map is not guaranteed. The Colorado Natural Heritage Program is not responsible and shall not be liable to the user for incidental, consequential or special damages arising from data use or interpretation.

The absence of data for a particular area or habitat does not necessarily mean that the species does not occur on or adjacent to the project site, rather that our files do not currently contain information to document their presence.

Although every attempt is made to provide the most current and precise information possible, please be aware that some of our sources provide a higher level of accuracy than others, and some interpretation may be required. CNHP's data system is constantly updated and revised. Please contact CNHP for an update or assistance with interpretation of this natural heritage information.

Data are not appropriate for site level planning or evaluation.

1 0 1 2 Miles

Projection: UTM, Zone13, NAD27

Alamosa River at De la Luz Cemetery Potential Conservation Area

Biodiversity Rank: B3 (High significance)
The Alamosa River at De la Luz Cemetery site supports one good example of a riparian plant community vulnerable on a global scale and one fair example of a submergent wetland plant community.

Protection and Management Issues: The site is privately owned and has no formal protection. The site has not been under any intensive management (grazing or agriculture) for the past five years. Besides the cumulative effects that an upstream reservoir has had on hydrology, non-native species, mainly Canada thistle (*Cirsium arvense*) and smooth brome (*Bromus inermis*), are the only known management concerns at this time.

Biodiversity Rank Justification: This site contains two elements of concern: the globally vulnerable montane riparian forest (*Populus angustifolia/Alnus incana*) and a montane floating/submergent wetland (*Sparganium angustifolium*). In Colorado, the narrowleaf cottonwood/thinleaf alder montane riparian forest is a fairly common community along montane streams, but few high quality examples exist. Although threatened by stream flow alterations and some effects of past grazing, this occurrence has not been grazed in five years.

Table 15. Natural Heritage element occurrences at Alamosa River at De la Luz Cemetery PCA.

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank
Plant Communities					
Populus angustifolia/Alnus incana	Montane Riparian Forest		S3		B
Sparganium angustifolium	Montane Floating/Submergent Wetlands	G4?	S2S3		C

*EO=Element Occurrence

Location: This site is located approximately 3 miles northwest of Centro in Conejos County, and occurs along the Alamosa River just southeast of the De la Luz Cemetery.
U.S.G.S. 7.5-min. quadrangle: Centro
Legal Description: T36N, R07E S 27, 28
Elevation: 8,100-8,160 ft. Approximate Size: 280 acres

General Description: This site contains submergent, wet meadow, and riparian habitat along the Alamosa River, and occurs at the meeting of the foothills of the San Juan mountains and the San Luis Valley floor (San Juan Mountains and Alamosa Basin physiographic sub-regions, respectively). Topography of the site is relatively flat.

This riparian/wetland complex is maintained by flows in the Alamosa River and the high groundwater table located in the narrow floodplain. Terrace Reservoir, which lies approximately four miles upstream, has greatly changed the hydrology of this site. Although periodic flooding does occur on the Alamosa River (often ditch companies are not diverting water in late spring), the volume of peak floods has been reduced by the presence of the reservoir (Stern 1997). Reservoirs often do not allow sediment to pass through the impoundment, which, in addition to channelization, causes the river downstream to scour the banks and the river bottom until its bed load has reached equilibrium with the sediment carrying capacity of the river (Federal Interagency Stream Restoration Working Group, 1998). This process causes the river channel to become incised, lowering local water tables and destroying riparian and floodplain habitat (Federal Interagency Stream Restoration Working Group 1998). Near the upstream end of the site, an abandoned irrigation headgate sits almost 10 feet higher than the current level of the river due to these processes. Although current hydrological conditions appear to be supporting the elements, the incision of the river channel and subsequent reduction in seasonal flooding limits the ability of these communities to regenerate on a scale that would maintain viable occurrences in the long-term. For example, the local groundwater table does not appear to have been lowered enough to negatively affect the floating/submergent wetland community. However seasonal flooding is necessary for creating the proper geomorphic setting for populations of cottonwood to establish, such as a sinuous river system (e.g., oxbows) and flood channel scouring.

Narrowleaf cottonwood (*Populus angustifolia*) and thinleaf alder (*Alnus incana*) are the dominant species along the riverbank, forming a long, narrow riparian community. Wet meadows occur within the floodplain with graminoids, such as Baltic rush (*Juncus balticus*) and timothy (*Phleum pratense*), and mixed forbs dominating these areas. A small slough (old oxbow) occurs on the south side of the river where beaked sedge (*Carex utriculata*) occupies the margins and narrow-leaved bur-reed (*Sparganium angustifolium*) occurs in open water areas.

Grazing has not occurred on the site (at least south of the river) in the past five years; as a result vegetation growth is dense and tall. Early explorers to the San Luis Valley noted "crops of rank sedges and grasses" and "rich, dark grasses" growing along many riparian areas (Essington 1996). Based on these statements and on observations of understory growth in other healthy riparian areas (e.g., McIntire Springs), this site could serve as a reference site for restoration efforts along the Alamosa River downstream of this location.

Boundary Justification: The site boundary includes the immediate floodplain and a secondary floodplain terrace to allow the river to continue its geomorphic processes when possible (i.e., water releases from Terrace Reservoir). Although grazing appears to be minimal on adjacent properties, the boundary provides a buffer against potential impacts of this activity by filtering surface water runoff from heavy nutrient and sediment loads that could potentially affect the elements, and protection from excessive trampling and browsing. It should be noted that although upstream portions of the Alamosa River were not included within the site boundary, but these areas and the ecological processes they support are vital to the viability of the elements.

Protection and Management Comments: The site is entirely under private ownership and has no formal protection. However, the landowner has not utilized the property, other than for recreation, for the past five years.

Non-native species such as Canada thistle (*Cirsium arvense*) and smooth brome (*Bromus inermis*) are conspicuous within wet meadow areas. Although this site has been disturbed by past grazing and the consequences of an upstream reservoir, it is in relatively good condition compared to downstream areas where heavy grazing still occurs along the river, water diversions are prevalent, and the river channel has been deeply incised. The cumulative effects from the upstream reservoir and downstream channelization are important management concerns.

Soils Description: Soils are mapped as Aquents and were confirmed via field reconnaissance (USDA 1980a). Aquents, which have formed in alluvium, are young soils that have either: (1) accumulated a large amount of organic matter in the upper horizons; (2) have aquic conditions (continuous or periodic saturation and reduction) within 50 cm of the soil surface; and/or (3) have a reduced matrix in all horizons below the 25 cm depth (Soil Survey Staff 1994). The Aquents in this area typically have a deep A-horizon (~15 inches) overlying the C-horizons. This indicates that organic matter accumulation began shortly after the alluvium was deposited. It is likely that soils in the old oxbow have accumulated much more organic matter.

Restoration Potential: Mechanisms to reestablish historic seasonal flood peaks and maintenance of natural winter stream flows to the site would require coordination and a working partnership with Terrace Irrigation Company. Physical restoration practices are currently being conducted downstream in an attempt to restore natural meanders and build up the streambed to alleviate further channel incision, subsequent loss of riparian habitat, and decline of local water tables (Jeff Stern person. comm. August, 1999). Upon determination of the effectiveness of these techniques, such methods may be useful for this site.

Wetland Functional Assessment for the Alamosa River at De la Luz Cemetery PCA:

Proposed HGM Class: Riverine. Subclass: R3.
Cowardin System: Palustrine. Subsystem: Emergent, Scrub/Shrub, and Forested.

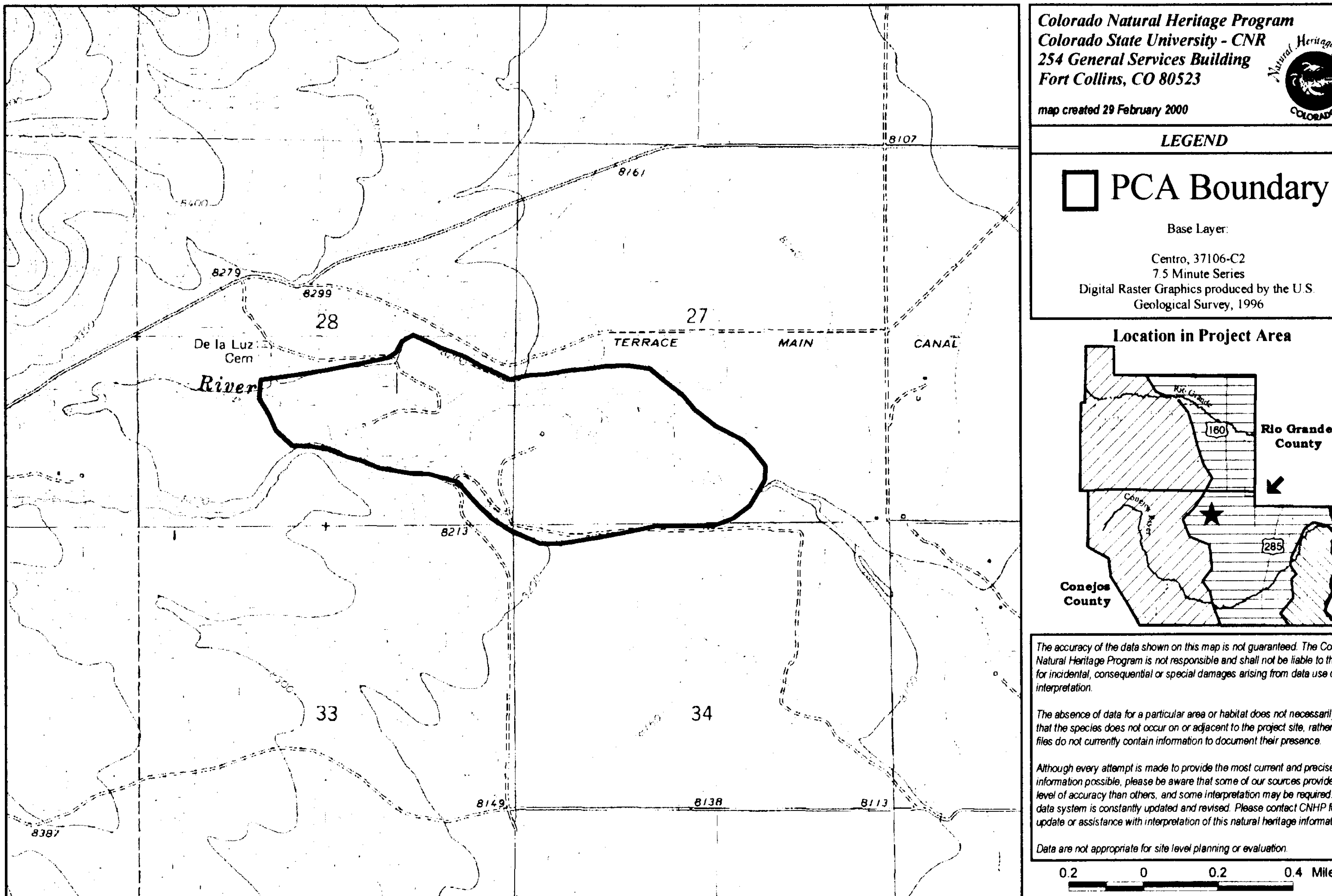
Table 16. Wetland functional assessment for the riverine wetland at the Alamosa River at De la Luz Cemetery PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	Moderate	Presence of Terrace Reservoir often precludes this site to perform much in the way of flood attenuation. Moderate cover of woody vegetation and a relatively broad floodplain provide moderate potential for flood control.
Sediment/Shoreline Stabilization	Moderate	Channel incision has caused many areas along the stream banks to erode into steep banks not allowing vegetation to establish. Other areas appear well vegetated.
Groundwater Discharge/ Recharge	High	The Colorado Department of Water Resources has determined that the Alamosa River loses water due to infiltration to the underlying aquifer between Terrace Reservoir and Gunbarrel Road (CO. Hwy 15), which is downstream of this site (Ford & D. Skidmore 1996).
Dynamic Surface Water Storage	N/A	Flooding is due to stream flows and not groundwater.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	Moderate	This area receives upstream water that is laden with heavy metals from abandoned mine drainage and natural sources. Gough et al. 1996 collected water and streambed sediment samples in close proximity to this site. They found high concentrations of copper and zinc in these samples and in wetland samples near the confluence with the Rio Grande. The riparian and wetland habitats do not appear to be retaining/removing any noticeable amounts of toxicants. This may be because floodwaters no longer reach floodplain soils and/or enough heavy metals are carried downstream in the main channel that no down-gradient trends are observed.
Biological Functions		
Habitat Diversity	Exceptional	Emergent, scrub/shrub, and forested wetland habitats occur at this site. Open water areas are also present
General Wildlife Habitat	Moderate	Elk and deer may use the area for browse. Diverse vegetation structure and high vegetation volume provides good potential habitat for songbirds. Unclear how heavy metals in the river have affected wildlife use of the area.
General Fish/Aquatic Habitat	Low	Heavy metals, especially from acid mine drainage, have inhibited fish from surviving. However, a local landowner recently sighted fish in the river.
Production Export/Food Chain Support	High	A diverse array of habitats, the presence of an outlet, and perennial surface water yields a high potential to produce and export a diverse composition of litter, particulate organic matter, and nutrients to downstream ecosystems
Uniqueness	Moderate	High habitat diversity, common riparian site, and history of past disturbance.

Proposed HGM Class: Depression. Subclass: D2. (wetland is permanently flooded (submergent vegetation).
Cowardin System: Palustrine. Subsystem: Emergent and Aquatic Bed.

Table 17. Wetland functional assessment for the depressional wetland at the Alamosa River at De la Luz Cemetery PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	N/A	Does not flood via overbank or in-channel flow.
Sediment/Shoreline Stabilization	N/A	Does not occur along a natural surface drainage.
Groundwater Discharge/ Recharge	High	Groundwater discharge associated with the floodplain water table supports this wetland.
Dynamic Surface Water Storage	Moderate	This wetland is permanently flooded but does not store large quantities of surface water due to its small size.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	Moderate	The wetland may retain some heavy metals from upstream sources. High vegetation cover and fine textured soils provide many potential pathways for nutrient transformation.
Biological Functions		
Habitat Diversity	High	Emergent and aquatic bed vegetation occur with small amounts of open water.
General Wildlife Habitat	Low to Moderate	Small wetland size. May potentially provide habitat for amphibians, and wading birds. However, poor water quality of may limit this potential.
General Fish/Aquatic Habitat	N/A	The wetland is small and does not have surface water connection with a major drainage.
Production Export/Food Chain Support	Low	The small size of the wetland, in addition to not having an outlet, leads to a low export of organic substances. However, the wetland does provide some food chain support by providing habitat for invertebrate species.
Uniqueness	Moderate	Old oxbow wetlands are fairly common in the area, however this particular one is in relatively good condition and has high habitat diversity.



Colorado Natural Heritage Program
Colorado State University - CNR
254 General Services Building
Fort Collins, CO 80523

map created 29 February 2000

LEGEND

PCA Boundary

Base Layer:

Centro, 37106-C2
7.5 Minute Series
Digital Raster Graphics produced by the U.S. Geological Survey, 1996

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Data are not appropriate for site level planning or evaluation.

0.2 0 0.2 0.4 Miles

Projection UTM, Zone13, NAD27

Figure 9. Alamosa River at de la luz Cemetary PCA

Elephant Rocks Potential Conservation Area

Biodiversity Rank: B3 (High significance)
The Elephant Rocks site supports a fair example of a wetland plant imperiled on a global scale, one good and two fair examples of plants vulnerable on a global scale, and an excellent example of a San Luis Valley endemic pocket mouse subspecies.

Protection and Management Issues: The majority of the site is publicly owned and managed by the Bureau of Land Management. However, the portion that is privately owned contains a population of the globally imperiled slender spiderflower (*Cleome multicaulis*). Consideration of this private inholding would be beneficial to a conservation plan at this site. Current land use practices do not appear to be endangering the elements of concern.

Biodiversity Rank Justification: This site supports a moderate-sized population of the globally imperiled slender spiderflower (*Cleome multicaulis*), which has a global range from southern Wyoming to central Mexico. The San Luis Valley contains the most numerous, largest, and healthiest populations in the world. Slender spiderflower has a limited distribution due to its requirement of moist alkaline soil along with periodic soil disturbance, such as pocket gopher (*Thomomys* sp.) diggings. These habitat requirements limit the slender spiderflower to the edges of alkaline wet meadows and playas. The site also supports a medium-sized population of the rock-loving neoparrya, a plant endemic to south-central Colorado. This species is restricted to south-central Colorado and is on the BLM and Forest Service lists of sensitive species. The size of this population is estimated at 2000 individuals. In addition to the rock-loving neoparrya, a silky pocket mouse subspecies (*Perognathus flavus sanluisi*) population is found here. The silky pocket mouse is a subspecies restricted to the San Luis Valley and is rare within its range. A small occurrence of the grass fern (*Asplenium septentrionale*) at this site represents the southern most extension of this uncommon fern.

Table 18. Natural Heritage element occurrences at Elephant Rocks PCA.

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank
Plants					
Neoparrya lithophila	Rock-loving neoparrya	G3	S3		B
Asplenium septentrionale	Grass fern	G3G4	S3S4		C
Cleome multicaulis	Slender spiderflower	G2G3	S2S3	BLM	C
Vertebrates					
Perognathus flavus sanluisi	Silky pocket mouse	G5T3	S3		A

*EO=Element Occurrence

Location: The Elephant Rocks site is located in south-western Saguache and northern Rio Grande counties, approximately 3.5 miles northeast of the town of Del Norte.
U.S.G.S. 7.5 min. quadrangle: Twin Mountains SE, Del Norte
Legal Description: T40N R06E S 2, 3, 4, 9
T41N R06E 33, 34

Elevation: 7,800-8,000 ft. Approximate Size: 890 acres

General Description: The Elephant Rocks site lies at the base of the San Juan foothills on the Saguache-Rio Grande County line. It is comprised of a complex of volcanic boulders, rock outcrops, and shrublands separating the prairie of the valley floor from the San Juan Mountains. The vegetation among the boulders is sparse piñon pine-juniper open woodland *(Pinus edulis-Juniperus monosperma*). Numerous native grasses and forbs occupy pockets of soil between the boulders and in crevices, including blue grama (*Bouteloua gracilis*), Fendler's poa (*Poa fendleriana*), and mountain muhly (*Muhlenbergia montana*). These grasses usually dominate the intermittent streams that separate the boulder outcrops as well.

Slender spiderflower is found along a permanent stream that drains from Shaw Springs. This is a newly documented population, first documented during the 1999 inventory. The stream and Shaw Springs are located on private land. The landowner, in partnership with local natural resource agencies, recently constructed a series of wetland cells along the course of the stream in order to enhance and create wildlife habitat. This activity resulted in the establishment of a medium-sized population of slender spiderflower. The plants were located along the periphery of each wetland cell and along the banks of the stream. The plants were more robust in their appearance than any other population located during this study. Although the hydrological source of the site is natural, human-induced disturbance modified the local soils creating a welcoming environment for slender spiderflower. Seeds carried by birds or possibly a remnant seed bank likely explain the proliferation of this species in such a short time frame.

The vulnerable rock-loving neoparrya, a forb in the carrot family, is found between crevices in rocks and on small flat pockets of soils between boulders. Overhanging boulders often protect the plant. The area surrounding the boulders are dominated by rabbitbrush (*Chrysothamnus nauseosus*), greasewood (*Sarcobatus vermiculatus*), and a grassland of blue grama, Indian rice grass (*Oryzopsis hymenoides*), and squirrel tail (*Elymus elymoides*). The silky pocket mouse (*Perognathus flavus sanluisi*), a San Luis Valley endemic, was found in the shrub and grassland habitat. Much of this site is part of a state-designated natural area. It receives some recreation, including hunting and camping.

Boundary Justification: This boundary encompasses an area in which direct impacts to the elements, such as trampling or other surface disturbance, should be avoided and provides suitable habitat where additional individuals can become established over time. The boundary also encompasses Shaw Springs to ensure the hydrological source necessary for the viability of the slender spiderflower is protected.

Protection and Management Comments: The majority of this site is managed by either the Bureau of Land Management or Rio Grande National Forest, and part is a State Natural Area. Consideration of the private inholding would be beneficial to any protection plan. A conservation easement may be a useful tool to ensure long-term protection. The landowner expressed a strong interest in protecting the cultural and natural resources located on the property.

Current land use practices at this site do not appear to be endangering the elements of concern. However, further alteration of the stream, springs, and constructed wetland cells may affect the population of slender spiderflower.

Soils Description: Soil pits were not dug at this site. The soil in which the wetland area has formed is mapped as the San Luis series. The San Luis is classified as a Fine-loamy over sandy or sandy-skeletal, mixed, frigid, Aquic Natrargids (USDA 1980b). These soils are somewhat poorly drained, formed in alluvium in old floodplains, and are strongly alkaline.

Restoration Potential: This area was once a popular destination for both Native Americans and early settlers who came to bath in the "healing waters" of Shaw Springs (Mike Wisdom person. comm. July, 1999). As a consequence, a lot of human induced impacts have occurred at this site for many centuries. The springs are, for the most part, contained in an old cement foundation. Restoring this area back to natural conditions would likely jeopardize many of the cultural resources at this site. In addition, recent wildlife enhancement activities have altered the natural flow of the stream and have created a series of wetland cells that previously did not exist at this site. Given the cultural resources that are present and recent efforts toward wildlife enhancement, there is low potential for restoring this area back to a free-flowing spring and associated stream. Although anthropogenic in origin, the created wetland cells do provide wildlife habitat and the population of the rare slender spiderflower at this site exists as a result of these manipulations.

Wetland Functional Assessment for the Elephant Rocks PCA:

Proposed HGM Class: Riverine. Subclass: R2 (permanent saturation is derived from warm springs).
Cowardin System: Palustrine. Subsystem: Emergent.

Table 19. Wetland functional assessment for the Elephant Rocks PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	Low	The creek is mostly supported by a series of springs. Thus, flood attenuation would not likely be a normal function at this site (dynamic surface water is more appropriate).
Sediment/Shoreline Stabilization	High	High vegetative cover exists along this perennial stream which results in a high ability to dissipate flow and stabilize sediment, thereby reducing erosion.
Groundwater Discharge/ Recharge	High	The presence of Shaw Springs, which have perennial flow, indicates that this is a groundwater discharge area.
Dynamic Surface Water Storage	Moderate to High	The soils in this area are somewhat poorly drained which likely accentuates surface water storage, however the creek drains down a moderate slope and appears to mainly be confined to the main channel limiting the area in which surface water could be stored. Thus, without the constructed wetland cells, surface water storage in this area would probably be moderate. However, the presence of the wetland cells currently stores large amounts of water.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	Moderate	Surface water is ponded in the wetland cells, vegetation cover is fairly high, and fine textured soils are present. Thus, normal biogeochemical processes are probably high but removal of sediments/nutrients/toxicants from upstream sources is minimal, since upstream inputs of managed water does not exist.
Biological Functions		
Habitat Diversity	Moderate	Emergent vegetation is present along with open water areas within the constructed wetland cells.
General Wildlife Habitat	Moderate	The open water areas provide potential habitat for waterbirds and amphibians. The springs and the perennial flow in the creek may provide feeding areas for other species such as raptors, deer, elk, songbirds, and small mammals. The presence of the artificial wetland cells may provide habitat for invertebrates.
General Fish/Aquatic Habitat	Low	The presence of the wetland cells limits the mobility of any fish that may have been present in the stream. In addition, the size of this creek is very small.
Production Export/Food Chain Support	Moderate	Food chain support was increased at this site with the construction of the wetland cells, however these areas decreased the export of litter and other organic substrates (they eliminate downstream movement of these substrates).
Uniqueness	High	The site contains a warm springs (Shaw Springs), contains numerous cultural resources, and supports a population of a globally imperiled plant species.

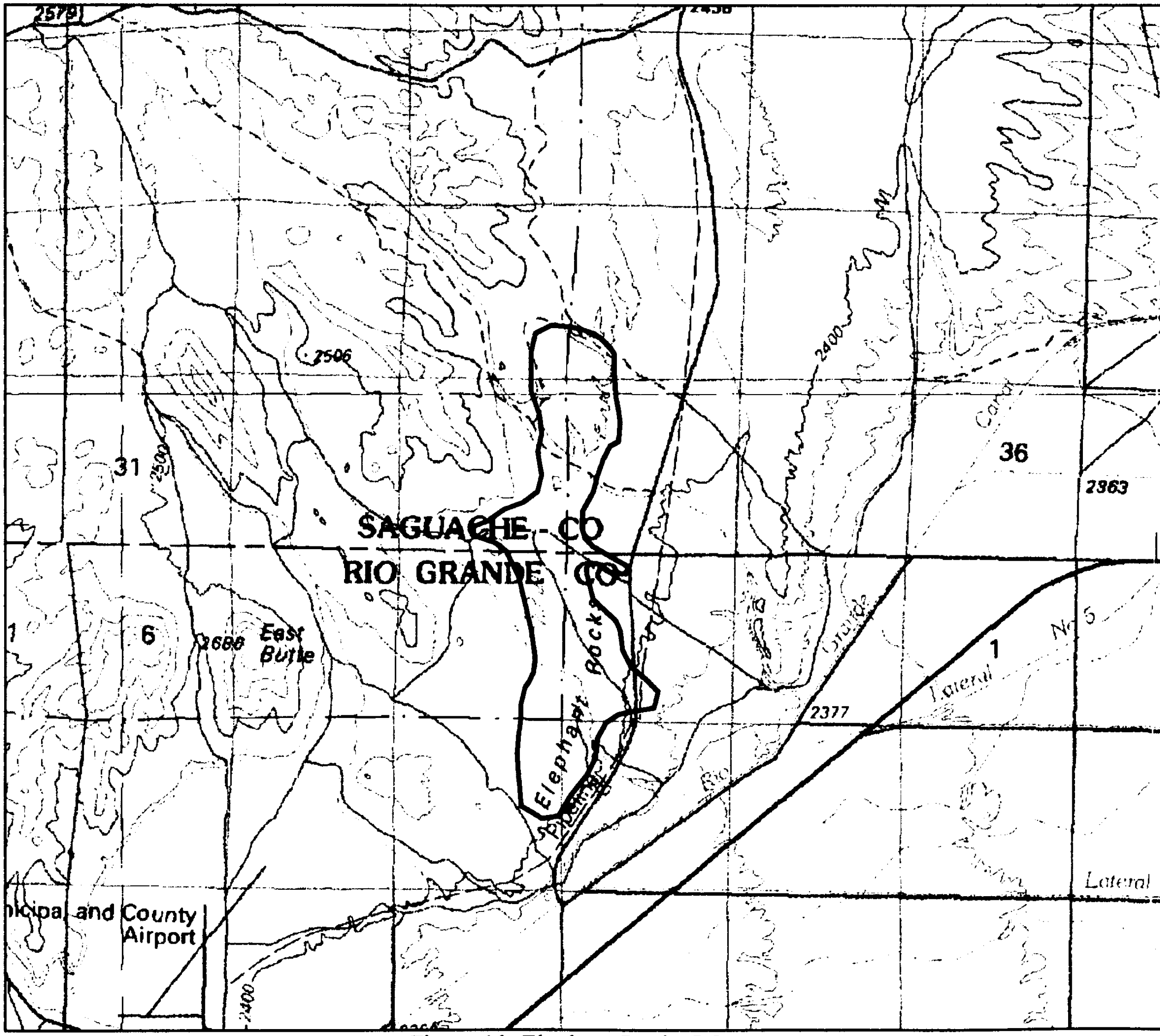


Figure 10. Elephant Rocks PCA

Colorado Natural Heritage Program
Colorado State University - CNR
254 General Services Building
Fort Collins, CO 80523

map created 6 March 2000

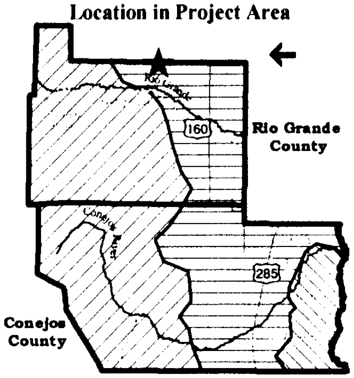
LEGEND

PCA Boundary

Base Layer:

Del Norte, 37106-E1
30 by 60 Minute Series
Digital Raster Graphics produced by the U.S. Geological Survey, 1996

Location in Project Area



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Data are not appropriate for site level planning or evaluation.

0.5 0 0.5 1 Miles

Projection UTM, Zone13, NAD27

Hot Creek/La Jara Creek Confluence Potential Conservation Area

Biodiversity Rank: B3 (High significance)
The Hot Creek/La Jara Creek Confluence site supports one good example of a wetland plant community vulnerable on a global scale and one good example of a common riparian plant community.

Protection and Management Issues: The majority of the site is privately owned and has no formal protection. The elements are currently not threatened by management practices. Non-native species along the periphery of the site could potentially impact the plant communities.

Biodiversity Rank Justification: This site contains two elements of concern, with the globally vulnerable montane wet meadow community (*Carex lanuginosa*) being the primary reason for the high biodiversity rank. Although the coyote willow/mesic graminoid community (*Salix exigua*/mesic graminoid) is very common, this stand was the most intact and pristine occurrence located during this survey. Non-native species cover in this stand is estimated at less than 5%. No grazing impacts were observed.

Table 20. Natural Heritage element occurrences at Hot Creek/La Jara Creek Confluence PCA.

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank
Plant Communities					
Carex lanuginosa	Montane wet meadows	G3?	S3		B
Salix exigua/mesic graminoid	Coyote willow/mesic graminoid	G5	S5		B

*EO=Element Occurrence

Location: This site is located approximately ½ mile south of Centro in Conejos County and occurs at the confluence of Hot Creek and La Jara Creek.
U.S.G.S. 7.5-min. quadrangle: Centro
Legal Description: T35N, R08E S 17, 18
Elevation: 7,840-7,870 ft. Approximate Size: 321 acres

General Description: This site occurs near the confluence of Hot Creek and La Jara Creek. The confluence of the two creeks, in addition to many small beaver ponds that line La Jara Creek, has caused permanent impoundment of water over much of the site. It is estimated that at least 150 acres of the site was inundated with approximately six inches of water at the time of the site visit (mid-September). Further upstream along Hot Creek is Hot Creek State Wildlife Area where numerous beaver ponds occur. The impoundment of water caused by these ponds saturate local soils and recharges the local groundwater table, providing perennial flow in Hot Creek. These flows, in addition to those in La Jara Creek (which is supplemented by upstream irrigation along La Jara Creek), are impounded by another series of beaver ponds near the confluence. This has created a large expanse of emergent marsh and wet meadows between the two creeks.

Woolly sedge (*Carex lanuginosa*), which occurs in sporadic patches throughout the area, is the most dominant community type at this site. Baltic rush (*Juncus balticus*), field mint (*Mentha arvense*), and silverweed (*Argentina anserina*) occur in wet meadow habitats. Cattail (*Typha latifolia*), spike rush (*Eleocharis palustris*), beaked sedge (*Carex utriculata*), nodding beggarticks (*Bidens cernua*), and water speedwell (*Veronica catenata*) are more prevalent in wetter areas. Coyote willow (*Salix exigua*) is found along the banks of the creeks and edges of beaver ponds. A large stand of coyote willow with a lush understory of mesic graminoids occurs on the western side of the site. In wet meadows along the northern and western portion of the site, signs of grazing become more evident.

Boundary Justification: The inundated area between Hot Creek and La Jara creek, along with numerous beaver ponds, were included within the site boundary. This allows natural sedimentation of beaver ponds and subsequent new channel formation to occur in the area. These hydrologic processes, along with continued beaver activity, are necessary to maintain the mosaic of wetland plant communities and species found at this site. The wet meadows located on the northern and western edge of the site were also included to provide a buffer between the main wetland complex and adjacent agricultural land. Although these areas currently abound with non-native species, future management efforts could potentially reestablish native wet meadow species. Upstream areas are not included in the site boundary, but activities such as water diversions and increased sediment and nutrient loads, occurring in these watersheds (Hot Creek and La Jara Creek) could affect the elements.

Protection and Management Comments: The site is mostly under private ownership. The Bureau of Land Management manages a small parcel, but there is no formal protection.

Impacts from grazing are minimal throughout most of the wetland complex due to very wet conditions (livestock do not appear to enter these areas). Thus, much of the wetland complex is void of non-native species and retains lush, productive growth of native vegetation. However, near the northern and western edges of the site, the soils are drier, evidence of grazing is apparent, and the abundance of non-native species greatly increases. Beyond these weedy meadows, native vegetation has for the most part been cleared for agriculture.

Soils Description: Soils are mostly mapped as the Shawa series, which are Fine-loamy, mixed Pachic Haploborolls (USDA 1980a). The Shawa series are moderately to well-drained soils that have formed in alluvium. Soil texture typically ranges from loam to clay loam. The accumulation of organic matter is occurring in areas where the soils are persistently saturated and are not scoured by seasonal flooding. Sediment is accumulating behind the many small beaver dams in the area.

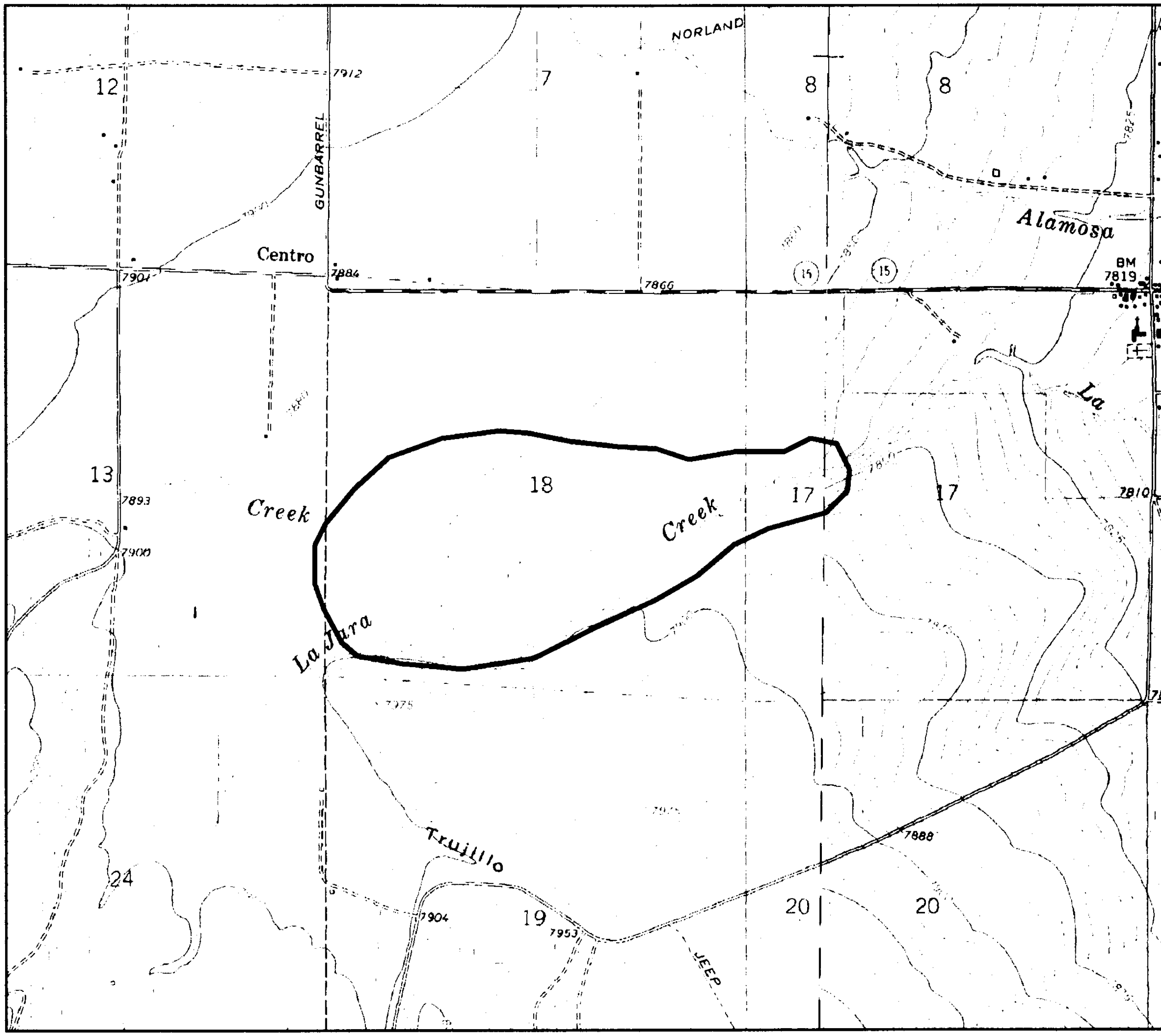
Restoration Potential: Restoration potential is minimal at this site due to the fact that most ecosystem processes appear to be intact. Enhancement efforts, such as non-native species control, would benefit the site. Upstream restoration and/or enhancement efforts along La Jara Creek may improve water quality and reduce sediment loads that may be transported to this site.

Wetland Functional Assessment for the Hot Creek/La Jara Creek Confluence PCA:

Proposed HGM Class: Riverine. Subclass: R2 (the confluence of two creeks and numerous beaver ponds saturate are large area).
Cowardin System: Palustrine. Subsystem: Emergent and Scrub/Shrub.

Table 21. Wetland functional assessment for the Hot Creek/La Jara Creek Confluence PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	High	The presence of many willows along the stream banks and around beaver pond edges and the impoundment of water from beaver ponds provide high potential for flood attenuation and storage.
Sediment/Shoreline Stabilization	High	There is high vegetation cover along a perennial source of water. Channel banks are not incised.
Groundwater Discharge/ Recharge	Unknown	Although the soils are somewhat poorly drained, the persistent inundation of water at the site may allow water to slowly move through the soil profile and recharge the underlying aquifer. More information is needed.
Dynamic Surface Water Storage	N/A	Flooding in the wetland is associated with Hot Creek and La Jara Creek versus groundwater or sheet flow.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	High	Return flow from irrigation along La Jara Creek may contribute excess nutrients and agrochemicals to the site. Large flooded areas, high vegetation cover, fine textured soils, and numerous beaver dams (which create a restricted outlet) all contribute to a high ability to remove excess sediments, nutrients, and toxicants. Natural biogeochemical processes (nutrient cycling and transformation) are also likely to be functioning well at this site.
Biological Functions		
Habitat Diversity	High	Emergent and scrub/shrub vegetation are dispersed throughout the site along with many small areas of open water located behind beaver dams.
General Wildlife Habitat	Moderate	The open water areas provide potential habitat for waterbirds and amphibians.
General Fish/Aquatic Habitat	High	Vegetation cover is good. Stream flow is perennial. In addition, populations of the Rio Grande sucker and Rio Grande chub exists just upstream within the Hot Creek PCA.
Production Export/Food Chain Support	High	High habitat and species diversity contribute a diverse array of organic substrates and nutrients to downstream ecosystems. Vegetation structure provides excellent habitat for invertebrates (food chain support).
Uniqueness	Moderate	The wetland types found at this site are not uncommon, however the extent and good condition of the wetlands found at this site are relatively rare.



Colorado Natural Heritage Program
Colorado State University - CNR
254 General Services Building
Fort Collins, CO 80523

map created 6 March 2000

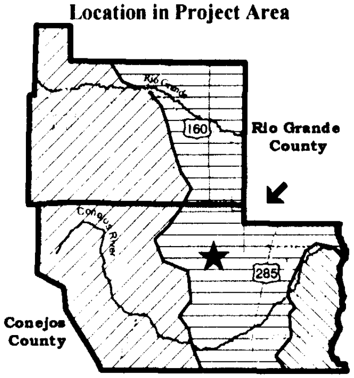
LEGEND

PCA Boundary

Base Layers:

Capulin, 37106-C1
Centro, 37106-C2
7.5 Minute Series
Digital Raster Graphics produced by the U.S. Geological Survey, 1996

Location in Project Area



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Data are not appropriate for site level planning or evaluation.

0.2 0 0.2 0.4 Miles

Projection UTM, Zone13, NAD27

Figure 11. Hot Creek/La Jara Creek Confluence PCA

Lower Rock Creek Potential Conservation Area

Biodiversity Rank: B3 (High significance)
The Lower Rock Creek site supports one fair example of a plant species imperiled on a global scale, one good example of a wetland plant community vulnerable on a global scale, and one fair example of a wetland plant community vulnerable in Colorado.

Protection and Management Issues: The entire site is privately owned. However, most of the site is owned by a single landowner that has shown a strong interest in placing a conservation easement on the property. Management concerns include alteration of current hydrology (a portion of which is believed to be derived from irrigation) and runoff and barrier functions of Colorado Highway 15. Current grazing management does not appear to be affecting the elements, however long-term effects should be monitored.

Biodiversity Rank Justification: This site contains three elements of concern. The scattered population of the globally imperiled slender spiderflower (*Cleome multicaulis*) is the primary reason for the high biodiversity rank. The slender spiderflower has a global range from southern Wyoming to central Mexico. The San Luis Valley contains the most numerous, largest, and healthiest populations in the world. Slender spiderflower has a limited distribution due to its requirement of moist alkaline soil along with periodic soil disturbance, such as pocket gopher (*Thomomys* sp.) diggings. These habitat requirements limit the slender spiderflower to the edges of alkaline wet meadows and playas. The site also supports two types of wet meadows (*Carex atherodes* and *C. lanuginosa*). The woolly sedge wet meadow (*C. lanuginosa*) located at this site is the largest and best occurrence of this community found in both Rio Grande and Conejos county during this survey.

Table 22. Natural Heritage element occurrences at Lower Rock Creek PCA.

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank
Plants					
Cleome multicaulis	Slender spiderflower	G2G3	S2S3	BLM	C
Plant Communities					
Carex atherodes	Awned sedge wet meadow	G4	S2?		C
Carex lanuginosa	Montane wet meadows	G3?	S3		B

*EO=Element Occurrence

Location: This site is located approximately 3.5 miles south of Monte Vista and east of Colorado Highway 15 in Rio Grande County. The site is adjacent (northwest) to the Monte Vista National Wildlife Refuge.
U.S.G.S. 7.5-min. quadrangle: Homelake and Monte Vista
Legal Description: T38N, R08E S 17, 18, 19, 20, 29, 30
Elevation: 7,625-7,640 ft. Approximate Size: 2,050 acres

General Description: This site contains an extensive stand of native wet meadows, emergent marshes, and saline bottomland shrublands. Hay meadows and pasture surround the site in all directions except south, where the site abuts the Monte Vista National Wildlife Refuge. Colorado Highway 15 skirts the west side of the site.

Aerial photographs and National Wetland Inventory (NWI) maps indicate that Rock Creek contributes much to the hydrology of this site. The broad alluvial fan associated with Rock Creek appears to funnel groundwater into the valley sediments where it discharges and supports native wet meadows, emergent marshes, and saline wetlands. It is assumed that a substantial amount of irrigation water supplements natural groundwater discharge to support the wetlands found at this site. The combination of these two hydrologic sources has given rise to very extensive stands of native wetland vegetation.

It is estimated that approximately 300 acres of this site are dominated by woolly sedge (*Carex lanuginosa*), with species such as small beaked sedge (*C. simulata*), beaked sedge (*C. utriculata*), awned sedge (*C. atherodes*), and spikerush (*Eleocharis palustris*) forming smaller stands. Sloughgrass (*Beckmannia syzigachne*) and Baltic rush (*Juncus balticus*) are also fairly common throughout the area. Most of the site had at least four inches of standing water present at the time of the site visit (mid-September). Some areas had deeper water where cattail (*Typha latifolia*) dominated the edges of open water wetlands. Small knolls are interspersed throughout the area, these being dominated by greasewood (*Sarcobatus vermiculatus*), saltgrass (*Distichlis spicata*), Baltic rush, and alkali sacaton (*Sporobolus airoides*) while broom seepweed (*Suaeda calceoliformis*) was found growing in highly saline areas where salt crusts on the soil surface were evident. Slender spiderflower (*Cleome multicaulis*) was found growing on every knoll that was visited. The size of the population on any given knoll was never very large, however the consistent occurrence of this species on the knolls put the total number of individuals near 2,000. It is estimated that many more individuals occur on nearby knolls that were not visited.

Due to persistent inundation and abundance of food sources, this site has high potential value for migrating waterbirds. During the site visit, approximately 100 Greater Sandhill Cranes (*Grus canadensis tabida)* were observed.

Boundary Justification: The site boundary encompasses the area in which groundwater discharge appears to be the greatest. Areas on the periphery of the site, where groundwater discharge and irrigation are not as prevalent, were also included to provide a buffer from non-native species and intense grazing. The buffer may also provide a filter for surface water runoff from nearby hay meadows and pastures that might contain heavy nutrient and sediment loads. Although Rock Creek was not captured within the site boundaries, actions affecting the volume and timing of water from this drainage would likely affect the elements at this site.

Protection and Management Comments: The entire site is privately owned, most of it by a single landowner. This particular landowner has shown much interest in placing a conservation easement on this site. An easement on this particular property would be very beneficial toward the conservation of the elements, especially the slender spiderflower.

Grazing does occur in the area and cattle were observed within the site, however impacts appear to be minimal and limited to the knolls. The remaining portion of the site appears to be too wet for livestock to congregate. Some portions of the site are managed for native hay production but many areas appear to be too wet for mowing. Most of the site had not been cut by mid-September. The fact that the site is inundated for much of the growing season has kept non-native species from establishing. Non-native and aggressive weedy species were only observed along the access road to the site. The periphery of the site, where groundwater discharge and irrigation are not as prevalent, are under more intense grazing management than the rest of the site.

Current management concerns also include a change in hydrology and Colorado Highway 15. Any changes to the current hydrology of the site could potentially lead to the establishment of unwanted species. Management of upstream lands along Rock Creek could have a large impact on hydrology, water quality, and species composition. Highway 15 serves as an artificial boundary on the west side. This road is a barrier to surface water movement from the Rock Creek drainage and may affect groundwater movement near the soil surface. The road also provides a corridor for non-native species that could potentially invade the site if hydrological conditions change. In addition, runoff from the road may carry excess sediment, nutrients, and heavy metals into the area.

Soils Description: Most of the site is mapped as the Alamosa series. Other mapped soil series in the area include the San Arcacio, Villa Grove, and the Zinzer. The Alamosa is a Fine-loamy, mixed, frigid Typic Argiaquoll (USDA 1980b). These soils are deep and poorly to somewhat poorly drained. Natural vegetation that typically occurs in these soils is very similar to the vegetation found at this site. Most of these soils are used for irrigated hay meadows (USDA 1980b). The large extent of this soil type at this site adds additional evidence that this area does receive natural groundwater discharge (in addition to irrigated water).

Restoration Potential: Except for alteration of natural hydrology, few disturbances to natural ecosystem processes have occurred at this site. Restoring a natural hydrologic regime at this particular location may be difficult since the hydrology of this area appears to be dependent on the local aquifer within the Rock Creek alluvial fan. Aerial photographs and National Wetland Inventory (NWI) maps suggests that stream flow from Rock Creek gets funneled into a broad alluvial fan, where it then flows into valley sediments and discharges and supports native wetland plant communities. Restoring natural hydrology (i.e., eliminating irrigation as a hydrological source) would require that a large-scale restoration project be implemented in the Lower Rock Creek area (i.e., the entire Rock Creek alluvial fan; impacts are minimal in the Upper Rock Creek watershed). NWI maps indicate that the Rock Creek alluvial fan supports one of the highest concentration of wetlands in Rio Grande and Conejos counties. Thus, such a large-scale project could potentially result in one of the largest, highly functioning, natural wetland ecosystem in the San Luis Valley.

Wetland Functional Assessment for the Lower Rock Creek PCA:

Proposed HGM Class: Slope. Subclass: S4 (groundwater discharge and irrigation water support extensive stands of native wet meadows)
Cowardin System: Palustrine. Subsystem: Emergent.

Table 23. Wetland functional assessment for the Lower Rock Creek PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	N/A	Although this wetland is hydrologically supported by Rock Creek and associated groundwater flow, the actually channel of Rock Creek does not flow through this area.
Sediment/Shoreline Stabilization	N/A	Although this wetland is hydrologically supported by Rock Creek and associated groundwater flow, the actually channel of Rock Creek does not flow through this area.
Groundwater Discharge/ Recharge	High	Aerial photographs indicate saturation or inundation of many areas associated with the Rock Creek alluvial fan. Since the main stem does not flow through this area, it is assumed that saturation and/or inundation occurs due to groundwater discharge.
Dynamic Surface Water Storage	High	Approximately 300-400 acres of wetland are semi-permanently flooded at this site. Most of the site was still inundated with approximately 6 inches of water during late summer (mid-September).
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	High	The site probably receives irrigation return water from upstream use. The extensive area of flooding, high vegetation cover, fairly fine soils with a thick A horizon (i.e., organic matter) provide potential sinks and/or pathways for nutrient/toxicant transformation. Sediment is likely not an issue at this site, since hydrological inputs are via groundwater.
Biological Functions		
Habitat Diversity	High	The wetland site consists of emergent, scrub-shrub (greasewood knolls), and open water habitats.
General Wildlife Habitat	High	Semi-permanent water has high potential for waterbird habitat (approximately 100 Greater Sandhill Cranes were observed during site visit). A few hawks were observed flying overhead. Diversity of emergent vegetation likely provides good habitat for invertebrates and potentially amphibians.
General Fish/Aquatic Habitat	None	This wetland does not supply habitat for fish, as it does not have a surface water connection with a stream channel.
Production Export/Food Chain Support	High	A diversity of habitats and the presence of perennial surface water yields a high potential to produce a diverse composition of standing biomass, litter, particulate organic matter, and nutrients that may support diverse invertebrate populations which provide subsequent resources for many waterbirds.
Uniqueness	Moderate	Large scale, native wet meadows are not very common in Rio Grande and Conejos counties.

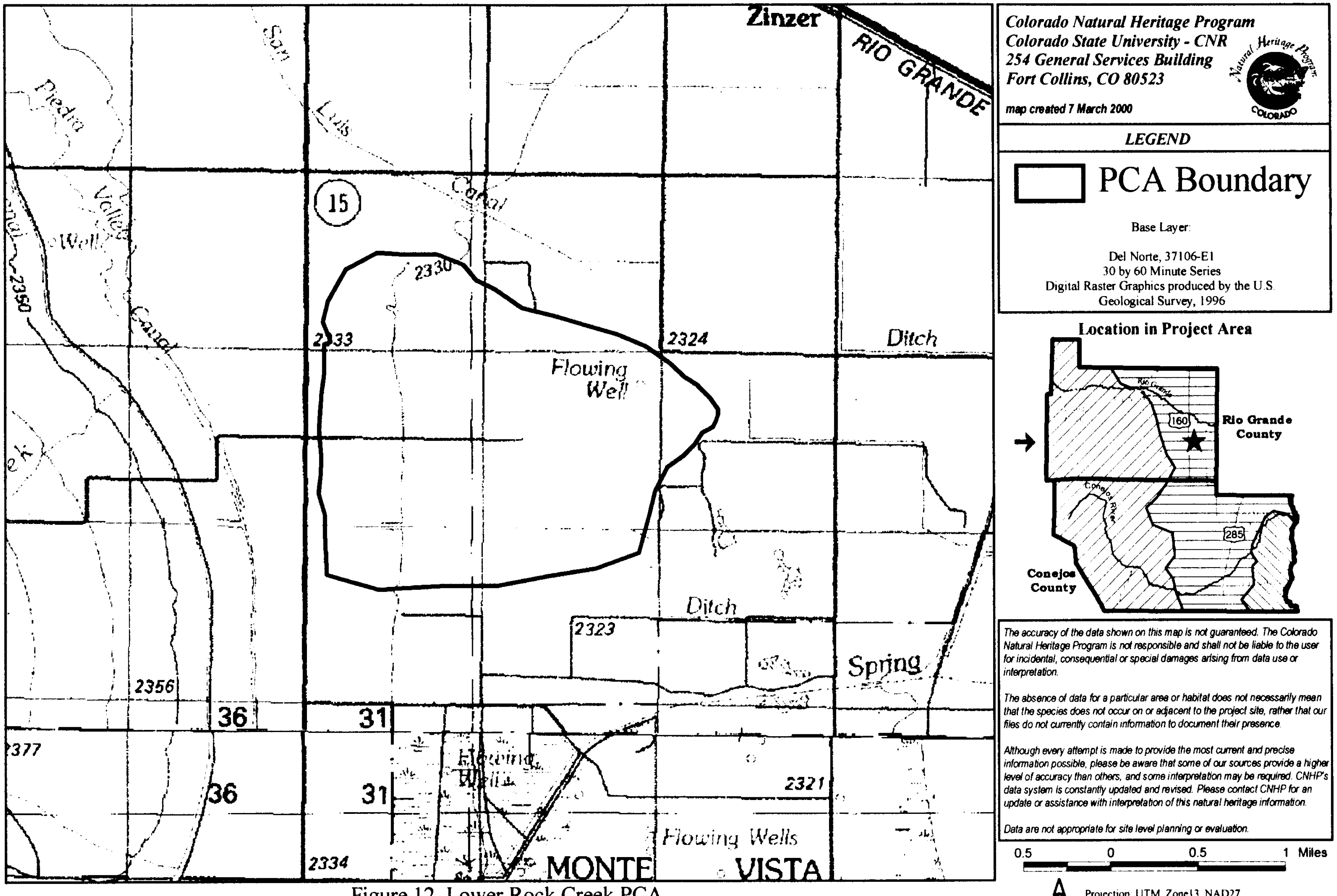

Figure 12. Lower Rock Creek PCA

Rio Grande at Monte Vista Potential Conservation Area

Biodiversity Rank: B3 (High significance)
The Rio Grande at Monte Vista site supports two fair examples of a plant that is imperiled on a global scale, two fair examples of wetland plant communities vulnerable on a global scale, one good example of a wetland plant community vulnerable in Colorado, a fair example of a riparian plant community imperiled on a global scale, and two good examples of widespread wetland plant communities.

Protection and Management Issues: Although the entire Rio Grande State Wildlife Area is located within the site, most of the site is privately owned. One landowner holds the majority of these lands and has shown interest in placing a conservation easement on the property. Non-native species, mainly Canada thistle (*Cirsium arvense*), are an important management issue. Efforts are underway to control Canada thistle and the success of these efforts should be monitored and management assessed thereafter.

Biodiversity Rank Justification: This site contains eight elements of concern at nine locations. The scattered population of the globally imperiled slender spiderflower found at the site is the primary reason for the high biodiversity rank. The slender spiderflower (*Cleome multicaulis*) has a global range from southern Wyoming to central Mexico. The San Luis Valley contains the most numerous, largest, and healthiest populations in the world. Slender spiderflower has a limited distribution due to its requirement of moist alkaline soil along with periodic soil disturbance, such as pocket gopher (*Thomomys talpoides*) diggings. These habitat requirements limit the slender spiderflower to the edges of alkaline wet meadows and playas. The San Luis Valley contains the most numerous, largest, and healthiest populations in the world.

The site also supports three types of wet meadows (*Carex atherodes*, *C. simulata,* and *C. lanuginosa*), a water ladysthumb emergent wetland (*Polygonum amphibium*), one floating/submergent wetland (*Potamogeton gramineus*), and a globally imperiled montane willow carr (*Salix eriocephala* var. *ligulifolia*).

Table 24. Natural Heritage element occurrences at Rio Grande at Monte Vista PCA.

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank
Plants					
Cleome multicaulis	Slender spiderflower	G2G3	S2S3	BLM	C
Cleome multicaulis	Slender spiderflower	G2G3	S2S3	BLM	C
Plant Communities					
Carex atherodes	Wet meadows	G4	S2?		C
Carex lanuginosa	Montane wet meadows	G3?	S3		C
Carex simulata	Wet meadows	G3	S3		C
Polygonum amphibium	Water ladysthumb emergent wetland	G4	S3		B
Potamogeton gramineus	Montane floating/ submergent wetland	G4?	S4?		B
Salix eriocephala var. ligulifolia	Montane willow carr	G2G3	S2S3		C

*EO=Element Occurrence. Multiple listings represent separate locations.

Location: This site includes the Rio Grande State Wildlife Area and adjacent parcels to the northeast and is located approximately 1 mile east of Monte Vista in Rio Grande County.
U.S.G.S. 7.5-min. quadrangle: Homelake and Monte Vista
Legal Description: T38N, R08E S 1, 2, 3, 12
T38N, R09E S 6, 7
T39N, R08E S 20-36
T39N, R09E S 31
Elevation: 7,650-7,590 ft. Approximate Size: 9,200 acres

General Description: This site contains open water, submergent, emergent, wet meadow, and riparian habitats along the Rio Grande River just east of Monte Vista. The Rio Grande State Wildlife Area (RGSWA) is included within the site boundaries in addition to some private land northwest of RGSWA.

The site encompasses a segment of the Rio Grande River and also occurs within the Rio Grande's historical floodplain. Natural overbank flooding still occurs, however the frequency and volume has been altered due to upstream water diversions and water control structures. Irrigation, via numerous ditches, is evident in areas northwest of RGSWA while water control structures and levees control movement and impoundment of water within RGSWA to benefit some wildlife. Although the natural hydrology of the site has been severely altered, many of the site's wetlands are associated with old river bottoms and sloughs where natural hydrological processes are still intact. Undoubtedly, irrigation water likely contributes to local groundwater tables and thus the hydrology of many local wetlands. The old river bottoms are permanently saturated and in a few places a deep accumulation of peat can be found. Hardstem bulrush (*Scirpus acutus*), cattail (*Typha latifolia*), arrowhead (*Sagittaria cuneata*), mare's tail (*Hippuris vulgaris*), and American mannagrass (*Glyceria grandis*) are dominant in these areas. The sloughs have permanent standing water and are lined with various species of willow (*Salix* *exigua*, *S. monticola*, and *S. eriocephala* var. *ligulifolia*). In open water areas, species such as water ladysthumb (*Polygonum amphibium*), floating pondweed (*Potamogeton gramineus*), mare's tail (*Hippuris vulgaris*), duckweed (*Lemna minor*), greater duckweed (*Spirodela polyrhiza*), an aquatic liverwort (*Ricciocarpus natans*), and bur-reed (*Sparganium angustifolium*) dominate. Wet meadows occur in low-lying areas where awned sedge (*Carex atherodes*), woolly sedge (*C. lanuginosa*), short-beaked sedge (*C. simulata*), and beaked sedge (*C. utriculata*) are the predominate species.

Northwest of RGSWA, saline bottomland shrublands dominate in areas that are not heavily irrigated or under cultivation. Species such as greasewood (*Sarcobatus vermiculatus*), saltgrass (*Distichlis spicata*), and Baltic rush (*Juncus balticus*) are predominant. Scattered throughout this area is a population of the globally imperiled slender spiderflower (*Cleome multicaulis*). The slender spiderflower appears to be taking advantage of the soil disturbance caused by livestock grazing. For example, in areas that would appear to be too moist for this species, it has established on the rims of livestock "pits." These pits are formed when livestock hoofs push soil up above the surrounding soil surface, due to their heavy weight and very moist soil. This microtopography appears to be very beneficial for slender spiderflower at this site. It is not clear how palatable or preferred slender spiderflower is to livestock as feed, but the population at this site appears to be tolerant of current grazing management. The current landowner grazes this area in the early spring and late summer. This rotation may allow slender spiderflower to flower and set seed prior to being subjected to grazing impacts in late summer. More information is needed to determine seed viability when passing through ungulates and the general mechanisms for pollination and dispersal for slender spiderflower.

Irrigated pastures are dominated by many wet meadow species such as spikerush (*Eleocharis palustris*), arrowgrass (*Triglochin maritima*), and Baltic rush (*Juncus balticus*). Grazing does not appear to be intense within RGSWA, however there is a conspicuous presence of non-native species, especially in well-drained floodplain areas. Most notable are Canada thistle (*Cirsium arvense*) and buyan (*Sphaerophysa salsula*).

Boundary Justification: The site boundary encompasses a large portion of the Rio Grande's floodplain east of Monte Vista. Topography within the site is very flat. Important hydrologic inputs include local groundwater tables that are associated with water levels in the river, surface water runoff from rain events, and periodic overbank flooding of the Rio Grande. The site boundary was drawn to incorporate an area where these natural processes function in a manner that would maintain viable populations of the elements. The boundary provides a buffer from nearby agriculture fields and roads where surface runoff may contribute excess nutrients and/or herbicides/pesticides that could be detrimental to the elements. The site contains many old oxbows and sloughs that could provide a source for recruitment for species associated with the elements. It should be noted that the hydrological processes necessary to the elements are not fully contained by the boundaries established for this site. Given that the elements are closely tied to natural processes associated with the Rio Grande, any upstream activities could detrimentally affect the elements.

Protection and Management Comments: Most of the site lies within the RGSWA and as such has adequate protection. Recreation (mostly hunting and fishing) appears to be the dominant use of the RGSWA however, some areas are likely grazed. The portion of the site northwest of RGSWA is under private ownership. The landowner is currently exploring the possibility of establishing a conservation easement on the property.

Non-native plant species control is an issue for this site. There are current efforts underway to control Canada thistle (*Cirsium arvense*) populations (both within the RGSWA and on the private parcel). The success of such efforts should be monitored and management should change if current methods are not successful. Any changes in upstream water use from the Rio Grande have the potential to affect the integrity of the elements at this site. Alterations of current water management at the RGSWA may also affect the elements.

Soils Description: Soils are variable within this large site. Most wetland areas are mapped as the Alamosa, San Luis, Typic Fluvaquents, and/or Typic Torrifluvents. The Alamosa is a Fine-loamy, mixed, frigid Typic Argiaquoll (USDA 1980b). These soils are deep and poorly to somewhat poorly drained. The San Luis is classified as a Fine-loamy over sandy or sandy-skeletal, mixed, frigid, Aquic Natrargids (USDA 1980b). These soils are somewhat poorly drained, formed in alluvium in old floodplains, and are strongly alkaline. Soil texture in the Typic Fluvaquents ranges from loam to clay loam. These soils are typically found in nearly level floodplain areas where old stream channel and oxbows are present. The Typic Torrifluvents range in texture from loam to sandy loam. Many of the wetland plant communities (*Polygonum amphibium*, *Carex atherodes*, *C. lanuginosa*) discussed above were found in areas mapped as Typic Torrifluvents. However, further investigation of the soils indicated that most of these were Typic Fluvaquents.

Restoration Potential: Restoration of natural hydrologic processes would require an immense collaboration with upstream water users, local landowners, and the Colorado Division of Wildlife. Wetland functions such as flood attenuation, biogeochemical functions, etc., have likely been impacted by hydrologic alterations and a large-scale restoration project could improve those functions. However, although natural hydrology has been altered, the current hydrologic regime is supporting the elements found at this site. Enhancement efforts such as non-native species control could improve the biological integrity of this site.

Wetland Functional Assessment for the Rio Grande at Monte Vista PCA:

Proposed HGM Class: Riverine. Subclass: R3. (wetlands and riparian areas along the main channel of the Rio Grande)
Cowardin System: Palustrine. Subsystem: Forested, Scrub/Shrub, and Emergent.

Table 25. Wetland functional assessment for the Rio Grande at Monte Vista PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	High	Dense cover of woody vegetation and an extensive floodplain provide high ability to attenuate flooding. However, upstream water diversions have altered the frequency and volume of seasonal flooding on the Rio Grande.
Sediment/Shoreline Stabilization	Low	Most immediate banks along the Rio Grande are not vegetated. This may be due to upstream alterations in the hydrology of the Rio Grande.
Groundwater Discharge/ Recharge	Unknown	It is not clear whether the Rio Grande is a losing or gaining river along this particular stretch.
Dynamic Surface Water Storage	N/A	Flooding occurs in this wetland due to overbank flow.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	High	Sewage disposal ponds are located upstream of most of the site (they sit southwest of the western border of the site). Dense herbaceous and woody vegetation in the floodplain along with periodic overbank flooding provides high potential for this area to function as a sink for sediments/nutrients/toxicants.
Biological Functions		
Habitat Diversity	Exceptional	The wetland site consists of aquatic bed, emergent, scrub-shrub, forested, and open water habitats.
General Wildlife Habitat	High	Elk and deer are likely frequent users of the area. Numerous songbirds and waterbirds utilize nearby old stream channels.
General Fish/Aquatic Habitat	High	Being a large river system, many fish species are likely to occur to occur in this stretch of the river. Back channels and old abandoned oxbows may provide suitable habitat for many fishes.
Production Export/Food Chain Support	High	A large wetland with exceptional habitat diversity and diverse vegetation structure contributes various types of litter (woody, herbaceous, etc.) all of which have different decomposition rates (i.e., different C:N ratios) which provide a sustainable long-term source for microbial activities. The result is exportation of a diverse array of organic substances to downstream ecosystems. In addition, these processes support local food chain dynamics by sustaining healthy invertebrate populations and lush vegetation cover.
Uniqueness	Moderate	Large riparian floodplain forests in Rio Grande and Conejos counties have largely been reduced and/or impacted by grazing and agriculture. However, prior to European settlement, these forests may have been less common than they are presently.

Proposed HGM Class: Depression. Subclass: D2. (numerous old stream channels and oxbows)
Cowardin System: Palustrine. Subsystem: Emergent and Scrub-Shrub.

Table 26. Wetland functional assessment for the Rio Grande at Monte Vista PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	N/A	Does not experience flooding via overbank flow.
Sediment/Shoreline Stabilization	N/A	Does not occur along a natural surface drainage.
Groundwater Discharge/ Recharge	High	Most areas are clearly the result of local water tables surfacing in low depressions.
Dynamic Surface Water Storage	High	There are numerous old stream channels and oxbows that retain standing water.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	High	Sewage disposal ponds are located upstream of most of the site (they sit southwest of the western border of the site). Dense herbaceous and woody vegetation and presence of standing water provides high potential for this area to function as a sink for sediments/nutrients/toxicants.
Biological Functions		
Habitat Diversity	Exceptional	The wetland site consists of aquatic bed, emergent, scrub-shrub, and open water habitats.
General Wildlife Habitat	High	Waterbirds such as Great Blue Heron, Snowy Egret, Cinnamon Teal, Gadwall, Common Snipe, and Wilson's Phalarope were observed. Other birds observed included Red-winged Blackbirds, Yellow-headed Blackbirds, Marsh Wren, and a Northern Harrier. Many frogs were heard but not seen. Snails and many insects were also observed in the area.
General Fish/Aquatic Habitat	High	Some fish may exist in old stream channels and oxbows. Dense cover of vegetation along the banks of these areas could provide potential habitat. Aquatic vegetation provides good cover and supports many aquatic invertebrates.
Production Export/Food Chain Support	Moderate to High	Dense emergent and aquatic vegetation cover support local food chain dynamics by sustaining healthy invertebrate populations. Export of organic substances and associated nutrients is limited due to restricted outlets.
Uniqueness	Moderate	The density of depressional wetlands found in this area is not common in Rio Grande and Conejos counties. There are only a few other locations along the Rio Grande and Conejos River where high densities of relatively intact oxbow and depressional wetlands occur.

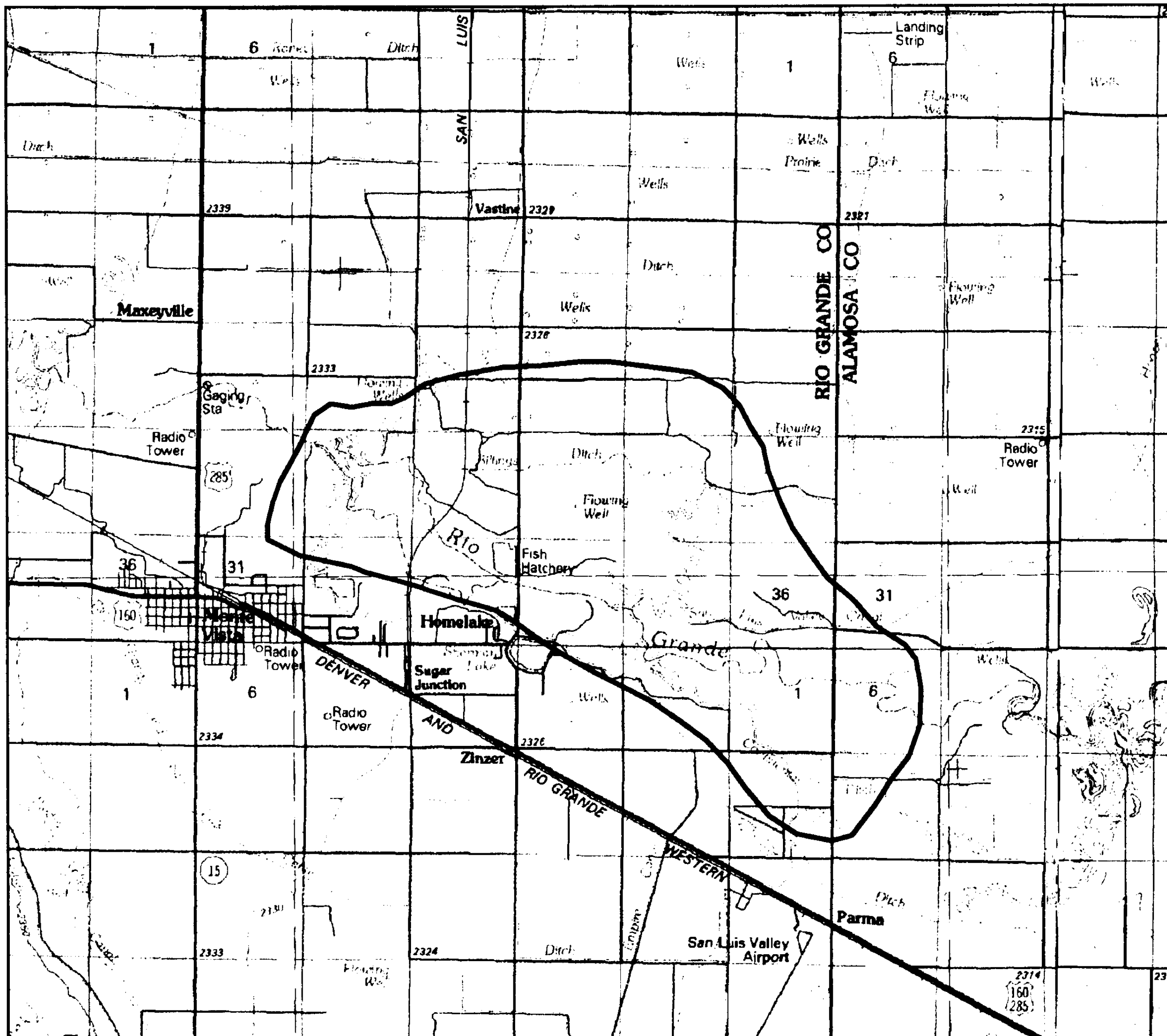

Figure 13. Rio Grande at Monte Vista PCA

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Fort Collins, CO 80523

map created 7 March 2000

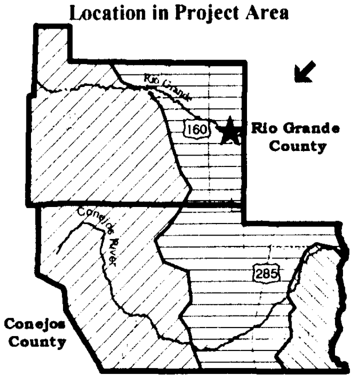
LEGEND

PCA Boundary

Base Layer:

Del Norte, 37106-E1
30 by 60 Minute Series
Digital Raster Graphics produced by the U.S. Geological Survey, 1996

Location in Project Area



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The absence of data for a particular area or habitat does not necessarily mean that the species does not occur on or adjacent to the project site, rather that our files do not currently contain information to document their presence.

Although every attempt is made to provide the most current and precise information possible, please be aware that some of our sources provide a higher level of accuracy than others, and some interpretation may be required. CNHP's data system is constantly updated and revised. Please contact CNHP for an update or assistance with interpretation of this natural heritage information.

Data are not appropriate for site level planning or evaluation.

0.5 0 0.5 1 Miles

Projection UTM, Zone13, NAD27

Diamond Springs Site of Local Significance

Location: Diamond Springs is located approximately 3 ½ miles west of Bountiful, CO. The springs discharge on private land just east of BLM property.
U.S.G.S. 7.5-min. quadrangle: Goshawk Dam

Legal Description:	T35N, R08E S 25, 36
	T38N, R09E S 30, 31
Elevation: 7,650-7,645 ft.	Approximate Size: 170 acres

General Description: Diamond Springs is one of the few remaining large natural springs, that has not been severely impacted by groundwater pumping, along the western edge of the San Luis Valley. Drainage from the springs feeds into La Jara Arroyo, which eventually drains into La Jara Creek northwest of the town of La Jara, CO.

Most of this site is heavily grazed. Vegetation structure was poor at the time of the site visit (mid-August). Species composition appears to be composed of increasers such as wild iris (*Iris missouriensis*), Baltic rush (*Juncus balticus*), and silverweed (*Argentina anserina*). Further downstream where drainage from Diamond Springs dumps into La Jara Arroyo, awned sedge (*Carex atherodes*), small-fruited bulrush *(Scirpus microcarpus*), and American mannagrass (*Glyceria grandis*) occur along the stream banks. Biologists from the Monte Vista office of the Colorado Division of Wildlife indicated that this area is highly used by waterbirds, especially during winter months.

The high wildlife value and the unique presence of an unaltered spring (in terms of hydrological flow) are the primary reasons this site was identified as having local significance.

Protection and Management Comments: The entire site is privately owned and does not have any formal protection status. Current grazing practices are negatively impacting plant species composition and vegetation structure. Stream banks and areas near the springs were heavily trampled.

Soils Description: No soil pits were dug at this site. The soils are mapped as the Lasauses series, a Fine, mixed, nonacid, frigid Aeric Halaquept (USDA 1980a). These soils are deep and poorly drained. There is typically a deep A horizon that is strongly alkaline. The Lasauses is typically calcerous in the surface horizons and grades from alkaline to medium acid in the lower horizons (USDA 1980a).

Restoration Potential: Implementing a grazing management plan that is more compatible with the native vegetation could greatly benefit this site. Hydrology appears to be intact thus improvement in plant species composition and vegetation structure could greatly increase the biological integrity of this site. The strongly alkaline nature of the soils indicates that potential natural plant communities may consist of the following species: greasewood (*Sarcobatus vermiculatus*), alkali sacaton (*Sporobolus airoides*), saltgrass (*Distichlis spicata*), western wheatgrass (*Pascopyron smithii*) (USDA 1980a), and, if proper conditions exist, potentially the globally imperiled slender spiderflower

(*Cleome multicaulis*). Along with wetlands associated with lower Rock Creek, this site should be a high priority for restoration efforts.

Wetland Functional Assessment for the Diamond Springs Site of Local Significance:

Proposed HGM Class: Slope. Subclass: S4.
Cowardin System: Palustrine. Subsystem: Emergent.

Table 27. Wetland functional assessment for the Diamond Spring Site of Local Significance.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	N/A	The site occurs at the headwaters of a small creek, thus potential to provide flood attenuation does not exist.
Sediment/Shoreline Stabilization	Low to Moderate	Some areas have good vegetation cover along the banks, but many areas have been trampled by livestock and are void of vegetation.
Groundwater Discharge/ Recharge	High	Multiple perennial seeps and springs occur in the area.
Dynamic Surface Water Storage	High	In addition to water storage in saturated soils surrounding the springs, the drainage from the springs collects in a moderate size, slow moving, sinuous creek.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	Moderate	Current livestock management probably contributes excess nutrients and sediments. The sinuous, slow moving stream allows sediments to settle and may retain nutrients either via sedimentation (i.e., adsorption of phosphorous to soil clay particles or other transformations (denitrification).
Biological Functions		
Habitat Diversity	Moderate	Emergent and open water habitats are present.
General Wildlife Habitat	High	CDOW biologists indicate heavy waterbird use during the winter. Numerous avocets were observed during site visit.
General Fish/Aquatic Habitat	Moderate	The creek provides some habitat for fish however current grazing practices limit streamside vegetation and have increased erosion into the stream.
Production Export/Food Chain Support	High	High waterbird use, moderate vegetation cover, and organic matter accumulation provide organic substances and nutrients for exportation to downstream ecosystems. Food chain support is also likely high as indicated by high waterbird use during the winter months.
Uniqueness	High	Although no plant or animal species and/or plant communities of biological significance were identified at this site, it is considered unique as it is one of the few remaining large natural springs, that has not been severely impacted by groundwater pumping, along the western edge of the San Luis Valley.

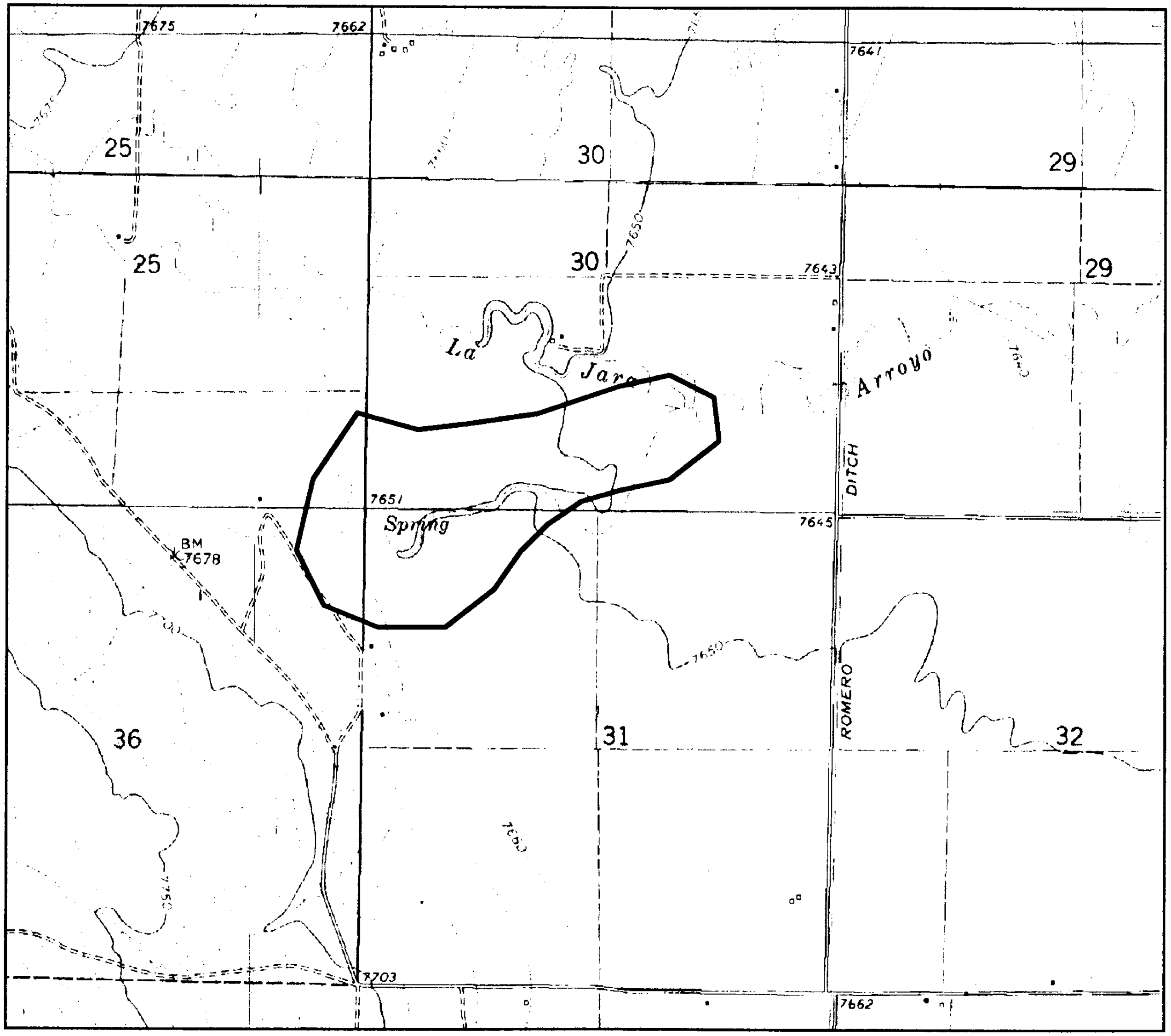

Figure 14. Diamond Springs Site of Local Significance

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map created 7 March 2000

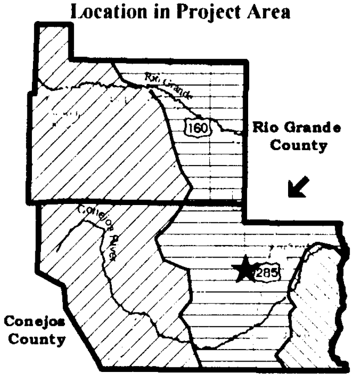
LEGEND

Site of Local Significance Boundary

Base Layer:

Goshawk Dam, 37106-B1
7.5 Minute Series
Digital Raster Graphics produced by the U.S. Geological Survey, 1996

Location in Project Area



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Data are not appropriate for site level planning or evaluation.

0.3 0 0.3 Miles

Projection: UTM, Zone13, NAD27

Road 24 Site of Local Significance

Location: This site is located approximately 1 ½ miles south of the Alamosa/Conejos county line on the east side of County Rd. 24.
U.S.G.S. 7.5-min. quadrangle: Pikes Stockade

Legal Description:	T36N, R09E S 30
	T36N, R10E S 25
Elevation: 7,650-7,645 ft.	Approximate Size: 175 acres

General Description: Natural groundwater discharge and irrigation water support a large open water area where many waterbird species were observed. A hardstem bulrush (*Scirpus acutus*) community occurs on the fringe of the open water. On the drier side of the bulrush community such species as common threesquare (*Scirpus pungens*), alkali bulrush (*Scirpus maritimus*), and arrowgrass (*Triglochin* spp.) occur. A greasewood/saltgrass (*Sarcobatus vermiculatus*/*Distichlis spicata*) community is located on slightly higher ground to the southwest of the open water area. There is also a large patch of water-plantain (*Alisma plantago-aquatica*) present between the hardstem bulrush community and the greasewood/saltgrass meadow.

In his journal from 1821-1822, Jacob Fowler mentions "a spring which contained clear cool water and the ground surrounding the area was soft and would shake when jumped up and down on for two rods all around" (Coues 1965). Fowler describes the location of the spring as being approximately 5 miles north of McIntire Springs/Pikes Stockade area and approximately five miles south of La Jara Creek (Fowler was heading south from the Rio Grande when he provided his locational descriptions) (Coues 1965). On a northern-oriented transect, La Jara Creek is never more than 5-6 miles away from the McIntire Springs/Pikes Stockade location. However, the Rd. 24 wetland is approximately half way between (on a north-south transect) La Jara Creek and the McIntire Springs/Pikes Stockade area. It is quite possible that the spring discussed in Fowler's Journal is the Road 24 wetland. The entire site was not ground-truthed during the site visit thus it is not possible to confirm the presence of, what can be assumed to be a thick accumulation of peat, "the soft, bouncing ground surrounding the spring" described in the Fowler journal. Such a description implies a deep accumulation of peat, a phenomena that is uncommon in this part of the San Luis Valley.

The high potential for waterbird habitat and the possibility of this site containing deep peat accumulations are the primary reasons this site was considered to have local significance.

Protection and Management Comments: The site is currently under private ownership and has no formal protection. Heavy grazing is occurring in adjacent lands to the west while agricultural fields surround the site on the east. County Rd. 24 bisects the wetland. Currently, non-native species do not seem to be a problem within the wetland itself. Most areas are too wet for livestock use (however horses were seen in areas with standing water). Hydrology appears to be somewhat managed (irrigation ditches present).

Soils Description: No soil pits were dug at this site. The soil survey maps reference this area simply as "water" and no soil types were mapped (USDA 1980a). This indicates the permanence of standing water at this site. Further investigation of the soil types at this site, especially the potential occurrence of organic soil, should be conducted.

Restoration Potential: A more thorough understanding of the hydrology (both natural and artificial) is needed. The appearance of the open water area on many maps, including the soil survey, suggests a strong presence of a natural hydrologic input (groundwater discharge). Enhancement of adjacent areas could be achieved by implementing a more compatible grazing management plan with the native vegetation. Establishing a buffer composed of native species between adjacent agricultural fields and the wetland would also be beneficial to waterbirds and may lessen the potential for non-native species to invade the site.

Wetland Functional Assessment for the Rd. 24 Site of Local Significance:

Proposed HGM Class: Depression. Subclass: D2.
Cowardin System: Palustrine. Subsystem: Emergent.

Table 28. Wetland functional assessment for the Rd. 24 Site of Local Significance.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	N/A	Does not occur along a natural surface drainage.
Sediment/Shoreline Stabilization	N/A	Does not occur along a natural surface drainage.
Groundwater Discharge/ Recharge	High	Wetland is supported by groundwater discharge. Volume of discharge is large enough to maintain a permanent large open water area.
Dynamic Surface Water Storage	High	Permanent inundation of a large area.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	Moderate	Runoff from adjacent agricultural fields and rangeland may contribute excess nutrients and/or sediments. Permanent saturation of many areas is conducive for denitrification, which requires anaerobic conditions, and sedimentation (which retains both excess sediments and phosphorous).
Biological Functions		
Habitat Diversity	Moderate	The wetland site consists of emergent and open water habitats.
General Wildlife Habitat	Moderate	Many waterbird species (ducks, Wilson's Phalarope, Avocets, and Black-necked Stilts) were observed during the site visit and throughout the summer (during the course of the survey, CNHP drove by this site many times).
General Fish/Aquatic Habitat	None	It is unlikely that the site supports any populations of fish. However, given the permanence of open water, it is possible that a population was introduced. No fish were observed during the site visit.
Production Export/Food Chain Support	Moderate	The site obviously provides high food chain support given the amount of waterbirds observed in the area. However, exportation of organic substances and nutrients is limited, as a defined outlet was not located.
Uniqueness	Moderate	A natural, large, permanent, isolated (not associated with a river) open water wetland such as this site is fairly uncommon in the San Luis Valley. Many other open water areas are intermittently or seasonally flooded and lose most of their standing water to evaporation by the end of the summer. It is unclear how large the permanent open water area would be without irrigation inputs. The description from Fowler's journal (if indeed this is the same location) suggests that groundwater discharge is the main hydrologic input. If organic soils were located, the unique value of this site would increase.

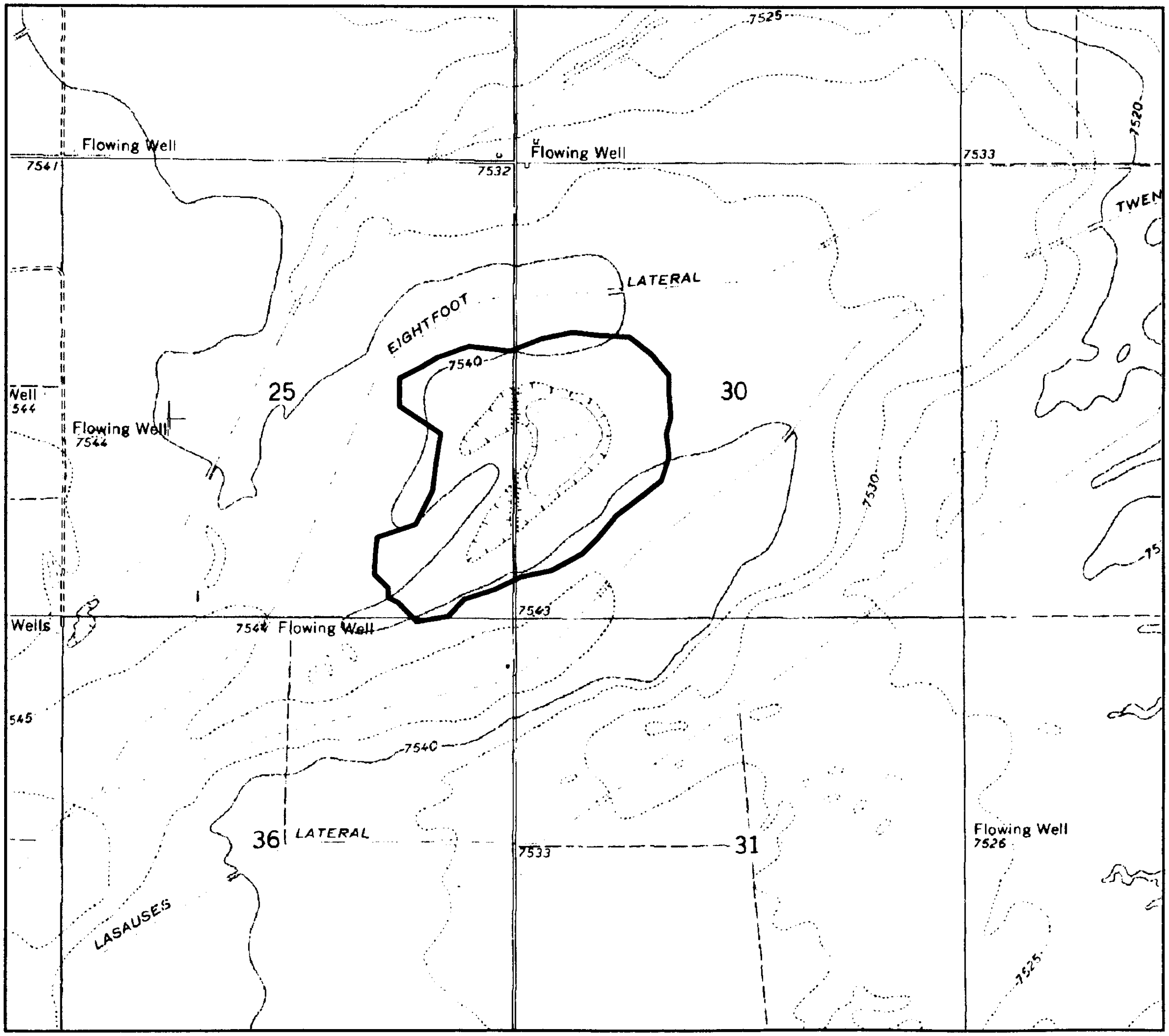


Figure 15. Rd. 24 Wetland Site of Local Significance

Colorado Natural Heritage Program
Colorado State University - CNR
254 General Services Building
Fort Collins, CO 80523

map created 7 March 2000

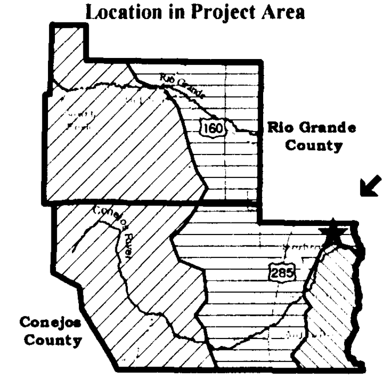
LEGEND

Site of Local Significance Boundary

Base Layer:

Pikes Stockade, 37105-C7
7.5 Minute Series
Digital Raster Graphics produced by the U.S. Geological Survey, 1996

Location in Project Area



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Data are not appropriate for site level planning or evaluation.

0.3 0 0.3 Miles

Projection UTM, Zone13, NAD27

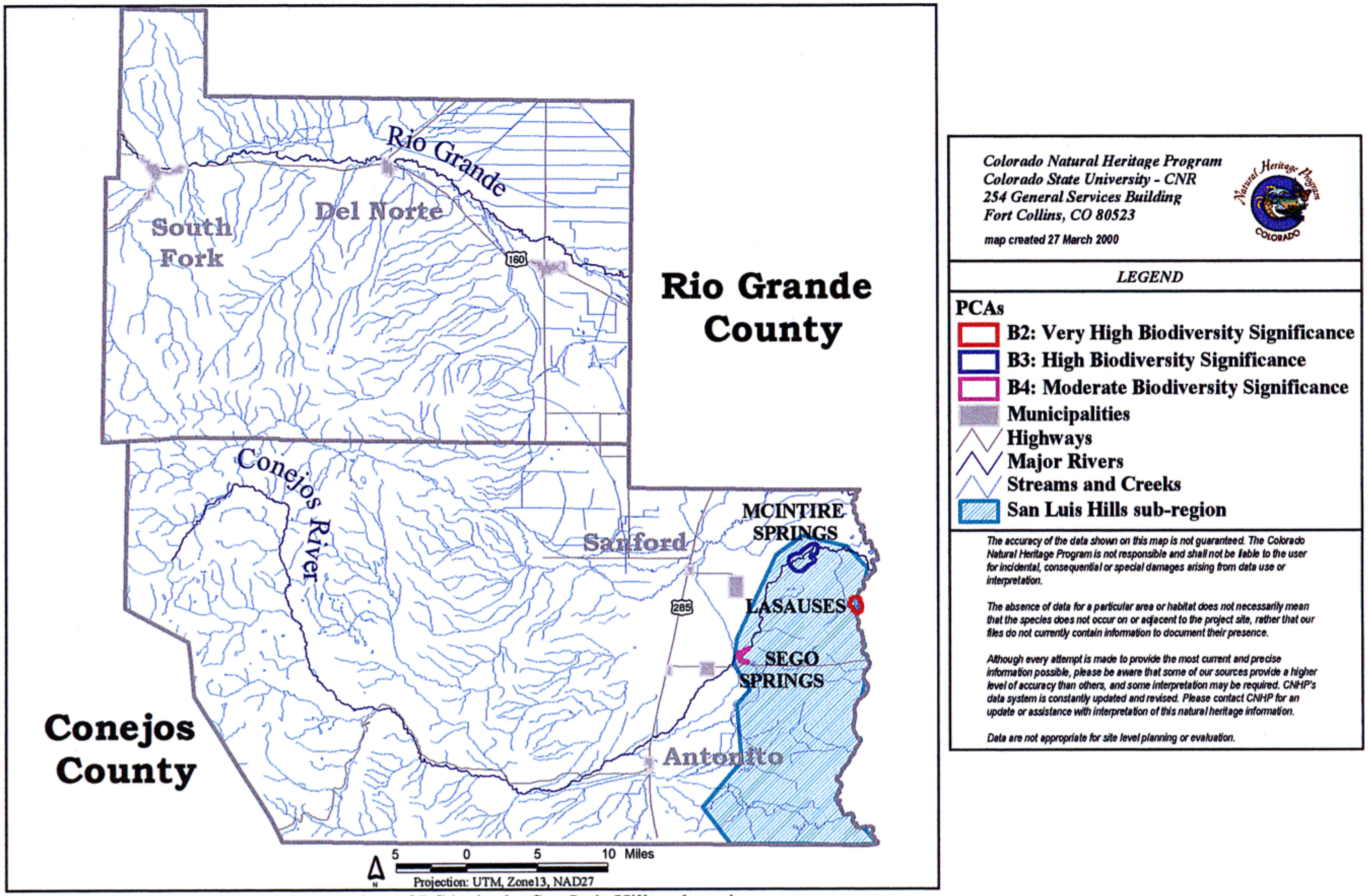


Figure 16. Location of PCAs in the San Luis Hills sub-region

Lasauses Potential Conservation Area

Biodiversity Rank: B2 (Very High significance)
The Lasauses site supports a good example of a plant imperiled on a global scale and a fair example of a wetland plant community imperiled in Colorado.

Protection and Management Issues: Most of the site is privately owned and is not formally protected. Areas along the Rio Grande are heavily grazed and in poor condition. Non-native species are numerous in certain locations on the site. More information is needed concerning management of a headgate present on one of the oxbow lakes and its effects on the elements.

Biodiversity Rank Justification: The site supports a good example of the globally imperiled slender spiderflower (*Cleome multicaulis*), which is the primary reason for the site's very high biodiversity rank. The slender spiderflower has a global range from southern Wyoming to central Mexico. In spite of its large range, populations of this plant have decreased dramatically in the last 100 years, especially in the southwestern states. No occurrences of this species have been documented in New Mexico or Arizona since the 1940's. There are some occurrences in Texas and Mexico while Wyoming only has one. The San Luis Valley contains the most numerous, largest, and healthiest populations in the world. There are approximately 35 occurrences of this species in Colorado. Slender spiderflower is limited by very specific habitat requirements including moist alkaline soils and some form of soil disturbance. These discriminating habitat requirements limit the slender spiderflower to the edges of alkaline wet meadows and playas.

In addition to the slender spiderflower, the site also supports a fair example of a submergent giant bur-reed (*Sparganium eurycarpum)* wetland community imperiled in Colorado, which is mainly found on the eastern plains of Colorado and in the San Luis Valley. This plant is also considered imperiled in Colorado.

Table 29. Natural Heritage element occurrences at Lasauses PCA.

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank
Plants Communities					
Sparganium eurycarpum	Foothills submergent wetland	G5	S2S3		C
Plants					
Cleome multicaulis	Slender spiderflower	G2G3	S2S3	BLM	B
Sparganium eurycarpum	Giant bur-reed	G5	S2?		

*EO=Element Occurrence

Location: The Lasauses site is located approximately 1 mile south of the town of Lasauses in Conejos County, on the west side of the Rio Grande.
U.S.G.S. 7.5-min. quadrangle: Manassa NE, Mesito Reservoir
Legal Description: T35N R11E S 26, 27, 34, 35
Elevation: 7,500 ft. Approximate Size: 450 acres

General Description: The site occurs along the western side of the Rio Grande within a broad floodplain where numerous large oxbow lakes occur. The site occurs just upstream from where the Rio Grande begins to cut a narrow gorge into the volcanic bedrock.

The hydrological source of the site is the Rio Grande and associated local groundwater tables. The two southern-most oxbow lakes that occur within the floodplain of the Rio Grande in Colorado are the primary hydrological features at this site. A series of oxbow lakes occur from this site northward to the Alamosa National Wildlife Refuge. Water levels in these oxbows are likely associated with water levels in the Rio Grande via local groundwater tables in the floodplain. A headgate was observed near the eastern side of the large oxbow located at this site. The headgate does not feed into an irrigation ditch but rather appears to control the amount of water that flows from the oxbow into the Rio Grande. The drainage from this headgate does not appear to be natural and may have been constructed to attempt to drain the oxbow when high water levels threaten to flood nearby hay meadows and rangeland.

Bands of cattail (*Typha latifolia*), hardstem bulrush (*Scirpus acutus*), and giant bur-reed (*Sparganium eurycarpum*) occur along the periphery of the oxbows. Saturated soils and the presence of duckweed (*Lemna* spp.) on the soil surface indicated that these areas are periodically inundated, but no standing water was observed during the site visit. Along the western edge of the site the typical sequence of vegetation types is: drier upland areas dominated by rabbitbrush (*Chrysothamnus* spp.) grading into wet meadows dominated by foxtail barley (*Hordeum jubatum*), saltgrass (*Distichlis spicata*), and Baltic rush (*Juncus balticus*). Other species present in these meadows include common threesquare (*Scirpus pungens*), greasewood (*Sarcobatus vermiculatus*), and broom seepweed (*Suaeda calceoliformis*). Slender spiderflower (*Cleome multicaulis*) was found growing along the fringe of the wet meadow and near the base of greasewood shrubs. The wet meadows grade into the band of cattail, bulrush, and giant bur-reed that line the oxbow lakes. A narrowleaf cottonwood (*Populus angustifolia*) riparian forest lines the banks of the Rio Grande.

Boundary Justification: The boundary encompasses enough of the Rio Grande floodplain to allow natural communities to shift in distribution as geomorphic settings change due to hydrological processes. Avoiding direct disturbances within the boundary (such as continuous trampling and overgrazing) will help ensure the continued existence of the elements. Upstream activities outside of these boundaries, such as water diversions and intensive grazing and agriculture, could affect the viability of the elements by altering hydrology and sedimentation processes.

Protection and Management Comments: The majority of the site is privately owned with a very small portion managed by the Bureau of Land Management. No formal protection exists for the site.

Areas surrounding the elements, especially near the banks of the Rio Grande, are heavily grazed. There are some hay meadows south of the large oxbow dominated by many non-native species (e.g., Kentucky bluegrass (*Poa pratense*), Canada thistle (*Cirsium arvense*), yellow sweetclover (*Melilotus officinalis*), clover (*Trifolium* spp.), and redtop (*Agrostis gigantea*). Management of non-native species on the site may be necessary. More information is needed concerning the use and purpose of the headgate on the east end of the large oxbow and its effects on the elements.

Soils Description: No soil pits were dug at this site. Soils are mapped as the Nortonville series and Aquents (USDA 1980a). Nortonville soils are classified as Fine-loamy, frigid Typic Calcioaquolls. These soils are deep, poorly drained, and were formed in alluvium primarily from volcanic rock. They are calcareous and strongly alkaline. Aquents are also deep, poorly drained soils but are not calcareous and are only moderately alkaline.

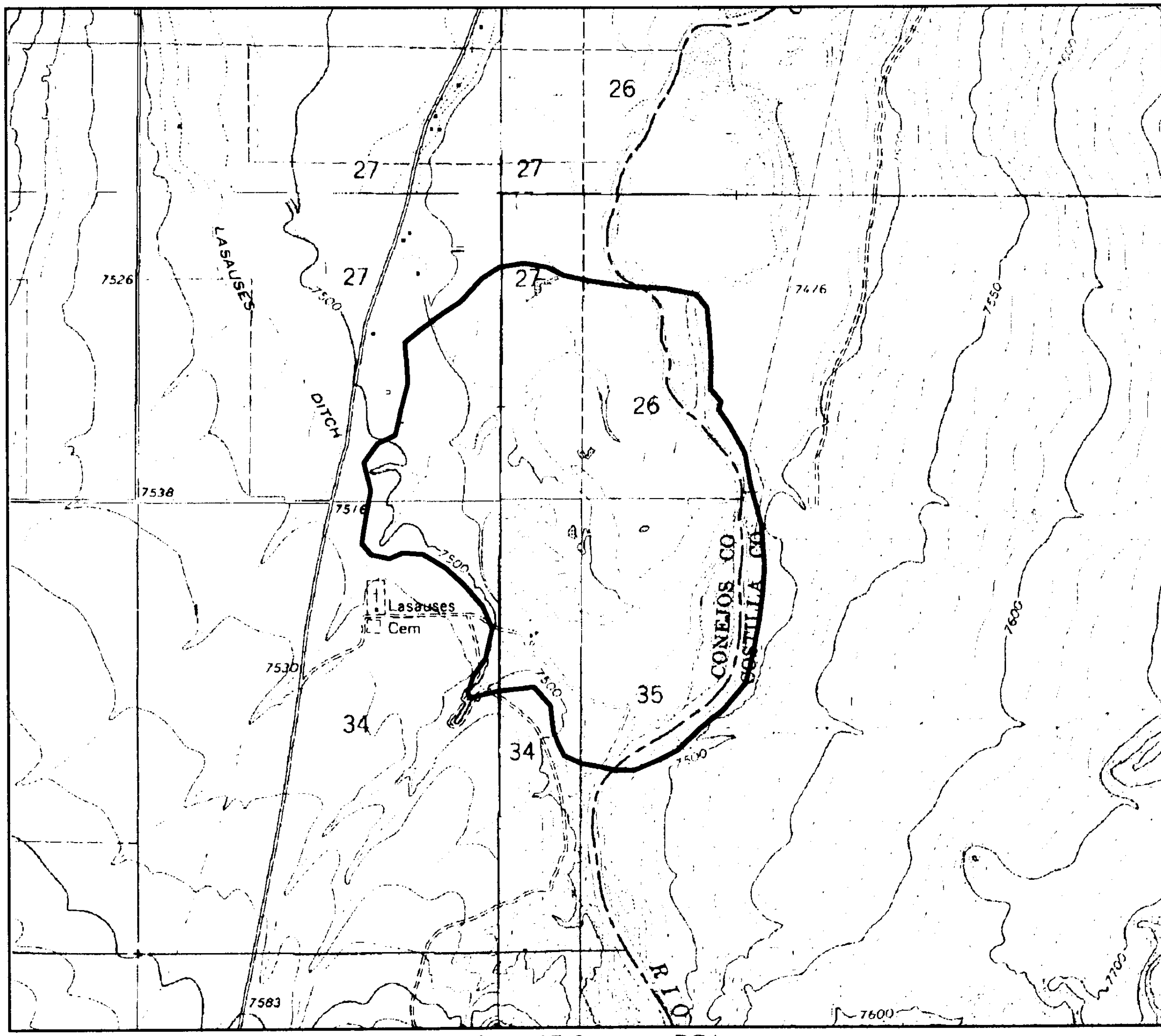
Restoration Potential: For the most part, hydrological processes appear to be relatively intact. However, more information is needed in regards to the use of the headgate that is located on the large oxbow. Water levels do appear to fluctuate, as areas that are typically inundated were exposed during the site visit. An analysis of water level fluctuations in nearby oxbows that have no headgate could provide reference data on the natural hydroperiod of these oxbow lakes. From this information, a determination can be made with regard to whether water management is affecting the natural vegetation at this site. If necessary, subsequent restoration efforts should focus on reestablishing a natural hydroperiod since most of the elements are associated with the hydrology of this oxbow. Enhancement efforts could focus on non-native species control in wet meadows that are in the southern half of the site.

Wetland Function and Value Assessment for the Lasauses PCA:

Proposed HGM Class: Depression. Subclass: D2.
Cowardin System: Palustrine. Subsystem: Emergent

Table 30. Wetland functional assessment for the Lasauses PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	High	This wetland occurs in the floodplain of the Rio Grande. Thus, the high surface water area, dense vegetation cover, and restricted outlet provide a high potential for flood attenuation. It should be noted however, that upstream alterations in hydrology have drastically affected the natural flooding cycle of the Rio Grande. In addition, the Rio Grande enters a long deep canyon (continues south of Taos, NM) downstream of this site. Thus, in terms of flood attenuation, the site does not provide anthropogenic value but does provide an important natural function.
Sediment/Shoreline Stabilization	N/A	Although the wetland occurs in the Rio Grande floodplain, it does not occur along the actual channel.
Groundwater Discharge/ Recharge	High	It is likely that groundwater discharge is associated with the local floodplain water table and may be seeping out of slopes from the western edge of the site.
Dynamic Surface Water Storage	High	Permanent inundation of a large area.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	High	Runoff and/or groundwater inputs from adjacent agricultural fields and rangeland may contribute excess nutrients and/or sediments. Permanent inundation and saturation of many areas is conducive for denitrification and sedimentation (which retains both excess sediments and phosphorous).
Biological Functions		
Habitat Diversity	Moderate	The wetland site consists of emergent and open water habitats.
General Wildlife Habitat	Moderate	Extensive open water area provides high potential habitat for waterbirds. Deer, elk, and coyotes may also use the area.
General Fish/Aquatic Habitat	Unknown	The site may support a population of fish within the large oxbow lake. However, no fish were observed during the site visit. Lack of sufficient information precludes ranking this function.
Production Export/Food Chain Support	High	High vegetation cover, moderate habitat diversity, and perennial surface water contribute a diverse array of organic substances and nutrients that potentially get exported to downstream ecosystems during flooding events or via groundwater flow. Diversity of herbaceous species and areas of saturation/inundation provide a diverse template for invertebrate populations.
Uniqueness	Moderate	Comparable size oxbows are scattered in the Rio Grande floodplain from Monte Vista south to this site. The oxbow at this site is the last one of its kind before the Rio Grande enters New Mexico.



Colorado Natural Heritage Program
Colorado State University - CNR
254 General Services Building
Fort Collins, CO 80523

map created 6 March 2000

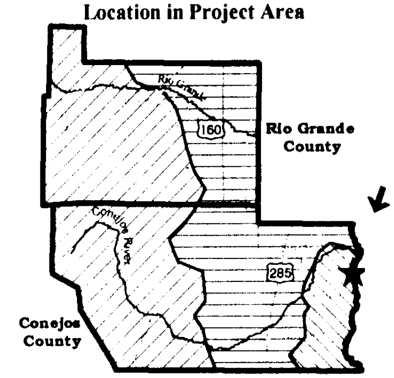
LEGEND

PCA Boundary

Base Layers:

Mesito Reservoir, 37105-B6
Manassa NE, 37105-B7
7.5 Minute Series
Digital Raster Graphics produced by the U.S. Geological Survey, 1996

Location in Project Area



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Data are not appropriate for site level planning or evaluation.

0.2 0 0.2 0.4 Miles

Projection: UTM, Zone13, NAD27

Figure 17. Lasauses PCA

McIntire Springs Potential Conservation Area

Biodiversity Rank: B3 (High significance)
The McIntire Springs site supports two good occurrences of a fish vulnerable on a global scale and critically imperiled in Colorado, one fair example of a wetland plant community imperiled in Colorado, and two good examples of widespread plant communities.

Protection and Management Issues: The majority of land in this site is publicly owned and managed by the Bureau of Land Management. A small parcel on the northern end is owned by the State of Colorado (Pikes Stockade Historic Site) and there may also be some private land encompassed in the site. This site currently has adequate protection.

No grazing has occurred on the site in the past five years and irrigation has not been conducted since 1988. Although the site still contains a fair number of non-native species (especially in the wet meadows), the area is recovering. The BLM intends to manage the site specifically for cultural and natural resources allowing only non-motorized recreational opportunities, which are compatible with the management objectives, to occur.

Biodiversity Rank Justification: The two populations of the Rio Grande chub (*Gila pandora*) found at this site are the primary reason for the site's high biodiversity rank. The Rio Grande chub was once widespread in creeks of the upper Rio Grande and Pecos watersheds of New Mexico and the upper Rio Grande watershed of southern Colorado. Populations are reported to be stable in New Mexico but are declining in Colorado. The site also supports a fair example of the state vulnerable giant bur-reed (*Sparganium eurycarpum*) plant community (which is also considered a state imperiled plant), a good example of the widespread beaked sedge (*Carex utriculata*) wet meadow, and a good example of the widespread narrowleaf cottonwood riparian forest (*Populus angustifolia*/*Salix exigua*). The riparian communities at this site are thought to be the best remaining riparian habitat along the Conejos River (Mike Cassell - pers. comm.).

Table 31. Natural Heritage element occurrences at McIntire Springs PCA.

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank
Plants					C
Sparganium eurycarpum	Giant bur-reed	G5	S2?		
Plants Communities					
Carex utriculata	Beaked sedge wet meadow	G5	S4		B
Populus angustifolia/Salix exigua	Narrowleaf cottonwood riparian forest	G4	S4		B
Sparganium eurycarpum	Foothills submergent wetland	G5	S2S3		C
Fish					
Gila pandora	Rio Grande chub	G3	S1?	SC	B
Gila pandora	Rio Grande chub	G3	S1?	SC	B

*EO=Element Occurrence. Multiple listings represent separate locations.

Location: The McIntire Springs site is located 9 miles east of La Jara in Conejos County and is adjacent to the Conejos River.

U.S.G.S. 7.5 min. quadrangle: Pikes Stockade

Legal Description: T35N R10E S 12,13
T35N R11E S 5, 6, 7, 8, 17, 18

Elevation: 7,525-8,000 ft. Approximate Size: 450 acres

General Description: The McIntire Springs site is located along the Conejos River approximately six miles upstream from the confluence with the Rio Grande River. The Pikes Stockade historic site is located on the northern edge of the site. The wetlands on the site are supported by the Conejos River and a series of perennial warm springs located at the base of Sierro Del Ojito. The area is highly diverse in terms of species, habitat types (at least five wetland types plus adjacent upland habitat), and vegetation structure. The Conejos River supports a healthy riparian system, with all age classes of trees and shrubs represented. Narrowleaf cottonwood (*Populus angustifolia*) and coyote willow (*Salix exigua*) are common along the riverbanks and in the floodplain. Beaked sedge (*Carex utriculata*), small fruited bulrush (*Scirpus microcarpus*), and giant bur-reed (*Sparganium eurycarpum*) occupy old oxbows within the floodplain. Monkeyflower (*Mimulus* spp.) is found growing in areas where the springs surface. Overall, habitat diversity at the site is extremely high in comparison to other sites visited during this study. Five wetland types are represented including open water (warm springs and river), wet meadows, scrub-shrub, forested, and emergent wetlands, in addition to nearby upland habitats that are dominated by rabbitbrush (*Chrysothamnus* spp.), greasewood (*Sarcobatus vermiculatus*), ring muhly (*Muhlenbergia torreyi*), and Indian ricegrass (*Oryzopsis hymenoides*). There are some meadows to the north and south of the Conejos River that were irrigated prior to 1988. These are currently dominated by smooth brome (*Bromus inermis*) a non-native grass, western wheatgrass (*Pascopyron smithii*), Baltic rush (*Juncus balticus*), wild iris (*Iris missouriensis*), and patches of the invasive non-native whitetop (*Cardaria* spp.) (Bureau of Land Management 1994).

Two populations of the Rio Grande chub were located in pools near the springs. Northern leopard frogs (*Rana pipiens*) were observed near the edges of the spring pools and in backwater areas along the river. McIntire Springs contributes a large volume of warm water creating 20 or more acres of open water during the winter months. These warm water pools provide wintering habitat for a large concentration of waterbirds (Bureau of Land Management 1994). The congregation of waterbirds also provides a forage base for wintering raptors such as bald and golden eagles. Communal roost of bald eagles (20 or more have been documented) have been observed in nearby cottonwood forests (Bureau of Land Management 1994). In addition, the diverse riparian/wetland complex found at this site provides roosting, resting, foraging habitat, escape routes, and thermal and nesting cover for many migratory bird species (Bureau of Land Management 1994).

Willow Flycatchers (*Empidonax trailii*) were seen at this site in June of 1997 and 1998. It is possible that these willow flycatchers are the subspecies *Empidonax trailii extimus,* which

ranges from California through Arizona and New Mexico, and possibly into southern Colorado. This subspecies was listed as endangered by the U.S. Fish and Wildlife Service in 1995 and is ranked G5T2 by the Natural Heritage Program. Range-wide populations are estimated at 300-500 breeding pairs (Sogge et al. 1997). Six individuals were banded at the site in 1997, including one female with a brood patch, confirming breeding in the area. Genetic material was taken from all six individuals. In 1998, four individuals were identified from the area. Should the individuals at McIntyre Springs be confirmed as the Southwestern Willow Flycatcher this would be the only confirmed location of this subspecies in Colorado and the significance of this conservation area could increase.

The site also contains a few significant cultural resources, including the ruins of Governor McIntire's Mansion and Pikes Stockade. The mansion is one of the few territorial structures left in southern Colorado (Bureau of Land Management 1994).

Hay meadows and rangeland are adjacent to the site to the north and west. Approximately two miles downstream, there are another series of springs (Dexter Springs) that may potentially support similar elements as this site. These springs were not visited and are located on private land.

Boundary Justification: The boundary encompasses the entire series of springs and their associated drainages that feed into the Conejos River to include one of the hydrological sources of the site. The other hydrological source (Conejos River) is not fully included in these boundaries. Upstream activities along the Conejos River have the potential to adversely affect the elements. The area within the boundaries should allow natural fluvial processes to continually establish new riparian and wetland habitats in which the elements could establish. The southeastern boundary extends to the top of Sierro Del Ojito to address excessive sediment loads that could potentially come from the steep slopes.

Protection and Management Comments: The Bureau of Land Management (BLM) manages the majority of the site. Pikes Stockade Historic Site is located on the northern end and is owned by the State of Colorado. There may also be some private land encompassed in the site. This site currently has adequate protection.

No grazing has occurred on the site in the past five years and irrigation has not been conducted since 1988. Although the site still contains a fair number of non-native species (especially in the wet meadows), the area is recovering nicely from past disturbances. The BLM intends to manage the site specifically for cultural and natural resources allowing only non-motorized recreational opportunities, which are compatible with the management objectives, to occur (Bureau of Land Management 1994). However, during the site visit, signs or other means of discouraging vehicular access were not observed and private vehicles were seen at the site. Until implementation of the BLM's McIntire Springs Integrated Activity Plan has been completed, it can be expected that vehicular access and hunting and fishing activities may occur along with their unintentional negative impacts.

Soils Description: Soils at this site are associated with fluvial processes. The soils along the Conejos River are mapped as the Quamon series, which are Sandy-skeletal, mixed, frigid Typic Ustorthents (USDA 1980a). Soils near the springs are mapped as the Arena series, which are Fine-loamy, mixed, frigid Aquentic Durorthids. Arena soils are moderately deep, poorly drained, and were formed in saline-alkali alluvium (USDA 1980a). Between the springs and the river, soils are mapped as the Zinzer series. These soils are Fine-loamy, mixed, Aridic Calciborolls. A few inclusions were located, especially in old sloughs and oxbows. For example, two soil pits were dug in beaked sedge and small-fruited bulrush stands. These two areas were located in an old oxbow of the Conejos River that has, for the most part, filled in with sediment and a high cover of vegetation. The soils under the beaked sedge stand had a histic epipedon and were classified as Histosols (Hemists). An underlying impermeable silty clay layer and persistent soil saturation has resulted in an accumulation of peat approximately 16 inches (~40 cm) deep. Within the same slough, but closer to the current river channel, was a small-fruited bulrush stand. The soils in this area would probably be classified as Aquents, as indicated by redoximorphic features found in the soil profile. The presence of buried A and B horizons indicates that periodic flooding and sediment deposition still occur in this area.

<u>Beaked sedge Stand</u>

Oe	16 – 0 inches	10 Y/R 2/2, hemic
A	0-? inches	10 Y/R 2/1, silty clay

Small-fruited bulrush Stand

A	0-3 inches	10 Y/R 3/2, lots of organic matter (had difficulty with texture due to high quantities of organic matter), oxidized rhizospheres
Bg	3-6 inches	2.5 Y 2.5/1, silty clay loam, distinct boundary
Ab	6-10 inches	10 Y/R 3/2, lots of organic matter (had difficulty with texture due to high quantities of organic matter), distinct boundary
Bg	10-16 inches	2.5 Y 2.5/1, silty clay loam, distinct boundary

Restoration Potential: Most ecosystem processes are intact at this site. Enhancement effort should focus on non-native species eradication and/or control in the wet meadow areas. Maintenance of water rights and ensuring that natural disturbances such as flooding and fire are allowed to occur is crucial for the long-term viability of this area. Monitoring of upstream water use may be beneficial for understanding potential future impacts to this site. This would allow a proactive response to potential impacts as opposed to implementing restoration efforts after the fact.

Wetland Functional Assessment for the McIntire Springs PCA:

Proposed HGM Class: Riverine. Subclass: R5. (floodplain areas along the Conejos River and large back channels (i.e., creek draining from McIntire Springs).
Cowardin System: Palustrine. Subsystem: Forested, Scrub-Shrub, and Emergent.

Table 32. Wetland functional assessment for the riverine wetland at the McIntire Springs PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	High	High cover of woody vegetation within a large floodplain allows energy of potential floodwaters to be dissipated and stored.
Sediment/Shoreline Stabilization	High	Most stream banks appear to have high vegetation cover and impacts to streambanks are minimal.
Groundwater Discharge/ Recharge	High	Warm, perennial springs (McIntire Springs) occur at the base of Sierro del Ojito and provide hydrological inputs to many wetlands in the area.
Dynamic Surface Water Storage	High	The warm springs drain into a wide, flat creek that eventually drains into the Conejos River. Some areas appear to have been historically excavated, forming large pools. These areas store large quantities of water.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	High	Upstream water inputs are likely laden with excess nutrients and possibly sediment from agriculture and grazing activities. Dense vegetation cover along the immediate floodplain aids in sediment retention while numerous small side channels, slough, and oxbows may retain and/or transform excess nutrients.
Biological Functions		
Habitat Diversity	Exceptional	The wetland site consists of emergent, scrub-shrub, forested, and open water habitats.
General Wildlife Habitat	High	Warm springs provide important winter habitat for many species of waterbirds. Elk, deer, and northern leopard frogs were observed during the site visit. The diversity of vegetation structure and composition provides excellent habitat for many species.
General Fish/Aquatic Habitat	High	Two populations of the Rio Grande chub are found at this site. The perennial warm springs and the Conejos River likely provide habitat for many other species.
Production Export/Food Chain Support	High	High diversity in vegetation structure and composition, which contributes a diverse assemblage of litter, along with a diversity of environments where decomposition occurs (e.g., inundated, saturated, and aerated soils) produces a complex, sustainable source of carbon and nutrients for internal ecosystem process and downstream ecosystems. Food chain support is also high due to the diversity of habitats and the invertebrate populations they likely support.
Uniqueness	High	The presence of warm springs, significant cultural resources, and what is probably the best remaining riparian habitat left along the Conejos River make this site highly unique.

Proposed HGM Class: Depression. Subclass: D1. (depressional areas associated with abandoned oxbows, sloughs, and channels).
Cowardin System: Palustrine. Subsystem: Scrub-Shrub and Emergent.

Table 33. Wetland functional assessment for depressional wetlands at the McIntire Springs PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	N/A	Does not typically flood via overbank flow.
Sediment/Shoreline Stabilization	N/A	Does not occur along a natural surface water drainage.
Groundwater Discharge/ Recharge	High	Groundwater discharge associated with the local floodplain water table and warm, perennial springs (McIntire Springs) that occur at the base of Sierro del Ojito support many depressional wetlands in the area.
Dynamic Surface Water Storage	High	Most of the depressional wetlands are small in area but collectively they have a high potential for surface water storage.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	High	Upstream water inputs are likely laden with excess nutrients and possibly sediment from agriculture and grazing activities. Sediment removal is likely not a high function of these depressional areas, but nutrient/toxicant retention is a high potential due to the presence of fine textured and/or organic soils, semi-permanent or permanent saturation, and a dense cover of vegetation.
Biological Functions		
Habitat Diversity	High	The wetland site consists of emergent, scrub-shrub, and periodically, open water habitats.
General Wildlife Habitat	Moderate	Northern leopard frogs and a Short-eared Owl were observed in these areas. Lack of permanent open water in most of these wetlands limits potential as waterbird habitat. Deer and elk likely visit these areas for browse.
General Fish/Aquatic Habitat	N/A	Most of these wetlands do not have standing water. Those that do are only periodically flooded (they appear to dry up by summers end) and have no surface water connection to a moving drainage.
Production Export/Food Chain Support	High	High production of herbaceous vegetation and some input from shrubs (mainly willows) contributes large quantities of organic matter to the soil surface. This litter is either partially incorporated into the soils, accumulates as peat, or is moved downstream during high floods. Either way, different sources and quality of organic matter and nutrients are either exported downstream or used for internal ecosystem processes.
Uniqueness	Moderate	The concentration of numerous depressional wetlands intermixed with various other riparian/wetland habitats is fairly unique in this part of the San Luis Valley.

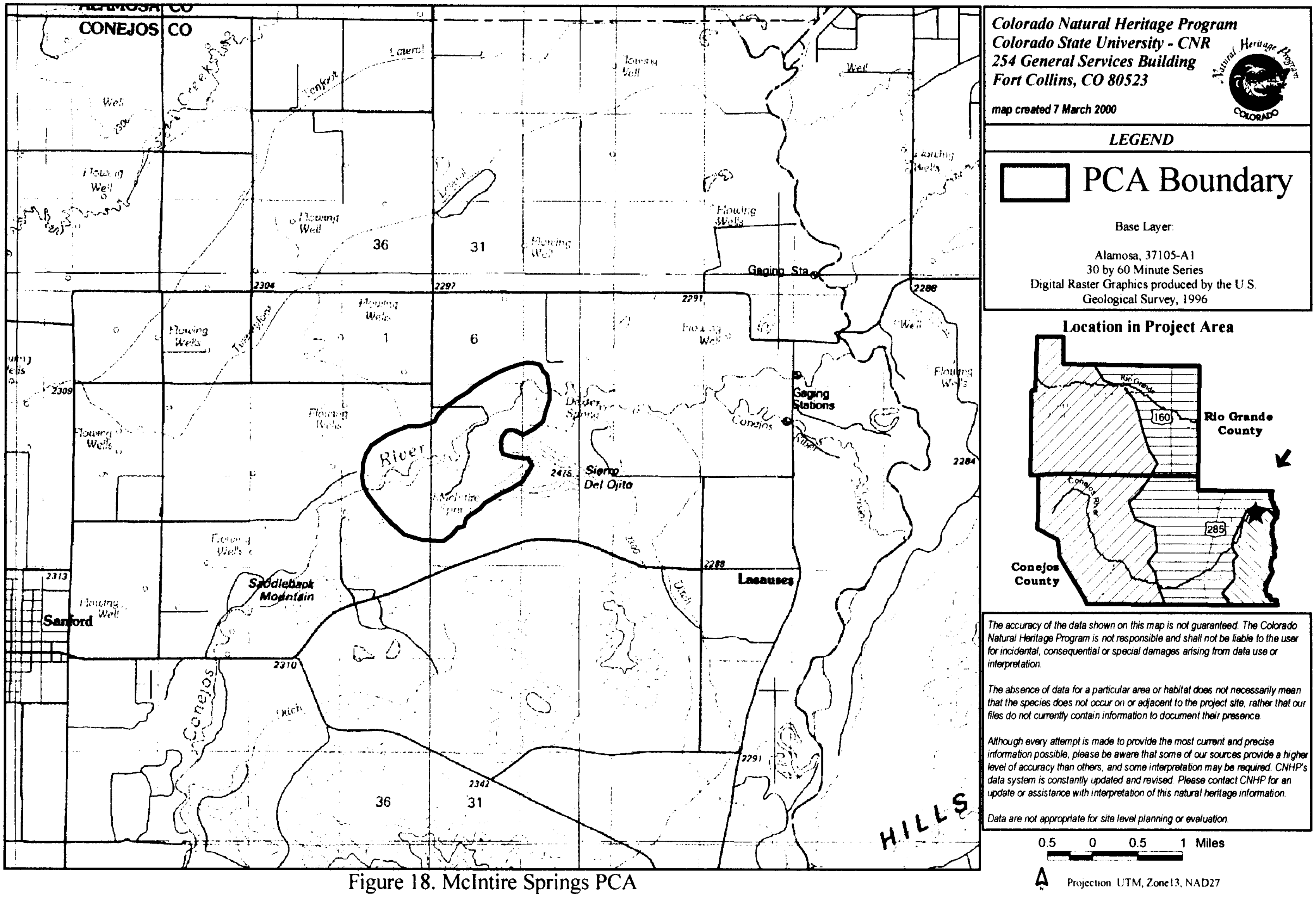


Figure 18. McIntire Springs PCA

Sego Springs Potential Conservation Area

Biodiversity Rank: B4 (Moderate Significance)
This site contains one fair occurrence of a fish that is vulnerable on a global scale.

Protection and Management Issues:
This site is within private and public lands. Management and protection of the elements found within this site might include prevention of introduced fish stock and reduction of erosion inputs to the stream.

Biodiversity Rank Justification: This site contains one element of concern at one location. The quality of the population of Rio Grande chub (*Gila pandora*) contributes to the rank of this site. The Rio Grande chub was once widespread in creeks of the upper Rio Grande and Pecos watersheds of New Mexico and the upper Rio Grande watershed of southern Colorado. Populations are reported to be stable in New Mexico but are declining in Colorado.

Table 34. Natural Heritage element occurrences at Sego Springs PCA.

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank
Fish					
Gila pandora	Rio Grande chub	G3	S1?	SC	C

*EO=Element Occurrence

Location: This site is located approximately 2 miles east of Antonito in Conejos County.
U.S.G.S. 7.5 minute quadrangles: Lobatos
Legal Description: T34N, R10E S 16, 17, 21
Elevation: 7,670-7,700 ft. Approximate Size: 133 acres

General Description: This site encompasses the riparian floodplain of the Rio San Antonio from two miles east of Manassa to approximately 1 mile north of Colorado Highway 142. The site encompasses approximately 2 miles of the Rio San Antonio.

The habitat for the chub along this stretch of the Rio San Antonio includes intermittent willow pockets and some woody debris within the stream channel. The Rio Grande chub uses debris, woody cover, and other substrate as refugia. It is commonly found in pools of small to moderate streams near areas of current and in association with undercut banks and overhanging vegetation (Woodling 1985). In addition, Sego Springs have been retained in numerous ponds where emergent vegetation has established along the edges. North of the springs, there is an extensive stand of narrowleaf cottonwood (*Populus angustifolia*) with as diverse understory composed of many non-native species.

Boundary Justification: The boundaries are drawn to provide habitat for the occurrence of chub. The boundary of this site is limited to 300 meters on either side of the creek system to provide adequate riparian vegetation for cover and possible prey (insect) needs, yet this potential conservation area, in and of itself, may not be sufficient to ensure the persistence of the population. Also, included in this site are substantial occurrences of northern leopard frog (*Rana pipiens*), which seems to be decreasing in number throughout Colorado.

Protection and Management Comments: This site is within private and public lands. Many of the surrounding ranches use the land for grazing or haying and some impacts such as erosion are evident. To provide and maintain sufficient habitat for the chub population, grazing and haying may be managed to minimize erosion in and around the creek or restricted to particular sections of the Rio San Antonio. In addition, limiting introduction of non-native fishes would benefit the existing chub population.

Soils Description: Soils are variable at this site due to the diverse topography in the area. Most wetland areas are mapped as Aquic Ustorthents, which are deep, somewhat poorly drained soils formed in mixed coarse alluvium (USDA 1980a).

Restoration Potential: The major disruptions of natural ecosystem processes in this area are the conspicuous presence of non-native species and the control of flow from the springs. Enhancement efforts focusing on the eradication and control of the non-native species would greatly benefit ecosystem processes. The ponds that retain flow from Sego Springs appear to be used for waterbird habitat. Removal of these ponds or at least creating an outlet from these ponds so that perennial overflow could maintain natural spring wetlands would be necessary to reestablish natural flow from the springs.

Wetland Functional Assessment for the Sego Springs PCA: No functional assessment was conducted for this site.

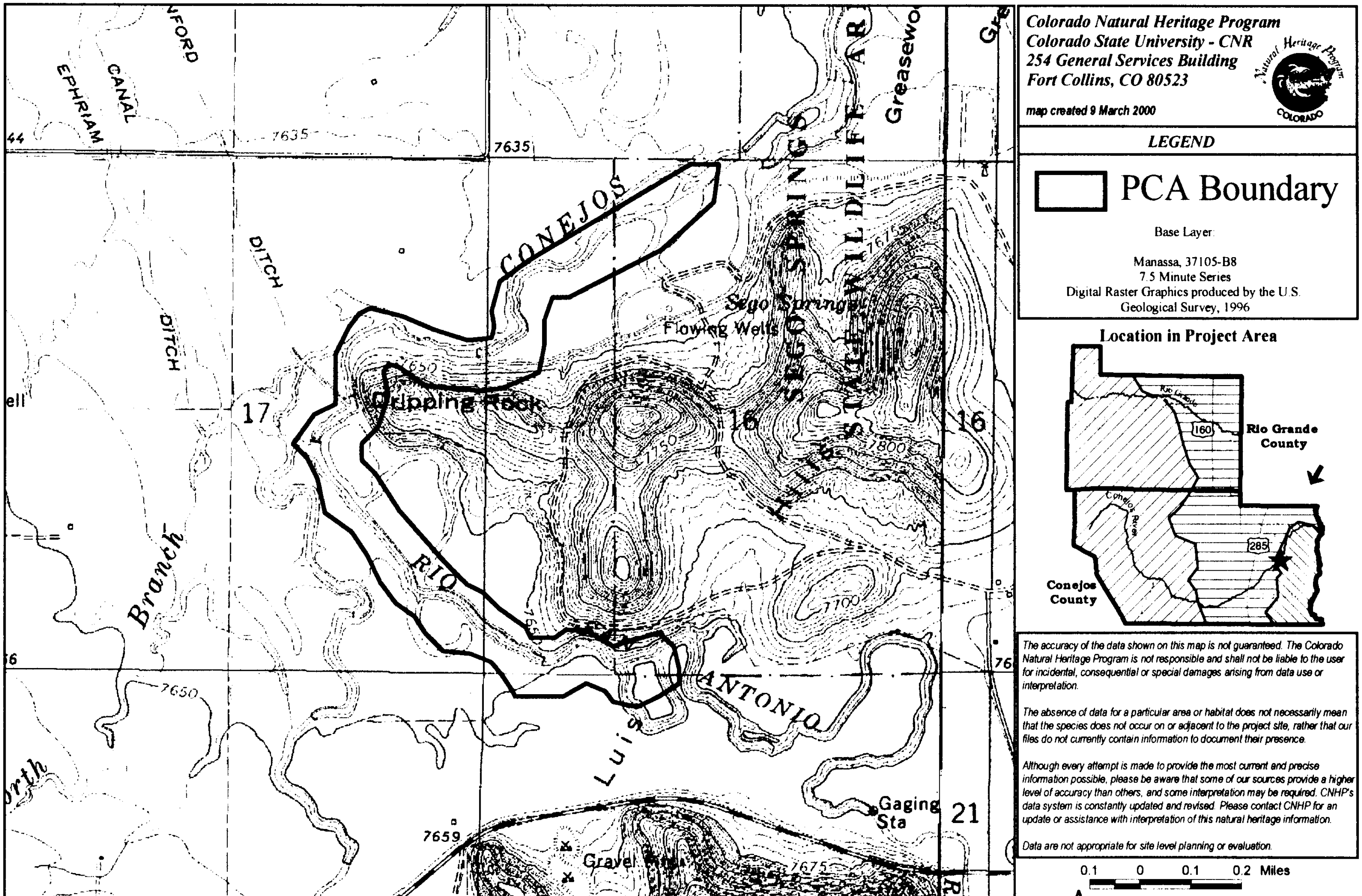


Figure 19. Sego Springs PCA

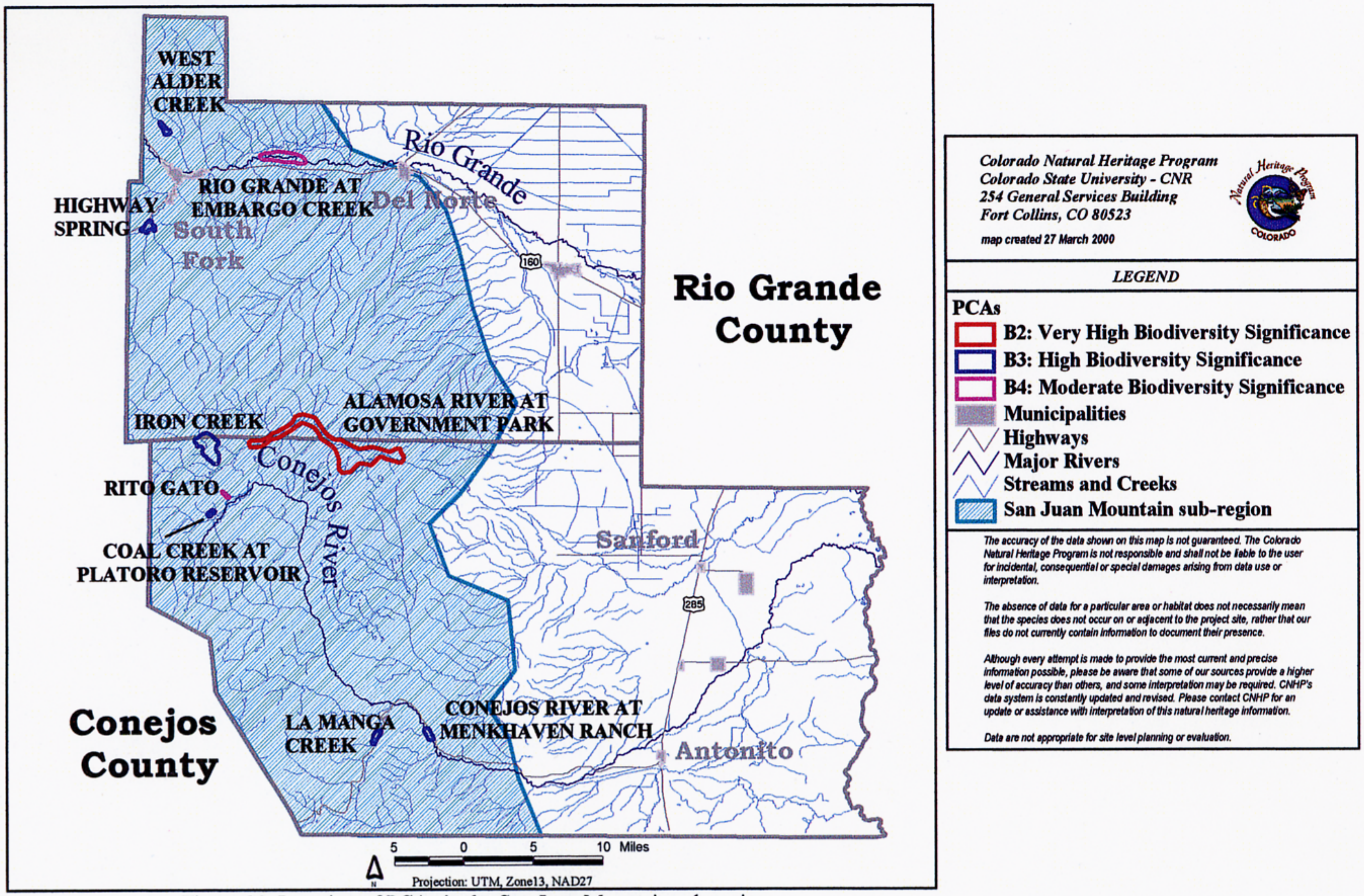


Figure 20. Location of PCAs in the San Juan Mountain sub-region

Alamosa River at Government Park Potential Conservation Area

Biodiversity Rank: B2 (Very High significance)
The site supports three good and two fair examples of plant communities vulnerable on a global scale.

Protection and Management Issues: Approximately half the site is privately owned while the Rio Grande National Forest manages the remaining portion of public land. No formal protection exists for any part of this site. Heavy grazing, heavy recreation use and the presence of Forest Service Road 250 have resulted in an abundance of non-native species. Water quality in the Alamosa River is an ongoing concern.

Biodiversity Rank Justification: The high concentration of globally vulnerable plant communities at this site is the primary reason for the very high biodiversity rank. Plant communities found at this site include: a quaking fen wet meadow (*Carex simulata*) which is vulnerable on a global scale; two willow carrs (*Salix monticola*/Mixed Forbs and *Salix monticola*/Mixed Graminoids) vulnerable on a global scale; three montane riparian forests (*Alnus incana*-Mixed *Salix* species, and *Populus angustifolia/Alnus incana*) which are vulnerable on a global scale.

Table 35. Natural Heritage element occurrences at Alamosa River at Government Park PCA.

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank
Plants Communities					
Alnus incana-mixed *Salix* species	Thinleaf alder-mixed willow species	G3	S3		B
Carex simulata	Wet meadows	G3	S3		B
Populus angustifolia/Alnus incana	Montane riparian forest	G3?	S3		C
Salix monticola/mixed forbs	Montane riparian willow carr	G3	S3		B
Salix monticola/mixed graminoids	Montane riparian willow carr	G3	S3		C

*EO=Element Occurrence

Location: The Alamosa River at Government Park site occurs along the Alamosa River upstream from Terrace Reservoir but below the Summitville Mine in Rio Grande County. The site begins near the Alamosa River Campground and continues upstream to the west side of Government Park.
U.S.G.S. 7.5-min. quadrangle: Jasper, Greenie Mountain
Legal Description: T36N R05E S 4, 5, 6, 8, 9, 10, 11, 12
T37N R05E S 25, 29, 30, 31, 32, 36
Elevation: 8,600-9,400 ft. Approximate Size: 5,764 acres

General Description: The site is large, stretching approximately 12 miles along the Alamosa River. This stretch of the Alamosa River is in relatively good condition. Since this site is upstream from Terrace Reservoir, the natural hydrologic regime is relatively intact. Due to natural sources of mineralization, the Alamosa River has probably always had a relatively high amount of heavy metals in the water compared to other local drainages (Stern 1997). However, since the 1870's when mining in the watershed commenced, acidic runoff from abandoned mines has increased the amount of heavy metals and acidity in the waters of the Alamosa River. Until the late 1980's, the river was able to buffer against excess acidity and large heavy metal loads. After many years of runoff and spills from an open pit gold mine located in Summitville, CO, the river lost its capability of withstanding these stresses and large fish kills occurred in Terrace Reservoir (Stern 1997). This open pit gold mine is now the Summitville Mine Superfund Site.

Hydrological processes appear to be intact and seasonal flooding appears to occur in the area. There are also a few beaver ponds scattered throughout the site. Common shrub and tree species growing along the banks of the Alamosa River and the floodplain include narrowleaf cottonwood *(Populus angustifolia*), thinleaf alder (*Alnus incana*), mountain willow (*Salix monticola*), and Colorado blue spruce (*Picea pungens*). Coyote willow (*Salix exigua*) and narrowleaf cottonwood saplings occupy recently disturbed areas. A fen occurs in Government Park and is supported by seeps coming out of nearby slopes on the north side of the river. Short-beaked sedge (*Carex simulata*) dominates the periphery of the fen while beaked sedge (*Carex utriculata*), bluejoint reedgrass (*Calamagrostis canadensis*), and tufted hairgrass (*Deschampsia cespitosa*) along with numerous fen mosses occupy the wettest areas. The peat is extremely deep and many areas are "quaking" and very unstable. The deep accumulation of peat indicates that hydrological processes are intact and very stable. Disturbance within the fen is minimal as the organic soils are unstable and likely do not support livestock.

Boundary Justification: The boundary encompasses all of the known elements that are ecologically connected in this stretch of the river and was drawn to address impacts from direct disturbances such as trampling and overgrazing. Lateral boundaries encompass the entire floodplain allowing the fluvial processes of the river to create new riparian and wetland habitat where the plant communities may establish in the future. The downstream boundaries were delimited by the reservoir. Although the upper watershed is not contained within this site's boundaries, activities there could potentially affect the integrity of the elements at this site.

Protection and Management Comments: Approximately half the site is privately owned while the Rio Grande National Forest manages the remaining portion. No formal protection exists for any part of this site.

Although poor water quality has drastically affected the aquatic community of the Alamosa River, effects on riparian/wetland vegetation along the banks and in the floodplain appear minimal. Potential impacts to wildlife are not known, however some research has suggested that wildlife that exclusively forage in areas of heavy metal contamination may accumulate heavy metals to the point of potential toxicity (Stern 1997). Heavy recreation, intensive grazing in some locations, and the presence of Forest Service Road 250, which traverses the north side of the river through the entire site, have contributed to the presence of non-native species along this stretch of the Alamosa River (mainly Canada thistle - *Cirsium arvense*, Kentucky bluegrass - *Poa pratensis*, and dandelion - *Taraxacum officinale*). Vegetation structure and species composition have been altered in most plant communities along the river due to grazing and/or heavy recreation activities.

Soils Description: Soils at this site are not mapped by the county soil survey. The U.S. Forest Service may have soil maps for this area. In general, soils along this stretch of the Alamosa River are fairly coarse with pockets of fine soil collecting in backwater flood channels. A soil pit was dug in the short-beaked sedge "quacking" fen. This area had a deep accumulation of peat due to a persistent upwelling of groundwater.

<u>Short-beaked sedge fen</u>
Oe 36-28 inches, hemic material, 10 YR 3/2
Oi 28-? inches, fibric material, 10 YR 3/6
Mineral soil material or a lithic contact was never reached. Unsure of peat depth.
Heavy sulfur odor
Soil water pH = 7.2

Restoration Potential: Most ecological processes are intact. There are no upstream water diversion structures along the Alamosa River thus hydrological processes are still functioning. The major disturbance issues are water quality associated with the Alamosa River and impacts from intensive grazing and recreation in riparian areas. Eradication and/or control of non-native species may be necessary in some areas. Reducing the amount or timing of recreation and grazing activities may allow natural vegetation structure to redevelop in areas that are heavily impacted.

Wetland Functional Assessment for the Alamosa River at Government Park PCA:

Proposed HGM Class: Riverine. Subclass: R3.
Cowardin System: Palustrine. Subsystem: Forested, Scrub-Shrub, and Emergent.

Table 36. Wetland functional assessment for the riverine wetland at the Alamosa River at Government Park PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	High	A high density of woody vegetation in a floodplain that seasonally floods provides high potential for flood attenuation. However, anthropogenic values associated with this function are minimal since Terrace Reservoir, located downstream from this site, provides flood control for downstream areas on the valley floor.
Sediment/Shoreline Stabilization	Moderate	Areas along the stream bank where soil development has occurred are well vegetated. However, many areas are not vegetated, as exposed bedrock is common along this stretch of the Alamosa River.
Groundwater Discharge/ Recharge	Unknown	It is not clear how much groundwater discharge and/or recharge is associated directly with the river. Given the amount of exposed bedrock in the area, the river may not be losing or gaining along this stretch. However, as it enters the valley, it does become a losing stream (recharge).
Dynamic Surface Water Storage	N/A	The wetland floods via overbank flow.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	Moderate	This area receives upstream water that is laden with heavy metals and sediments from abandoned mine drainage and natural sources. Given the density of woody vegetation in the floodplain sediment retention is likely occurring. The capacity of the riparian vegetation and soils to retain excess heavy metals is likely not very high (*sensu* Gough et al., 1996). Since flooding cycles are relatively intact, natural biogeochemical processes are probably functioning well.
Biological Functions		
Habitat Diversity	Exceptional	The wetland site consists of emergent, scrub-shrub, forested, and open water habitats associated with the river.
General Wildlife Habitat	Low to Moderate	Deer and elk are likely users of the riparian area. However, poor water quality of the Alamosa River has likely decreased invertebrate populations, which in turn may affect songbird use of the area.
General Fish/Aquatic Habitat	Low	In recent years, the Alamosa River did not support any fish populations due to excess heavy metal loads from abandoned mine drainage (i.e., Summitville Mine). It is unclear whether this is still the case.
Production Export/Food Chain Support	Moderate	Diverse vegetation structure and composition suggests a diversity of litter inputs and habitat for invertebrate populations. However, poor water quality may be limiting the capability of this area in performing this function.
Uniqueness	Low	Similar riparian wetlands are fairly common in Rio Grande and Conejos counties.

Proposed HGM Class: Depression. Subclass: D1. (Short-beaked sedge fen)
Cowardin System: Palustrine. Subsystem: Emergent.

Table 37. Wetland functional assessment for the fen at the Alamosa River at Government Park PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	N/A	Does not typically flood via overbank flow.
Sediment/Shoreline Stabilization	N/A	Does not occur along a natural surface water drainage.
Groundwater Discharge/ Recharge	High	Groundwater discharge is persistent and upwelling in this area. Many small seeps can be seen on adjacent slopes.
Dynamic Surface Water Storage	High	An extremely deep accumulation of peat provides a high capacity to store water (organic matter has a high water holding capacity).
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	High	Groundwater inputs are not hydrologically connected to the Alamosa River; thus the fen is not being subjected to heavy metals loads and/or sediment. Natural biogeochemical processes are intact.
Biological Functions		
Habitat Diversity	Low	The wetland site consists of emergent wetland habitat.
General Wildlife Habitat	Low	The organic soils are unstable and do not have the capacity to support large animals. Thus, deer, elk, coyotes, and black bears probably do not use the area. Songbirds may use emergent vegetation for feeding.
General Fish/Aquatic Habitat	N/A	Does not occur along and is not connected to a natural surface water drainage that is capable of supporting fish.
Production Export/Food Chain Support	Moderate	Since there is no defined outlet, the wetland probably provides very little in terms of production export. However, the dense cover of emergent vegetation and mosses and the invertebrate populations they support probably provide food for some songbirds.
Uniqueness	High	Quaking fens are uncommon. This particular fen has an extremely deep accumulation of peat and thus is irreplaceable.

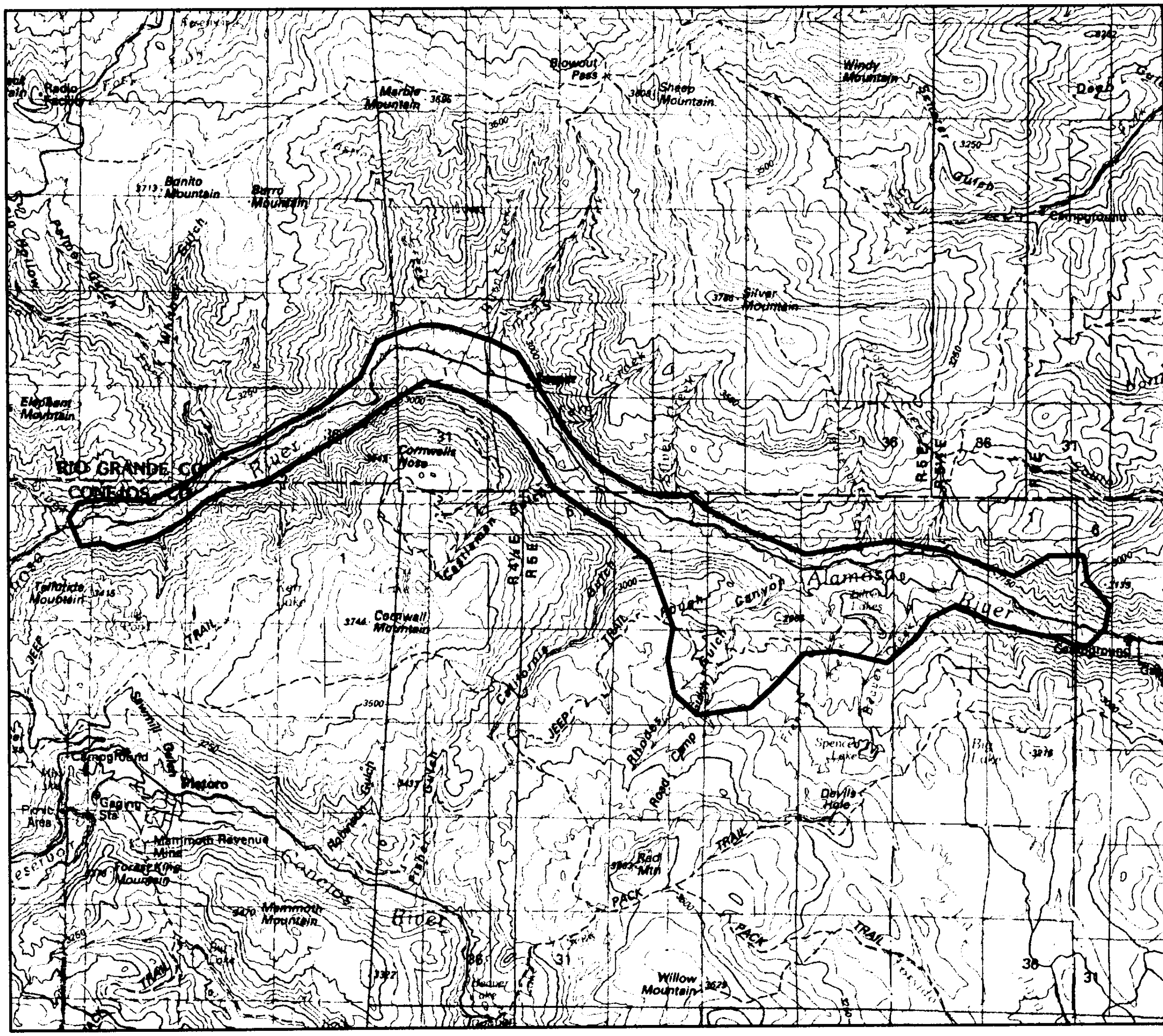


Figure 21. Alamosa River at Government Park PCA

Colorado Natural Heritage Program
Colorado State University - CNR
254 General Services Building
Fort Collins, CO 80523

map created 28 February 2000

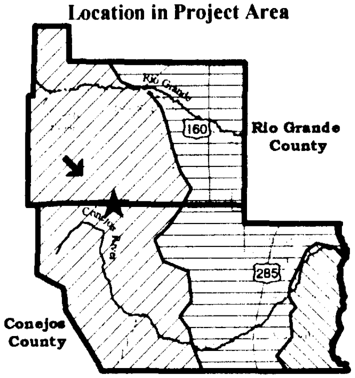
LEGEND

□ PCA Boundary

Base Layer:

Antonito, 37106-A1
30 by 60 Minute Series
Digital Raster Graphics produced by the U.S.
Geological Survey, 1996

Location in Project Area



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The absence of data for a particular area or habitat does not necessarily mean that the species does not occur on or adjacent to the project site, rather that our files do not currently contain information to document their presence.

Although every attempt is made to provide the most current and precise information possible, please be aware that some of our sources provide a higher level of accuracy than others, and some interpretation may be required. CNHP's data system is constantly updated and revised. Please contact CNHP for an update or assistance with interpretation of this natural heritage information.

Data are not appropriate for site level planning or evaluation.

0.5 0 0.5 1 1.5 Miles

N

Projection UTM, Zone13, NAD27

Conejos River at Menkhaven Ranch Potential Conservation Area

Biodiversity Rank: B3 (High significance)
The site supports a good example of a plant community vulnerable on a global scale.

Protection and Management Issues: Almost the entire site is privately owned while the Rio Grande National Forest manages the remaining portion. The Colorado Division of Wildlife maintains a fishing access easement with the private landowners. Development pressure is a concern at this site as summer home developments are common along this stretch of the Conejos River. The site has historically been grazed, but not in recent years.

Biodiversity Rank Justification: The site supports a good example of a montane willow carr (mountain willow/bluejoint reedgrass - *Salix monticola*/*Calamagrostis canadensis*). This plant community apparently only occurs in Colorado, where mountain willow appears to be at the center of its distribution.

Table 38. Natural Heritage element occurrences at Conejos River at Menkhaven Ranch PCA.

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank
Plant Communities					
Salix monticola/ Calamagrostis canadensis	Montane willow carr	G3	S3		B

*EO=Element Occurrence

Location: The Conejos River at Menkahven Ranch site is located approximately ¼ mile downstream of the Menkhaven Ranch which is approximately 16 miles west of Antonito, along Highway 17 in Conejos County.
U.S.G.S. 7.5-min. quadrangle: Osier
Legal Description: T33N R06E S 19, 10, 15, 16
Elevation: 8,600 ft. Approximate Size: 217 acres

General Description: The site occurs in a broad valley with steep volcanic cliffs covered by aspen (*Populus tremuloides*), Engelmann spruce (*Picea engelmannii*), and sub-alpine fir (*Abies lasiocarpa*). The river has created a broad meandering channel through the valley floor where point bars, oxbows, and floodplain areas provide a diversity of riparian and wetland habitat. Narrowleaf cottonwood (*Populus angustifolia*) and Colorado blue spruce (*Picea pungens*) dominate the majority of the floodplain. Mountain willow (*Salix monticola*) and Bebb willow (*Salix bebbiana*) occupy wet areas within the floodplain and near beaver ponds and old oxbows. The understory in these areas consists of bluejoint reedgrass (*Calamagrostis canadensis*), woolly sedge (*Carex lanuginosa*), Kentucky bluegrass *(Poa pratensis*), woodreed (*Cinna latifolia*), redtop *(Agrostis stolonifera*), and dandelion (*Taraxacum officinale*).

Boundary Justification: The boundary includes the floodplain to allow natural fluvial processes (lateral flow, creation of oxbows, scouring) to continue to create potential habitat for the element.

Protection and Management Comments: Almost the entire site is privately owned, while the Rio Grande National Forest manages the remaining portion. Numerous summer home developments occur in the area and the Menkhaven Ranch sits just upstream from the site. The Colorado Division of Wildlife currently maintains a fishing access easement with the private landowners.

Direct disturbance such as trampling and incompatible grazing should be minimized or avoided. Signs of past grazing are visible, but the site does not appear to have been grazed in recent years. Non-native species such as Kentucky bluegrass, timothy (*Phleum pratense*), dandelion, and clover (*Trifolium repens*) are present but not in large numbers. Platoro Reservoir has likely altered natural hydrology, and may impact the plant community. Development pressure is a concern at this site.

Soils Description: Soils at this site are not mapped by the county soil survey. The U.S. Forest Service may have soil maps for this area. In general, soils along this stretch of the Conejos River are composed of mixed alluvium. Due to dense cover of herbaceous species and seasonal soil saturation, the soils in this area have accumulated a fairly large amount of organic matter in the A-horizon.

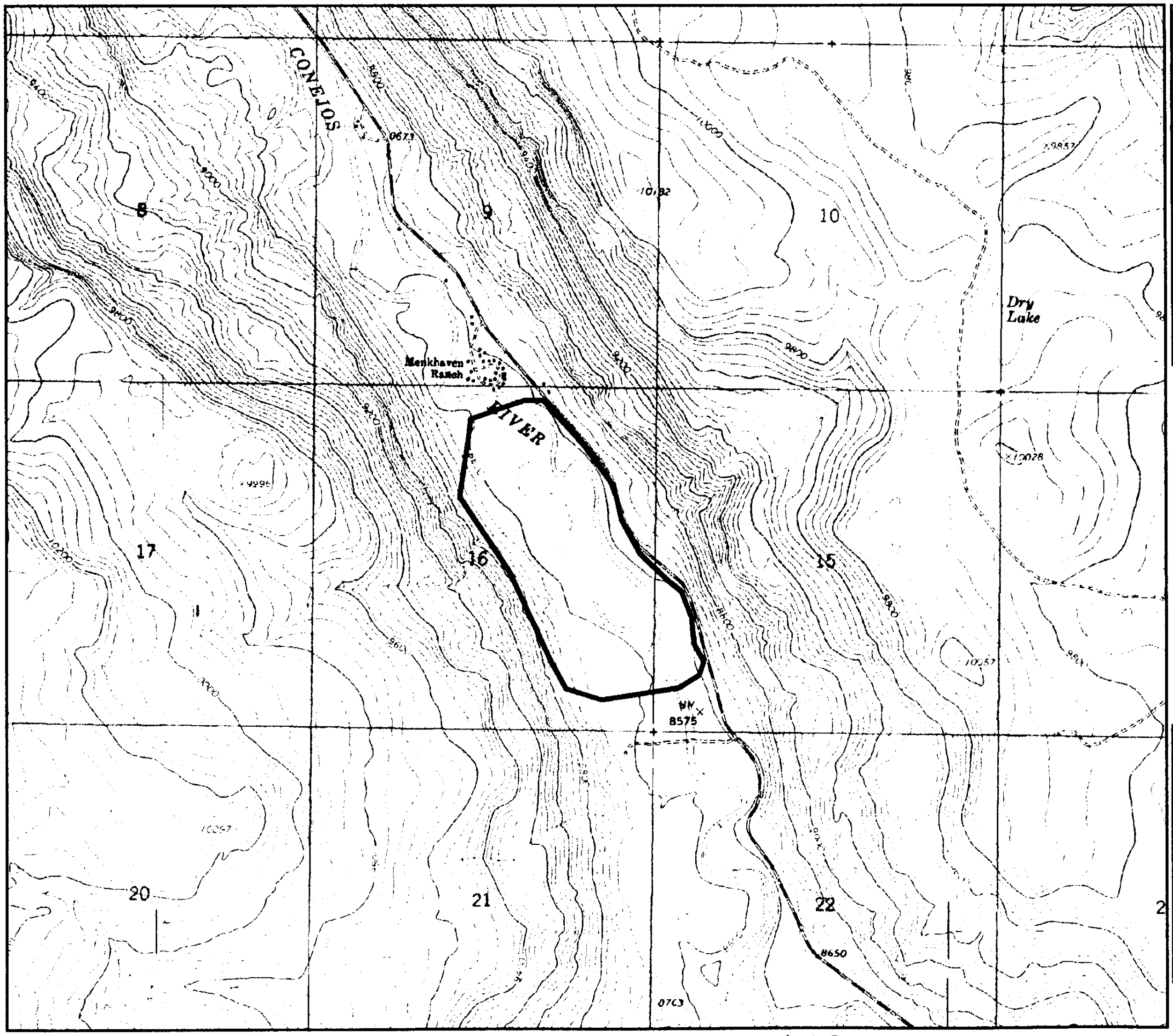
Restoration Potential: Restoration efforts should focus on ensuring that a natural flooding regime is maintained. Platoro Reservoir, which lies upstream from this site, has potentially altered the natural hydroperiod of this area. The degree to which the reservoir has changed flow patterns is not known.

Wetland Functional Assessment for the Conejos River at Menkhaven Ranch PCA:

Proposed HGM Class: Riverine. Subclass: R3.
Cowardin System: Palustrine. Subsystem: Forested, Scrub-Shrub, and Emergent.

Table 39. Wetland functional assessment for the riverine wetland at the Conejos River at Menkhaven Ranch PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	High	A high density of woody vegetation in a floodplain that seasonally floods provides high potential for flood attenuation.
Sediment/Shoreline Stabilization	High	Most stream banks are densely vegetated.
Groundwater Discharge/ Recharge	Unknown	It is not clear how much groundwater discharge and/or recharge is associated directly with the river.
Dynamic Surface Water Storage	N/A	The wetland floods via overbank flow.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	High	Upstream inputs from private homes along the Conejos River may contain excessive nutrients and sediments. High cover of herbaceous and woody vegetation along the immediate floodplain provides high capacity for this wetland to retain sediments and/or nutrients.
Biological Functions		
Habitat Diversity	Exceptional	The wetland site consists of emergent, scrub-shrub, forested, and open water habitats associated with the river.
General Wildlife Habitat	Moderate	Deer and elk are likely users of the riparian area. The diverse vegetation structure provides excellent songbird habitat.
General Fish/Aquatic Habitat	High	The Conejos River does provide habitat for many different fish species.
Production Export/Food Chain Support	High	Dense cover of herbaceous and woody species contributes a diversity of litter and debris leading to exportation of various organic substrates. These areas probably support a diverse invertebrate population and, along with seed production from the diversity of herbaceous species present, provide excellent food chain support.
Uniqueness	Low	Similar riparian wetlands are fairly common in Rio Grande and Conejos counties.



Colorado Natural Heritage Program
Colorado State University - CNR
254 General Services Building
Fort Collins, CO 80523

map created 29 February 2000

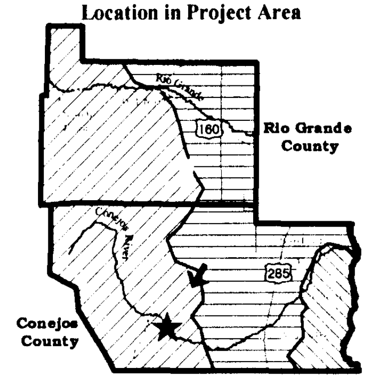
LEGEND

PCA Boundary

Base Layer:

Osier, 37106-A3
7.5 Minute Series
Digital Raster Graphics produced by the U.S. Geological Survey, 1996

Location in Project Area



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Data are not appropriate for site level planning or evaluation.

0.2 0 0.2 0.4 Miles

Projection UTM, Zone13, NAD27

Figure 22. Conejos River at Menkhaven Ranch PCA

Conejos River at Platoro Potential Conservation Area

Biodiversity Rank: B3 (High significance)
The site supports a good example of a plant community vulnerable on a global scale.

Protection and Management Issues: Most of the site is publicly owned and managed by the Rio Grande National Forest, while a small portion is privately owned. The site has no formal protection. No signs of current grazing were observed however old pack trails were still evident. Heavy recreational use is a concern at this site.

Biodiversity Rank Justification: The site supports a good example of a montane willow carr (mountain willow/mesic forb - *Salix monticola*/Mesic forb). This plant community appears to occur only in Colorado, where mountain willow appears to be at the center of its distribution.

Table 40. Natural Heritage element occurrences at Conejos River at Platoro PCA.

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank
Plant Communities					
Salix monticola/mesic forb	montane willow carr	G3	S3		B

*EO=Element Occurrence

Location: The Conejos River at Platoro site is located approximately 1 miles downstream from the town of Platoro in Conejos County.
U.S.G.S. 7.5-min. quadrangle: Red Mountain, Platoro
Legal Description: T36N R04E S 23, 24, 25, 26, 35, 36
Elevation: 9,800 ft. Approximate Size: 1,164 acres

General Description: The site is in a glaciated valley along the Conejos River and contains scrub\shrub riparian habitat and slope wetlands. The river meanders across a wide valley floor leaving many wetlands associated with numerous oxbows. Natural hydrological processes have been altered due to the presence of Platoro Reservoir. Seasonal flooding has likely been minimized relative to historical flows. However, many small drainages and seeps on adjacent slopes appear to maintain saturated conditions in much of the site. The seeps support willow carrs dominated by a complex of willows (*Salix* spp.), sedges (*Carex* spp.), and mixed forbs. Drier areas of adjacent slopes are dominated by aspen (*Populus tremuloides*), Engelmann spruce *(Picea engelmannii*) and sub-alpine fir (*Abies lasiocarpa*). Mountain willow (*Salix monticola*), Booth willow (*Salix boothii*), water sedge (*Carex aquatilis*), tufted hairgrass (*Deschampsia cespitosa*), beaked sedge (*Carex utriculata*), and elephantella (*Pedicularis groenlandica*) occur in the floodplain around old oxbows and in low-lying areas. Shrubby cinquefoil (*Pentaphylloides floribunda*) occupies slightly drier areas in the floodplain.

Boundary Justification: The floodplain of the Conejos River was included in the boundary to allow the river to meander, thereby creating potential habitat for the plant community to establish. The willow carrs observed on adjacent slopes were included as they provide important hydrological functions, such as maintenance of surface and groundwater flow. Although not included in the site, upstream activities along the Conejos River could potentially affect the elements.

Protection and Management Comments: Most of the site is contained within the Rio Grande National Forest, however a small portion is privately owned. The site has no formal protection status.

Recreational impacts (e.g., trampling, trash, etc.) are apparent at the site. No signs of grazing were observed however old pack trails were evident. Activities associated with the upstream presence of Platoro Reservoir and the town of Platoro pose potential threats to the elements such as future manipulation of hydrology and increased nutrient loads from wastewater. Forest Service Road 250 also passes through the site. Non-native plants such as dandelion (*Taraxacum officinale*) and clover (*Trifolium repens*) are abundant at the site.

Soils Description: Soils at this site are not mapped by the county soil survey. The U.S. Forest Service may have soil maps for this area. In general, soils are composed of mixed alluvium. Due to dense cover of herbaceous and woody species and seasonal soil saturation, the soils in this area have accumulated a fairly large amount of organic matter.

Restoration Potential: Platoro Reservoir, which lies approximately 1 ½ miles upstream, has altered the natural hydroperiod of this area. Restoring a natural flow regime would require collaboration with the owners of the reservoir to allow seasonal releases to mimic natural flood cycles. Enhancement effort could focus on alleviating trampling from recreation users by implementing a different management plan for this area.

Wetland Functional Assessment for the Conejos River at Platoro PCA:

Proposed HGM Class: Riverine. Subclass: R2. (wetlands along the floodplain of the Conejos River)
Cowardin System: Palustrine. Subsystem: Scrub-Shrub and Emergent.

Table 41. Wetland functional assessment for the riverine wetland at the Conejos River at Platoro PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	High	A high density of woody vegetation in the floodplain provides high potential for flood attenuation. However, Platoro Reservoir has altered the natural flooding cycle and probably alleviates many natural floods that would otherwise inundate this area.
Sediment/Shoreline Stabilization	High	Most stream banks are densely vegetated.
Groundwater Discharge/ Recharge	Unknown	It is not clear how much groundwater discharge and/or recharge is associated directly with the river. Locally, the willow carr at this site is probably supported by the local floodplain water table.
Dynamic Surface Water Storage	N/A	The wetland floods via overbank flow.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	High	Upstream inputs from the town of Platoro may contain excessive nutrients and sediments. High cover of herbaceous and woody vegetation along the immediate floodplain provides high capacity for this wetland to retain sediments and/or nutrients.
Biological Functions		
Habitat Diversity	High	The wetland site consists of emergent, scrub-shrub, and open water habitats associated with the river.
General Wildlife Habitat	Low	Songbirds may frequent the area. The close proximity of this site to a busy road along with high recreation use probably precludes most wildlife from using this area.
General Fish/Aquatic Habitat	High	The Conejos River does provide habitat for many different fish species.
Production Export/Food Chain Support	High	Dense cover of herbaceous and woody species contributes a diversity of litter and debris. Periodic flooding exports various organic substrates derived from this litter to downstream ecosystems. These areas probably support a diverse invertebrate population and, along with seed production from the diversity of herbaceous species present, provide excellent food chain support.
Uniqueness	Low	Similar riparian wetlands are fairly common in Rio Grande and Conejos counties.

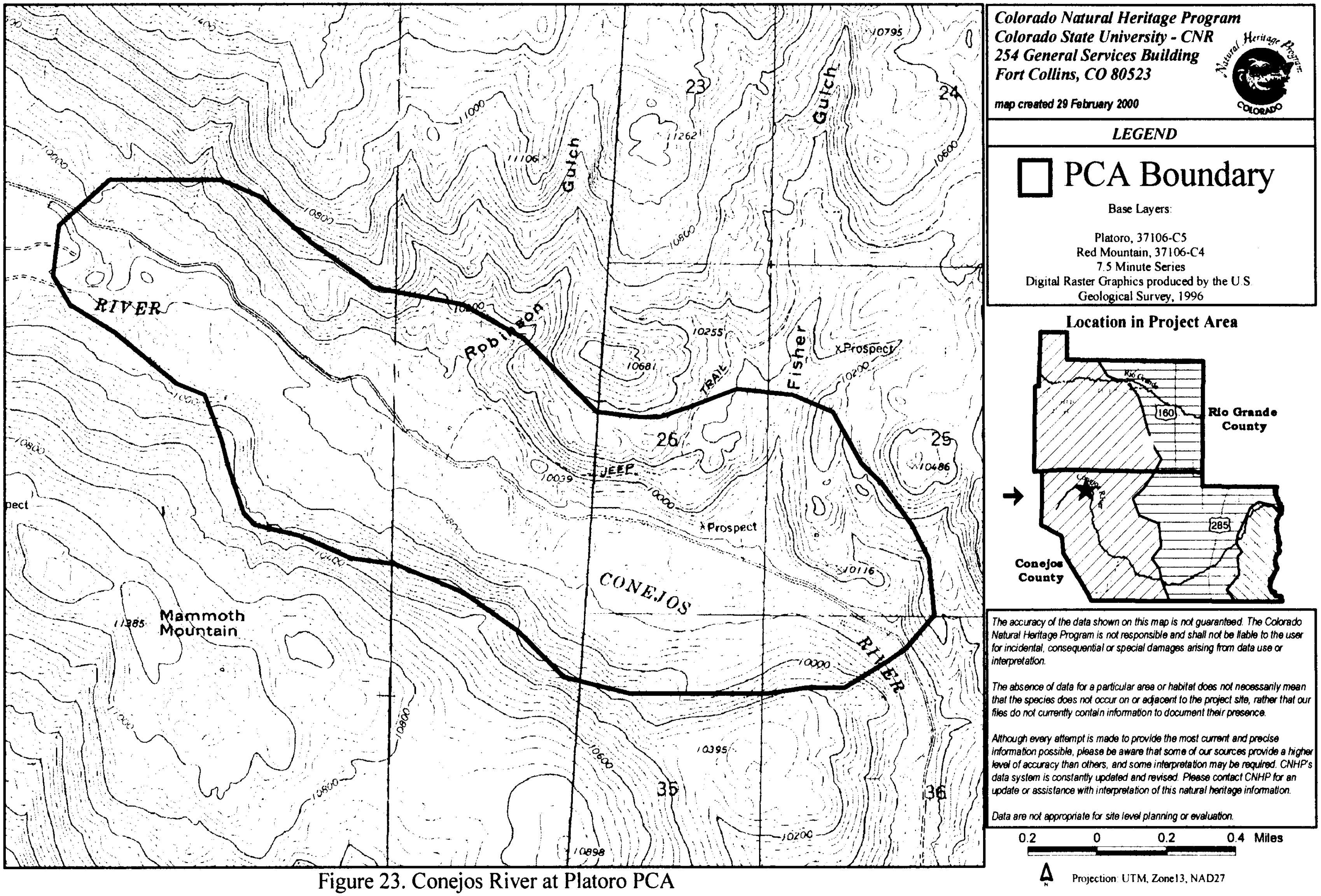


Figure 23. Conejos River at Platoro PCA

Highway Spring Potential Conservation Area

Biodiversity Rank: B3 (High significance)
The site supports a good and excellent example of two riparian plant communities vulnerable on a global scale, a good example of a widespread riparian plant community, a fair and good example of two willow carrs vulnerable on a global scale, and one excellent example of a wetland plant community.

Protection and Management Issues: The majority of the site is publicly owned and managed by the Rio Grande National Forest, while a very small portion is privately owned. The site has no formal protection. Impacts from heavy recreational use associated with a nearby campground could potentially be of concern.

Biodiversity Rank Justification: The site supports an excellent example of the thinleaf alder-red osier dogwood riparian shrubland (*Alnus incana*/*Cornus sericea*), which is widespread throughout the Rocky Mountains. The occurrence at this site is in excellent condition. The site also supports good examples of two narrowleaf cottonwood riparian forests (*Populus angustifolia*/*Alnus incana* and *Populus angustifolia*/*Salix exigua*). Both of these communities are important indicators of fluvial process and riparian health as they represent mid-seral and early-seral plant communities. The presence of these communities in addition to mature stands of narrowleaf cottonwood and conifers indicates that natural hydrological processes are intact and support a diverse array of successional communities. Also present at the site are good examples of two montane willow carrs (*Salix monticola*/*Calamagrostis canadensis* and *Salix monticola*/Mesic forb), and an excellent example of a submergent wetland plant community (*Sparganium angustifolium*). Overall, the site exhibits high species and habitat diversity.

Table 42. Natural Heritage element occurrences at Highway Spring PCA.

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank
Plant Communities					
Alnus incana/*Cornus sericea*	Thinleaf alder-red osier dogwood riparian shrubland	G3G4	S3		A
Populus angustifolia/*Alnus incana*	Montane riparian forest	G3?	S3		B
Populus angustifolia/*Salix exigua*	Narrowleaf cottonwood riparian forest	G4	S4		B
Salix monticola/*Calamagrostis canadensis*	Montane willow carr	G3	S3		B
Salix monticola/mesic forb	Montane willow carr	G3	S3		C
Sparganium angustifolium	Montane floating/submergent wetland	G4?	S2S3		A

*EO=Element Occurrence

Location: The Highway Springs site is located west of South Fork, along Highway 160 in Rio Grande County. The site is located just below the Highway Springs Campground.
U.S.G.S. 7.5-min. quadrangle: Beaver Creek Reservoir
Legal Description: T39N R03E S 17, 20, 21
Elevation: 8,400 ft. Approximate Size: 310 acres

General Description: The site encompasses beaver ponds, old oxbows, wet meadows, and scrub/shrub wetlands in addition to riparian communities representing all successional age classes. The site occurs near the confluence of Tewksberry Creek, Beaver Creek, and the South Fork of the Rio Grande. The confluence of these drainages in addition to the many beaver ponds located in the area have created a diverse riparian and wetland complex in a relatively broad floodplain. The riparian vegetation is represented by late (*Populus angustifolia*/*Picea pungens*), mid (*Populus angustifolia*/*Alnus incana*), and early seral (*Populus angustifolia*/*Salix exigua*) plant communities, indicating that fluvial processes (e.g., seasonal flooding, channel scouring, and sediment deposition) are still intact. Narrowleaf cottonwood (*Populus angustifolia*) and coyote willow (*Salix exigua*) were found on point bars and areas of recent disturbance. Thinleaf alder is present in slightly more stable areas, where disturbance from flooding is not as frequent. In areas furthest from the river channel and on slightly higher ground, mature narrowleaf cottonwood and Colorado blue spruce (*Picea pungens*) are the dominant species.

Many beaver ponds and channels were found throughout the site. More recent ponds are dominated by narrowleaved bur-reed (*Sparganium angustifolium*), mare's tail (*Hippuris vulgaris*), and white water-buttercup (*Ranunculus aquatilis*). Around older beaver ponds, large stands of mountain willow (*Salix monticola*) occur with a diverse understory of Bluejoint reedgrass (*Calamagrostis canadensis*), sedges (*Carex* spp.), and mixed forbs. Wet meadows are dominated by Baltic rush (*Juncus balticus*), Kentucky bluegrass (*Poa pratensis*), and various sedges (*Carex* spp.). Beaked sedge (*Carex utriculata*), water parsnip (*Sium suave*), purple checkermallow (*Sidalcea neomexicana*), and golden banner (*Thermopsis montana*) occupy a large oxbow on the south side of the site. This area has accumulated approximately 25 centimeters of peat and is obviously saturated year round.

Boundary Justification: The entire floodplain of the area is included to allow natural fluvial processes and beaver activity to continue, both of which are crucial for the viability of the elements. Although upstream areas along each of the three drainages are not included, activities in these watersheds could potentially affect the elements.

Protection and Management Comments: The majority of the site is managed by the Rio Grande National Forest. A very small portion along the western side of the site is privately owned. The site has no formal protection.

Direct impacts are associated with recreational use (mainly fishing), but appear minimal. A Forest service campground is located nearby; impacts from recreation should be closely monitored. Non-native species such as Kentucky bluegrass and dandelion

(*Taraxacum officinale*) are present but do not appear to be negatively affecting the elements at this time.

Soils Description: Soils are not mapped in this area by the county soil survey. The U.S. Forest Service may have soil maps for this area. Most soils formed in alluvium and vary in texture depending on their geomorphic position. Soils in the narrowleaf cottonwood/coyote willow stand located on the point bar were very coarse and had very little organic matter accumulation. Further away from the point bar, where narrowleaf cottonwood and thinleaf alder were dominant, soil development was much greater. Soils in the large oxbow on the south side of the site have developed a thick organic surface horizon (histic epipedon). This horizon, however, is not thick enough to classify this soil as a Histosol.

<u>Narrowleaf Cottonwood/Thinleaf Alder Stand</u>
A 0-6 inches, 10 YR 2/1, silt loam
Bw 6-14 inches, 10 YR 3/2, mottles – many, medium 10 YR 3/6, silt loam
C 14-? Inches, 10 YR 3/3, coarse sand
Water table at soil surface.

<u>Beaked sedge, oxbow wetland</u>
Oe 10-0 inches, 10 YR 2/2
A 0-6 inches, 10 YR 2/2, silty clay with large quantities of organic matter
Water table at soil surface.

Restoration Potential: This area is in very good shape. There is one moderate size reservoir upstream and several small reservoirs along some of the tributaries of the South Fork Rio Grande. Natural hydrologic patterns, however, do appear to be intact.

Wetland Functional Assessment for the Highway Spring PCA:

Proposed HGM Class: Riverine. Subclass: R3. (includes the numerous depressional wetlands located behind beaver ponds)
Cowardin System: Palustrine. Subsystem: Forested, Scrub-Shrub and Emergent.

Table 43. Wetland functional assessment for the riverine wetland at the Highway Spring PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	High	A high density of woody and herbaceous vegetation in the floodplain and numerous beaver dams provides a high potential for flood attenuation.
Sediment/Shoreline Stabilization	Moderate	The banks of the South Fork Rio Grande aren't completely vegetated in all areas. However, the many small flood and beaver channels within the floodplain are densely vegetated.
Groundwater Discharge/ Recharge	Unknown	It is not clear how much groundwater discharge and/or recharge is associated directly with the river. At a minimum, the beaver ponds are probably recharging local water tables that support other depressional wetlands such as those in the large oxbow.
Dynamic Surface Water Storage	High	Organic soils in the large oxbow and water stored behind beaver dams provide a high potential for surface water storage.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	High	Upstream inputs of excess nutrients is probably minimal, but runoff from Hwy. 160. may contribute sediment and heavy metals to the river. During flood events, there is high potential for this area to retain these due to dense cover of vegetation, the presence of many beaver ponds, and fine soils with lots of organic matter.
Biological Functions		
Habitat Diversity	Exceptional	The wetland site consists of aquatic bed, emergent, scrub-shrub, forested, and open water habitats.
General Wildlife Habitat	High	The diversity in vegetation structure provides excellent habitat for invertebrates and songbirds and open water areas provide potential habitat for waterbirds. Beavers still appear to be present in the area. Deer were observed.
General Fish/Aquatic Habitat	High	The river provides habitat for many different fish species. This area is a popular fishing location.
Production Export/Food Chain Support	High	Dense cover of herbaceous and woody species contributes a diversity of litter and debris. The diversity of pathways in which decomposition occurs (e.g., under inundated, saturated, aerated conditions) produces a diverse composition of organic substrates (soluble vs. fine vs. coarse particulate carbon). Periodic flooding exports these substrates to downstream ecosystems. These areas probably support a diverse invertebrate population and, along with seed production from the diversity of herbaceous species present, provide excellent food chain support.
Uniqueness	Moderate	The types of individual wetlands found at this site are fairly common; however, the collection of all these types in such good shape is becoming quite rare.

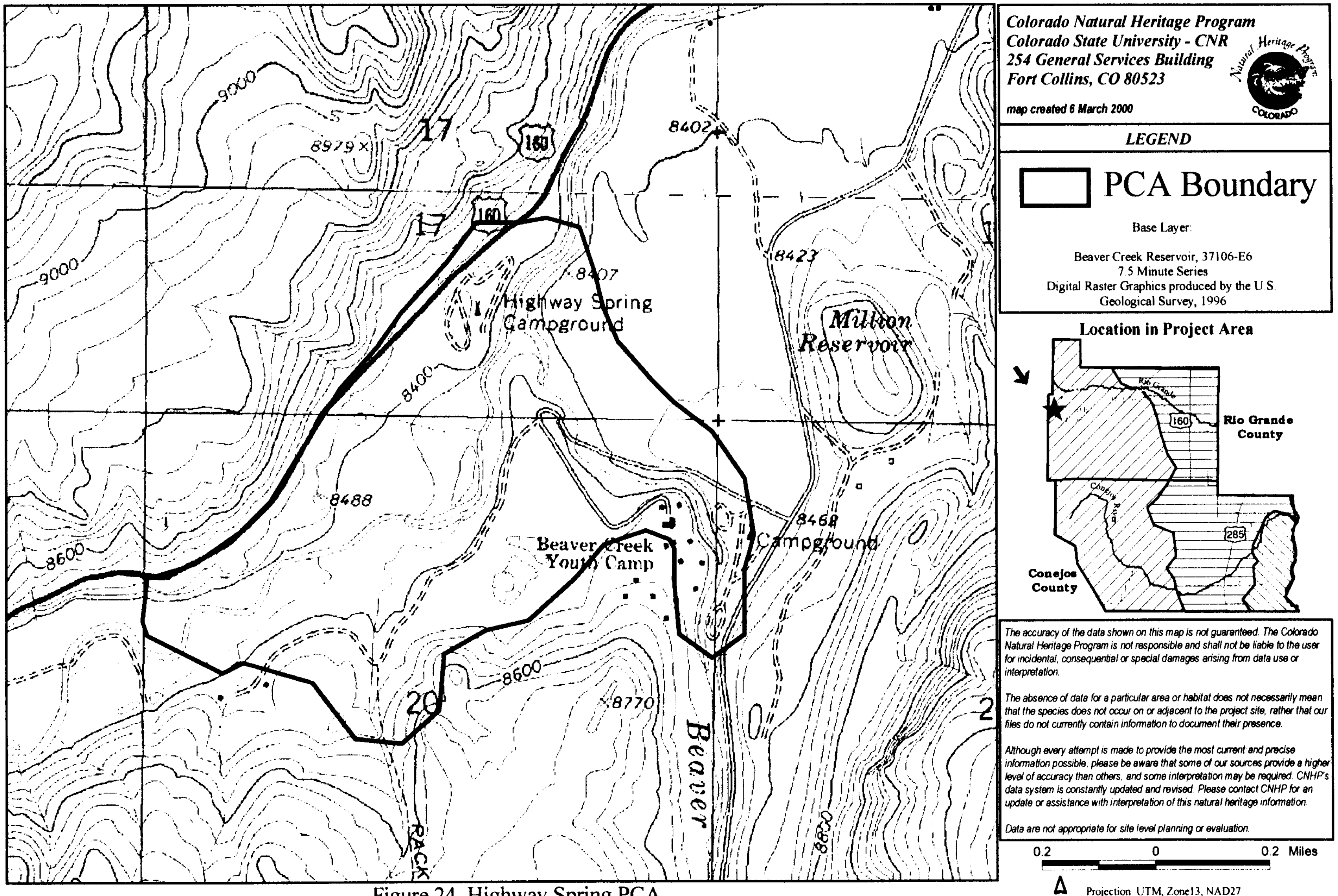


Figure 24. Highway Spring PCA

Iron Creek Potential Conservation Area

Biodiversity Rank: B3 (High significance)
The site supports fair examples of two plant species imperiled on a global scale and one plant species vulnerable on a global scale. In addition, the site also supports three small examples of a globally imperiled to vulnerable wetland plant community.

Protection and Management Issues: Much of the site is publicly owned and managed by the Rio Grande National Forest, however there are mining claims within the site boundaries. Remnants of an abandoned mine exist on the site and a few occupied private cabins are within site boundaries. There is no formal protection status given to this area. The site was logged prior to 1967 and probably much earlier based on the condition of rotting stumps. The area is regenerating very slowly. Hydrologic modifications could impact the wetlands.

Biodiversity Rank Justification: The occurrences of the two plants imperiled on a global scale, reflected and pale moonworts (*Botrychium echo* and *B. pallidum*, respectively), are the primary reason for the high biodiversity rank. Another plant species vulnerable on a global scale, the western moonwort (*Botrychium hesperium*) is known from the site. In addition to these species, three small occurrences of an extremely unusual wetland type (iron fen) were also located at this site.

Iron fens are unusual peatlands where the surface/groundwater pH and plant species are typical of ombrotrophic bogs and acidic, nutrient poor fens (pH < 4.4), while the concentration of ions is more typical of rich and extreme rich fens (pH > 6.0) (Cooper 1999). The combination of species (more typical of true bogs) that occur in iron fens is rare in Colorado (approximately 8 large occurrences of iron fens are known in the state). Mineralized zones in Idaho, Montana, Wyoming, and South Dakota may contain similar wetlands (George Jones – pers. comm.). For example, there is an Iron Bog Research Natural Area within the Challis National Forest in Idaho where cation concentrations and pH are very similar to the iron fens documented here in Colorado (Fred Rabe - pers. comm.). More research is needed within the Rocky Mountain region to determine the extent of this wetland type.

Table 44. Natural Heritage element occurrences at Iron Creek PCA.

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank
Plants					
Botrychium echo	Reflected moonwort	G2	S2		C
Botrychium hesperium	Western moonwort	G3	S2		E
Botrychium pallidum	Pale moonwort	G2	S2		C
Plant Communities					
Carex aquatilis/ *Sphagnum* spp.	Iron Fen	G2G3	S2?		E

*EO=Element Occurrence

Location: The Iron Creek site occurs along Iron Creek approximately 3 miles south-southwest of Summitville in Conejos County.
U.S.G.S. 7.5-min. quadrangle: Summitville, Platoro
Legal Description: T36N R04E S 7
T36N R03E S 1, 12
T37N R04E S 31
Elevation: 10,200-12,400 ft. Approximate Size: 1,440 acres

General Description: The site occurs along a steep drainage and includes much smaller and steeper tributaries. The area is characterized by moderate to steep mountain slopes covered with Engelmann spruce *(Picea engelmannii*), aspen (*Populus tremuloides*), and common juniper (*Juniperus communis*). The globally imperiled and vulnerable moonworts (*Botrychium echo*, *B. pallidum*, and *B. hesperium*) were found growing in disturbed areas (e.g., old logged areas, roadsides, etc.). Associated plant species in these areas included: wild strawberry (*Fragaria virginiana* spp. g*lauca*), clover (*Trifolium* sp.), spike trisetum (*Trisetum spicatum*), blueberry (*Vaccinium myrtillus* spp. o*reophilum*), pine dropseed (*Blepharoneuron tricholepis*), yarrow (*Achillea lanulosa)*, *Oreochrysum parryi*, bottle gentian (*Pneumonanthe parryi*), dwarf fleabane (*Erigeron vetensis*), and goldenrod (*Solidago spathulata* var. *neomexicana*). This Goldenrod species is a diagnostic plant which indicates potential moonwort habitat.

A few small occurrences of iron fens were located along the Iron Creek drainage. Iron fens are unusual peatlands in that surface/groundwater pH and the associated plant species are typical of ombrotrophic bogs and acidic, nutrient poor fens, while the concentration of ions is more typical of rich and extreme rich fens (Cooper 1999). Peatlands are usually classified along a chemical gradient (pH and concentration of cations such as Ca^{2+}, Na^{+}, K^{+}, and Mg^{2+}). The gradient is typically as follows: ombrotrophic bogs and poor fens are characterized by low pH and low cation concentration, whereas rich and extreme rich fens (e.g., High Creek Fen near Fairplay, CO) are characterized by high pH and high cation concentration. Iron fens do not fit into this gradient because of the unusual biogeochemistry (low pH but high concentration of cations (especially Ca^{2+} and SO_4^{2-}). This occurs due to groundwater and surface water draining through rock rich in pyrite. As the pyrite becomes oxidized, it produces a sulfuric acid, which leaches ions from surrounding rock while also creating an acidic solution, leading to a nutrient rich yet acidic water supply (Cooper 1999). Iron fens are characterized by limonite ledges, which form when iron precipitates out of solution and then solidifies into hard rock. Organic substrates (e.g., peat and coarse woody debris) often are mixed with the iron precipitate thus limonite often contains large amounts of organic materials. The plant species typically found in iron fens include: bog birch (*Betula glandulosa*), dwarf blueberry (*Vaccinium cespitosum*), creeping wintergreen (*Gaultheria humifusa*), swamp-laurel (*Kalmia microphylla*), water sedge (*Carex aquatilis*), bluejoint reedgrass (*Calamagrostis canadensis*), with a continuous carpet of mosses mainly dominated by sphagnum peat moss (S*phagnum* spp).

The iron fens located at this site were supported by seepage passing over oxidizing pyritic rock causing seepage waters to have a low pH (<4.0). The extent of acidic drainage was often very narrow and areas with low pH often rapidly graded into more alkaline areas where pH was above 6.5. Poor fen sphagnum (*Sphagnum angustifolium*), water sedge, and bluejoint reedgrass are the dominant species whereas dwarf blueberry, creeping wintergreen, and a few other mosses (*Pohlia longicolla*, *Polytrichastrum longisetum*, and *Hypnum lindbergii*) are less abundant. The peat in two of the occurrences was very deep despite being on extremely steep slopes. Although the three occurrences found were quite small, there is high probability that many other small iron fens occur in the area (CNHP was unable to search all potential locations). A large number of small iron fens in one area may have as much or more conservation value than a single large system.

Boundary Justification: The site encompasses most hydrological sources, except for those originating upstream in Schinzel Flats. This also includes habitat in the area that may support additional moonwort populations and to allow the elements additional areas to establish.

Protection and Management Comments: Although the Rio Grande National Forest manages much of the site, there are numerous mining claims within the site boundaries. A few occupied private cabins and remnants of an abandoned mine are within site boundaries. There is no formal protection status given to this area.

The site was logged prior to 1967 and probably much earlier based on the condition of rotting stumps. The area is regenerating very slowly. For example, one of the cabin occupants appears to have rerouted a small tributary that flows near one of the iron fens. Although this does not appear to have affected the iron fen (the area was still saturated and the seep, supporting the fen, was still flowing), long term results could be negative.

Soils Description: The soils in this area have not been mapped by the county soil survey. The U.S. Forest Service may have soil maps for this area. Due to the steep topography of the area, soils are generally very shallow. Each of the iron fens located at this site had an accumulation of peat derived from sphagnum moss. Depth of peat accumulation varied but always consisted of very fibric material. One iron fen had accumulated approximately 28 inches of peat.

Restoration Potential: Two of the three iron fens are very remote and inaccessible. Thus, no disturbance of natural processes has occurred in these areas. The third iron fen, could potentially experience long-term impacts from an upstream water diversion (see discussion under Protection and Management comments). If monitoring results indicate that this activity is affecting seepage flow, then restoration efforts should focus on restoring this flow.

Wetland Functional Assessment for the Iron Creek PCA:

Proposed HGM Class: Slope. Subclass: S1. (only includes iron fens)
Cowardin System: Palustrine. Subsystem: Emergent and Moss-Lichen.

Table 45. Wetland functional assessment for the riverine wetland at the Iron Creek PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	N/A	Doesn't occur along a drainage that experiences flooding (the drainages are very steep and are supported by seeps).
Sediment/Shoreline Stabilization	N/A	The drainages are very steep and mostly without a defined channel (most drain across bare limonite deposits).
Groundwater Discharge/ Recharge	High	These iron fens are supported by groundwater discharge that has come into contact with pyritic rock.
Dynamic Surface Water Storage	Low to Moderate	In areas where there has been deep peat accumulation, there is good potential for surface water storage.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	High	Probably does not provide anthropogenic values in terms of this function, but the natural biogeochemical processes of these fens is the major reason these wetlands are considered highly unique.
Biological Functions		
Habitat Diversity	Low	The wetland site consists of emergent and moss-lichen habitat.
General Wildlife Habitat	Low to Moderate	Due to the extremely steep slopes on which most of these fens occur, large mammal use of these areas in probably minimal. Whether or not there is unique fauna (mainly invertebrates) associated with these unique wetlands needs to be researched.
General Fish/Aquatic Habitat	None	In addition to some of these areas being extremely steep, these drainages are probably too acidic too support fish populations.
Production Export/Food Chain Support	Moderate	Due to very acidic conditions, exportation of organic substrates and nutrients is probably minimal since the low acidity cause decomposition rates to be very slow and incomplete. This is in evidence by the fibric nature of the peat. Food chain support is probably good, with emergent and moss-lichen vegetation supporting invertebrate populations.
Uniqueness	High	Eight large iron fens are currently known in Colorado. There are probably many more small iron fens, as the ones located at this site.

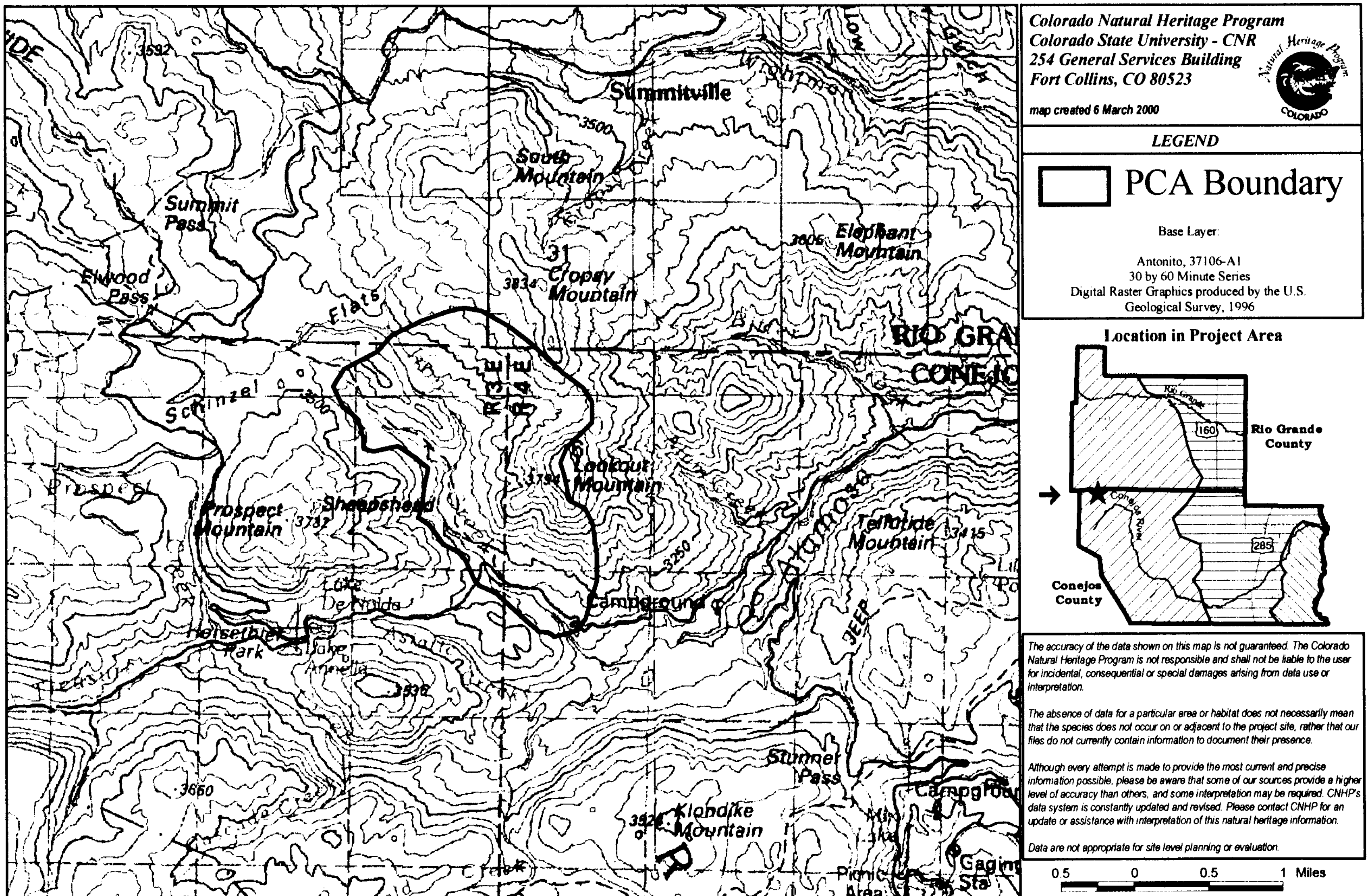


Figure 25. Iron Creek PCA

La Manga Creek Potential Conservation Area

Biodiversity Rank: B3 (High significance)
The site supports good examples of a riparian plant community vulnerable on a global scale and a widespread riparian plant community.

Protection and Management Issues: The entire site is managed by the Rio Grande National Forest but has no formal protection. Grazing is occurring in some portions of the site, however many areas are too dense in willow growth for livestock to penetrate. Colorado Highway 17 parallels the site along its eastern edge and could potentially contribute excess heavy metals and sediment to the site. Presence of non-native species is minimal.

Biodiversity Rank Justification: The site supports a good example of a montane willow carr community (*Salix monticola*/Mesic forb). This plant community appears to only occur in Colorado where mountain willow (*Salix monticola*) appears to be at the center of its distribution. In addition, the site supports a good example of a subalpine riparian willow carr (*Salix planifolia*/*Caltha leptosepala*).

Table 46. Natural Heritage element occurrences at La Manga Creek PCA.

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank
Plant Communities					
Salix monticola/mesic forb	Montane riparian willow carr	G3	S3		B
Salix planifolia/*Caltha leptosepala*	Subalpine riparian willow carr	G4	S4		B

*EO=Element Occurrence

Location: The La Manga Creek site is approximately 1 ½ miles north of the La Manga Pass along Colorado Highway 17 in Conejos County.
U.S.G.S. 7.5-min. quadrangle: Cumbres
Legal Description: T33N R05E S 13, 14
Elevation: 9,960 ft. Approximate Size: 220 acres

General Description: The site is located along La Manga Creek and supports a high diversity of willows and understory species. For example, mountain willow (*Salix monticola*), Drummond willow (*S. drummondiana*), planeleaf willow (*S. planifolia*), Booth willow (*S. boothii*), and wolf willow (*S. wolfii*) are found growing along the stream bank. The understory in these areas is dominated by bluejoint reedgrass (*Calamagrostis canadensis*), water sedge (*Carex aquatilis*), marsh marigold (*Caltha leptosepala*), and heart-leaved bittercress (*Cardamine cordifolia*) along with many other forbs. On the west side of the creek, there are many small seeps that support dense stands of planeleaf willow and
marsh marigold. These seeps drain into La Manga Creek and are an important factor in supporting the diverse assemblage of species at this site.

Boundary Justification: The numerous seeps on the west side of the creek are encompassed within the site because the hydrological contribution is necessary for the long-term viability of the elements.

Protection and Management Comments: The entire site is managed by the Rio Grande National Forest but has no formal protection.

Grazing is occurring in some portions of the site, however many areas are too dense in willow growth for livestock to penetrate. Colorado Highway 17 parallels the site along its eastern edge and could potentially contribute excess heavy metals and sediment to the site. The highway might also serve as a corridor for non-native species. The amount of non-native species on the site is minimal but Kentucky bluegrass (*Poa pratensis*) and dandelion (*Taraxacum officinale*) are present.

Soils Description: The soils in this area have not been mapped by the county soil survey. The U.S. Forest Service may have soil maps for this area. Soils are coarse along the creek. Soils in seepage areas on the western slope are accumulating organic matter due to persistent soil saturation.

Restoration Potential: Most ecosystem processes appear to be intact. Enhancement efforts could focus on alleviating trampling impacts to the vegetation.

Wetland Functional Assessment for the La Manga Creek PCA:

Proposed HGM Class: Riverine. Subclass: R2.
Cowardin System: Palustrine. Subsystem: Scrub-Shrub and Emergent.

Table 47. Wetland functional assessment for the riverine wetland at the La Manga Creek PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	Low	Although there is a dense cover of woody vegetation, the floodplain in this area is minimal.
Sediment/Shoreline Stabilization	High	Streambanks are densely covered with herbaceous and woody vegetation
Groundwater Discharge/ Recharge	High	Numerous seeps occur on adjacent slopes.
Dynamic Surface Water Storage	Low	Although there are many seeps in the area, they are on very steep slopes with moderate soil development. Thus, the soils aren't able to retain large amounts of water.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	Moderate	The small riparian area may be able to retain or transform moderate amounts of nutrients associated with grazing inputs.
Biological Functions		
Habitat Diversity	High	The wetland site consists of emergent, scrub-shrub, and open water habitats associated with La Manga Creek.
General Wildlife Habitat	Moderate	The diversity in vegetation structure provides excellent habitat for invertebrates and songbirds. Deer and elk may browse in the area.
General Fish/Aquatic Habitat	Unknown	La Manga Creek may provide potential fish habitat.
Production Export/Food Chain Support	High	Dense cover of herbaceous and woody species contributes a diversity of litter and debris. These areas probably support a diverse invertebrate population and, along with seed production from the diversity of plant species present, provide excellent food chain support.
Uniqueness	Low	Locally, this is a fairly common wetland/riparian type.

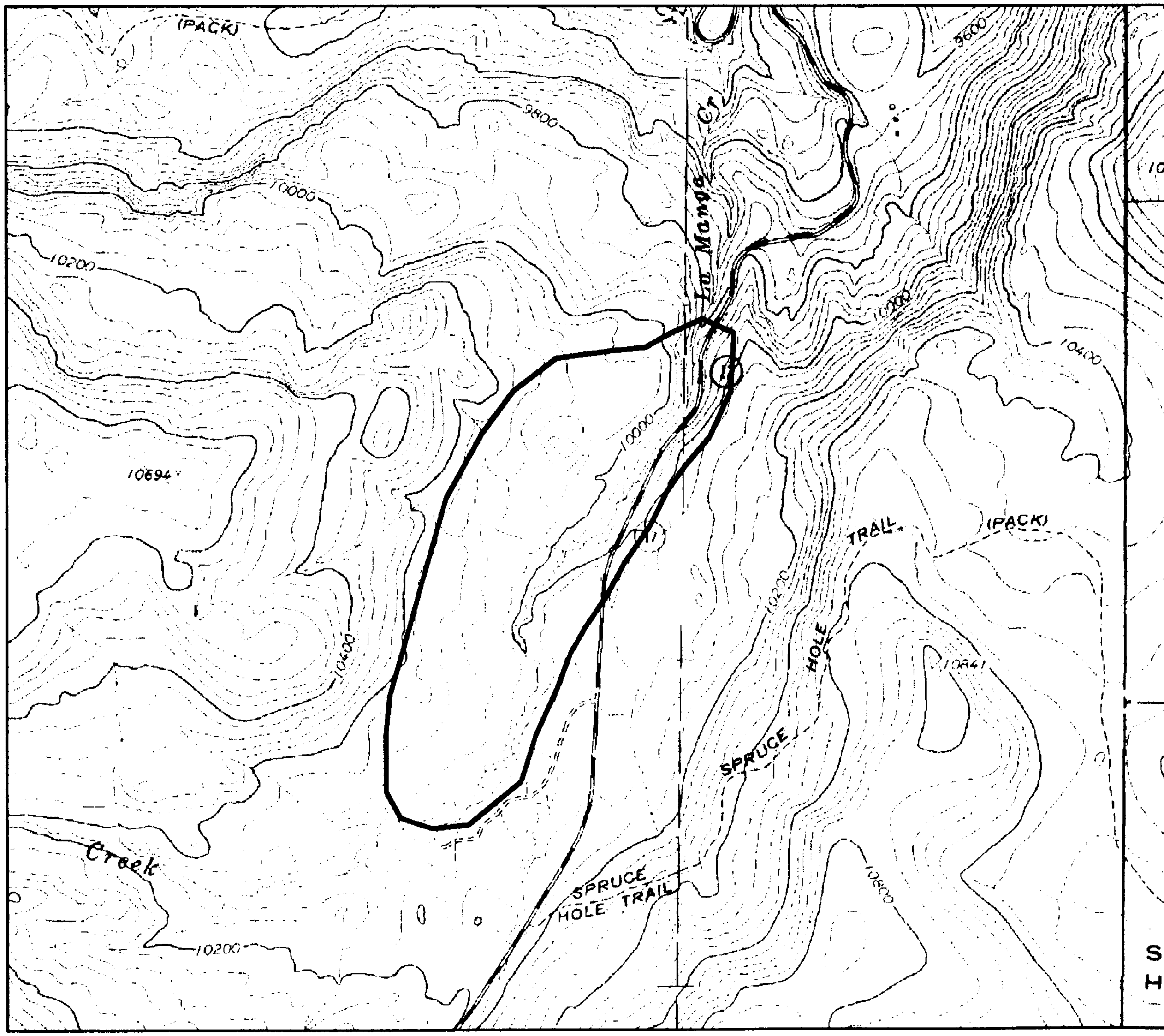


Figure 26. La Manga Creek PCA

Colorado Natural Heritage Program
Colorado State University - CNR
254 General Services Building
Fort Collins, CO 80523

map created 6 March 2000

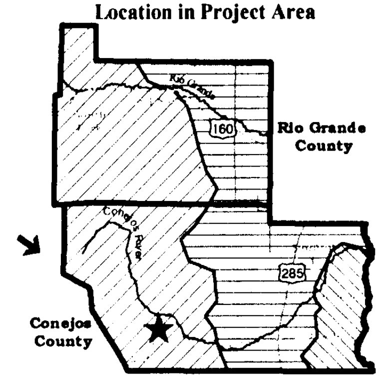
LEGEND

PCA Boundary

Base Layers:

Osier, 37106-A3
Cumbres, 37106-A4
7.5 Minute Series
Digital Raster Graphics produced by the U.S. Geological Survey, 1996

Location in Project Area



The accuracy of the data shown on this map is not guaranteed. The Colorado Natural Heritage Program is not responsible and shall not be liable to the user for incidental, consequential or special damages arising from data use or interpretation.

The absence of data for a particular area or habitat does not necessarily mean that the species does not occur on or adjacent to the project site, rather that our files do not currently contain information to document their presence.

Although every attempt is made to provide the most current and precise information possible, please be aware that some of our sources provide a higher level of accuracy than others, and some interpretation may be required. CNHP's data system is constantly updated and revised. Please contact CNHP for an update or assistance with interpretation of this natural heritage information.

Data are not appropriate for site level planning or evaluation.

0.2 0 0.2 0.4 Miles

Projection UTM, Zone13, NAD27

West Alder Creek Potential Conservation Area

Biodiversity Rank: B3 (High significance)
The site supports a good example of a plant community vulnerable on a global scale.

Protection and Management Issues: The site is entirely within the Rio Grande National Forest but has no formal protection. No signs of grazing or recreational impacts were observed. No disruption of hydrology upstream was observed and access to the site is very difficult. However, non-native species are present.

Biodiversity Rank Justification: The site supports a good example of a globally vulnerable montane riparian shrubland (*Alnus incana*/*Salix drummondiana*). This plant community is found in the southern half of Colorado. Although, this plant community is expected to occur in other Rocky Mountain States, it has not been documented outside of Colorado. There is also an historical record for an occurrence of the Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*) at this site.

Table 48. Natural Heritage element occurrences at West Alder Creek PCA.

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank
Plant Communities					
Alnus incana/*Salix drummondiana*	Montane riparian shrubland	G3	S3		B

*EO=Element Occurrence

Location: The West Alder Creek site is located approximately 4 miles north-northwest of South Fork in Rio Grande County.
U.S.G.S. 7.5-min. quadrangle: South Fork West
Legal Description: T40N R03E S 17
Elevation: 8,400-8,700 ft. Approximate Size: 190 acres

General Description: The site is located along West Alder Creek, which is a small tributary to the Rio Grande. The site is a narrow riparian area with a high diversity of shrubs and evidence of regeneration. Thinleaf alder (*Alnus incana*), whiplash willow (*Salix lucida* var. *caudata*), Drummond willow (*Salix drummondiana*), mountain maple (*Acer glabrum*), and red-osier dogwood (*Cornus sericea*) are the dominant shrubs. A diverse assemblage of herbaceous species is also found at the site including bluejoint reedgrass (*Calamagrostis canadensis*), woolly sedge (*Carex lanuginosa*), black-eyed Susan (*Rudbeckia* sp.), yarrow (*Achillea lanulosa*), western willow aster (*Aster hesperius*) and cow parsnip (*Heracleum sphondylium*). The surrounding slopes are steep and dry. The dominant trees on these slopes include piñon pine (*Pinus edulis*), one-seed juniper (*Juniperus monosperma*), ponderosa pine (*Pinus ponderosa*) and Douglas fir (*Pseudotsuga menziesii*). Beaver activity is evident and small beaver ponds are scattered along this stretch of the creek. At times the creek is constricted by steep canyon walls and in some areas a small floodplain exists.

Boundary Justification: The boundary includes all of the floodplain along this stretch of the creek to allow the effects of fluvial processes and beaver activity to continue to create additional habitat where the element could potentially establish. Ecological processes or environmental impacts that originate upstream of the site may affect the viability of this occurrence.

Protection and Management Comments: The site is entirely within the Rio Grande National Forest but has no formal protection.

Grazing is occurring downstream along private land but no signs of grazing or recreational impacts were observed at this site. However, non-native species such as timothy (*Phleum pratense*), Kentucky bluegrass (*Poa pratensis*), Canada thistle (*Cirsium arvense*), and dandelion (*Taraxacum officinale*) are present. There is little upstream disruption of hydrology and there are no marked access routes to the site.

Soils Description: The soils in this area have not been mapped by the county soil survey. The U.S. Forest Service may have soil maps for this area. Most of the site occurs in a narrow, steep canyon where soil development is minimal. However, in areas where beaver ponds have been established, soil development is much more accelerated. The beaver dams trap sediment and organic matter and slow the velocity of the creek, allowing fine sediments to settle out in the small floodplain areas.

Restoration Potential: This site is surrounded by extremely steep canyon walls and thus is relatively inaccessible. Anthropogenic impacts are minimal. Enhancement efforts could focus on the presence of non-native species, especially Canada thistle.

Wetland Functional Assessment for the West Alder Creek PCA:

Proposed HGM Class: Riverine. Subclass: R2.
Cowardin System: Palustrine. Subsystem: Scrub/Shrub.

Table 49. Wetland functional assessment for the riverine wetland at the West Alder Creek PCA.

Function	Ratings	Comments
Hydrological Functions		
Flood Attenuation and Storage	Low to Moderate	Although there is a dense cover of woody vegetation, a narrow canyon and minimal floodplain limits the capability of this area to attenuation floods. However, the presence of small beaver ponds does add some value.
Sediment/Shoreline Stabilization	High	Streambanks are densely covered with herbaceous and woody vegetation, especially near the beaver ponds.
Groundwater Discharge/ Recharge	Low	Given the steep nature of this site, there is probably very little groundwater recharge/discharge occurring. The small beaver ponds may be recharging stream flow (i.e., storing and releasing water over a long time period) but probably not a local water table since bedrock is very close to the surface.
Dynamic Surface Water Storage	Low	Although there are some beaver ponds in the area, they are too small to store large quantities of water.
Biogeochemical Functions		
Sediment/Nutrient/ Toxicant Removal	Moderate	The presence of the beaver ponds and high cover of woody and herbaceous vegetation potentially retain excess sediment loads.
Biological Functions		
Habitat Diversity	Moderate	The wetland site consists of scrub-shrub and open water habitats associated with West Alder Creek and the beaver ponds.
General Wildlife Habitat	High	The diversity in vegetation structure provides excellent habitat for invertebrates and songbirds. Deer, elk, and potentially black bear may browse in the area. Although none were observed, the beaver ponds are potential amphibian and reptile habitat.
General Fish/Aquatic Habitat	Moderate	The abundance of vegetation cover, perennial flow, and periodic pools behind beaver dams provide potential fish habitat in West Alder Creek.
Production Export/Food Chain Support	High	Dense cover of herbaceous and woody species contributes a diversity of litter and debris. These areas probably support a diverse invertebrate population and, along with seed production from the diversity of plant species present, provide excellent food chain support.
Uniqueness	Low	Locally, this is a fairly common wetland/riparian type.

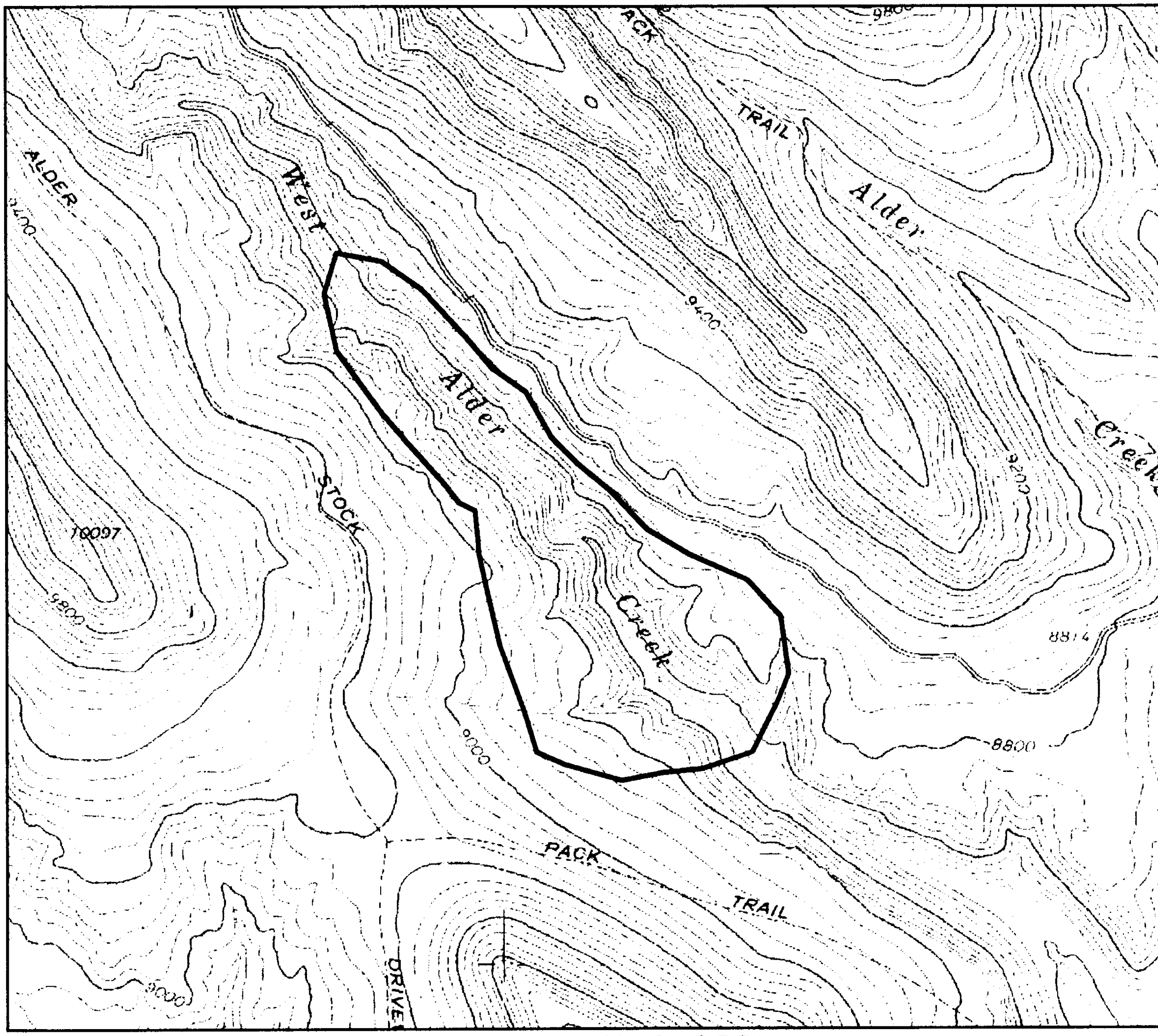


Figure 27. West Alder Creek PCA

Colorado Natural Heritage Program
Colorado State University - CNR
254 General Services Building
Fort Collins, CO 80523

map created 9 March 2000

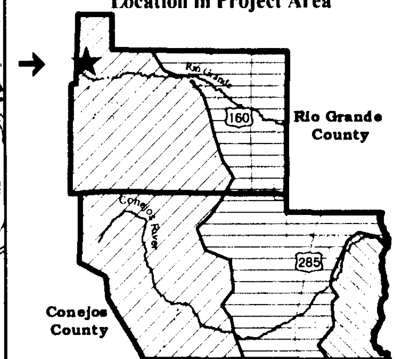
LEGEND

PCA Boundary

Base Layer:

South Fork West, 37106-F6
7.5 Minute Series
Digital Raster Graphics produced by the U.S. Geological Survey, 1996

Location in Project Area



The accuracy of the data shown on this map is not guaranteed. The Colorado Natural Heritage Program is not responsible and shall not be liable to the user for incidental, consequential or special damages arising from data use or interpretation.

The absence of data for a particular area or habitat does not necessarily mean that the species does not occur on or adjacent to the project site, rather that our files do not currently contain information to document their presence.

Although every attempt is made to provide the most current and precise information possible, please be aware that some of our sources provide a higher level of accuracy than others, and some interpretation may be required. CNHP's data system is constantly updated and revised. Please contact CNHP for an update or assistance with interpretation of this natural heritage information.

Data are not appropriate for site level planning or evaluation.

0.2 0 0.2 Miles

Projection UTM, Zone13, NAD27

Rio Grande at Embargo Creek Potential Conservation Area

Biodiversity Rank: B4 (Moderate significance)
The site supports a fair example of a plant community vulnerable on a global scale.

Protection and Management Issues: The site is entirely privately owned and has no formal protection. The Colorado Division of Wildlife maintains a fishing access easement with private landowners along much of this stretch of the Rio Grande, including most of this site. Some grazing occurs in the area and there is an abundance of non-native species.

Biodiversity Rank Justification: The site supports a fair example of a montane riparian shrubland (*Salix lucida* var. *caudata*). This community is documented from Montana to Colorado. In Colorado, it is highly threatened by stream channelization.

Table 50. Natural Heritage element occurrences at Rio Grande at Embargo Creek PCA.

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank
Plant Communities					
Salix lucida var. *caudata*	Montane riparian shrubland	G3Q	S3		C

*EO=Element Occurrence

Location: The Rio Grande at Embargo Creek site is located approximately 2.5 miles east southeast of Agua Ramon in Rio Grande County along a back channel of the Rio Grande.
U.S.G.S. 7.5-min. quadrangle: South Fork East, Indian Head
Legal Description: T40N R04E S 21, 22, 23, 24, 25, 26, 27, 28
Elevation: 8,010 to 8,080 ft. Approximate Size: 1,176 acres

General Description: The site is located along the Rio Grande and includes the broad floodplain in the area along with oxbows and a few back channels. Whiplash willow (*Salix lucida* var. *caudata*), coyote willow (*Salix exigua*), and thinleaf alder (*Alnus incana*) occur around the edges of back channels and beaked sedge (*Carex utriculata*) is found in very wet areas. Narrowleaf cottonwood (*Populus angustifolia*) and a diverse number of mixed forbs occur on the floodplain between the main stem of the Rio Grande and the back channel. Coyote willow lines the banks of the main channel.

Boundary Justification: The boundary encompasses a large portion of the Rio Grande's floodplain to protect potential habitat in which the element may establish.

Protection and Management Comments: The site is entirely privately owned and has no formal protection. The Colorado Division of Wildlife maintains a fishing access easement with private landowners along much of this stretch of the Rio Grande, including most of this site.

Some livestock grazing occurs in the area. Hay meadows border natural riparian vegetation to the north and south of the river. Non-native species such as smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), clover (*Trifolium* spp.), dandelion (*Taraxacum officinale*), and yellow sweetclover (*Melilotus officinalis*) are abundant.

Soils Description: Soils are mapped as Typic Torrifluvents. These soils are excessively drained due to their coarse texture (from loam to sandy loam) and the fact that they are underlain by sand and gravel (USDA 1980b).

Restoration Potential: Due to the amount of development and the amount of water diversions that occur upstream between this site and South Fork, CO, the potential for restoring a natural hydroperiod is minimal. Such an effort would be very large in scale. Enhancement efforts at this site could focus on eradicating populations of non-native species that have become established.

Wetland Functional Assessment for the Rio Grande at Embargo Creek PCA: No functional assessment was conducted for this site.

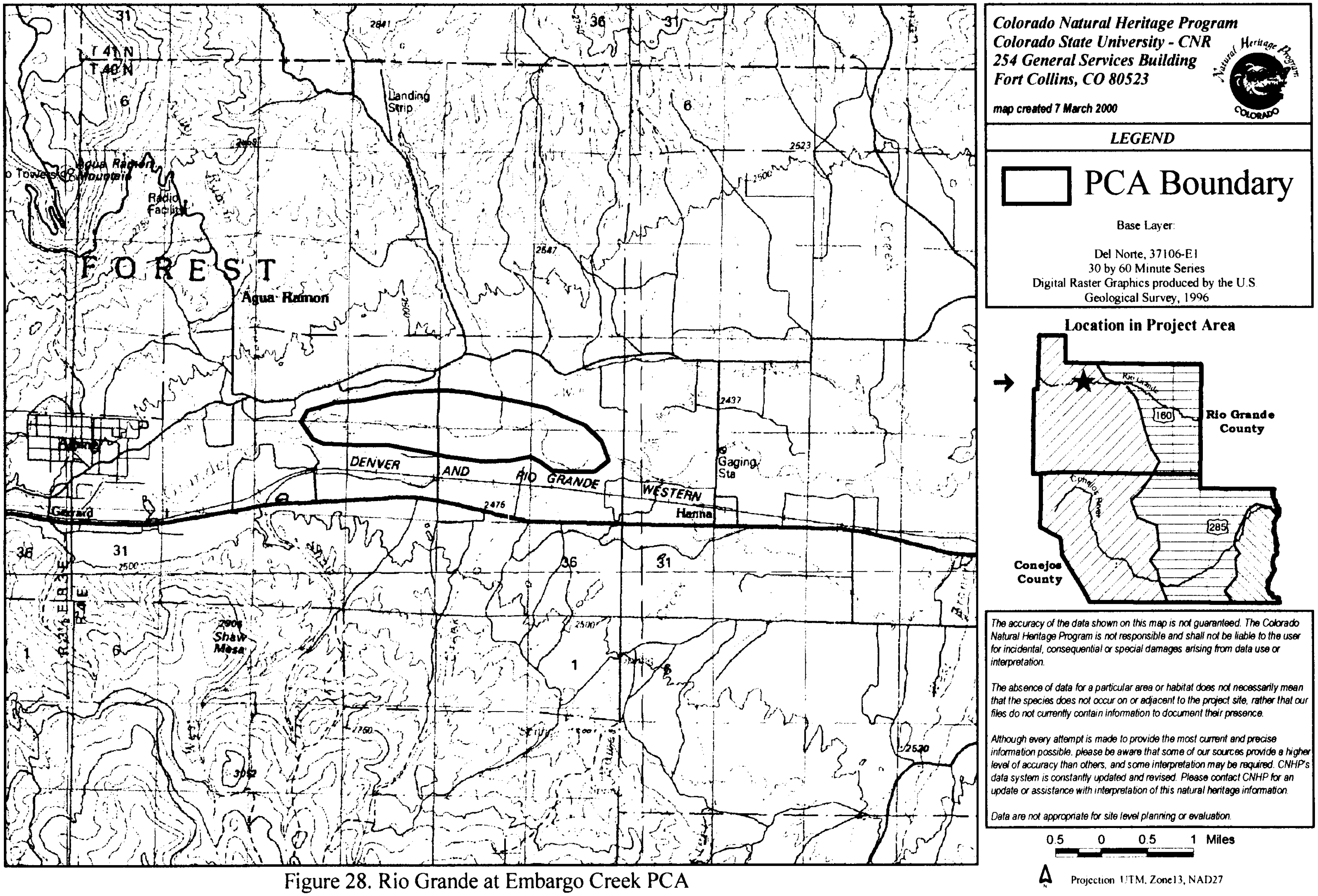


Figure 28. Rio Grande at Embargo Creek PCA

Rito Gato Potential Conservation Area

Biodiversity Rank: B4 (Moderate significance)
The site supports an excellent example of a widespread plant community.

Protection and Management Issues: The site is within the Rio Grande National Forest and has no formal protection. However, the steep character of this site potentially precludes it from most management activities. No signs of grazing or recreation use were observed. Grazing likely occurs upstream in Hillman Park.

Biodiversity Rank Justification: The site supports an excellent example of a montane riparian forest (*Abies lasiocarpa-Picea engelmannii/Salix drummondiana*).

Table 51. Natural Heritage element occurrences at Rito Gato PCA.

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank
Plant Communities					
Abies lasiocarpa-Picea engelmannii/Salix drummondiana	Montane riparian forest	G5	S4		A

*EO=Element Occurrence

Location: The Rito Gato site is located near the upstream end of Platoro Reservoir in Conejos County.
U.S.G.S. 7.5-min. quadrangle: Platoro
Legal Description: T36N R04E S 29
Elevation: 10,200-10,600 ft. Approximate Size: 44 acres

General Description: The site is a steep narrow canyon with a very narrow riparian area dominated by Engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), Drummond willow (*Salix drummondiana*), and mountain willow (*Salix monticola*). There is also a 30-foot waterfall within the site. Upstream from the waterfall is a small stand of shortfruit willow (*Salix brachycarpa*). The site ends where Rito Gato crosses Forest Service Road 247 and drains into Platoro Reservoir. The upstream end of the site is Hillman Park.

Boundary Justification: The boundary encompasses the known extent of the element at this location. Upstream activities in Hillman Park could potentially affect the element.

Protection and Management Comments: The site is entirely within the Rio Grande National Forest and has no formal protection. However, the steep character of this site potentially precludes it from most management activities.

Soils Description: The soils in this area have not been mapped by the county soil survey. The U.S. Forest Service may have soil maps for this area. This site occurs along a steep, narrow canyon. Thus, soil development is minimal with many areas consisting of exposed bedrock. Litter accumulation and pockets of fine sediment do occur in some areas.

Restoration Potential: Since this site is relatively inaccessible, it has escaped anthropogenic impacts. Thus, restoration potential is minimal.

Wetland Function and Value Assessment for the West Dallas Creek PCA: No functional assessment was conducted for this site.

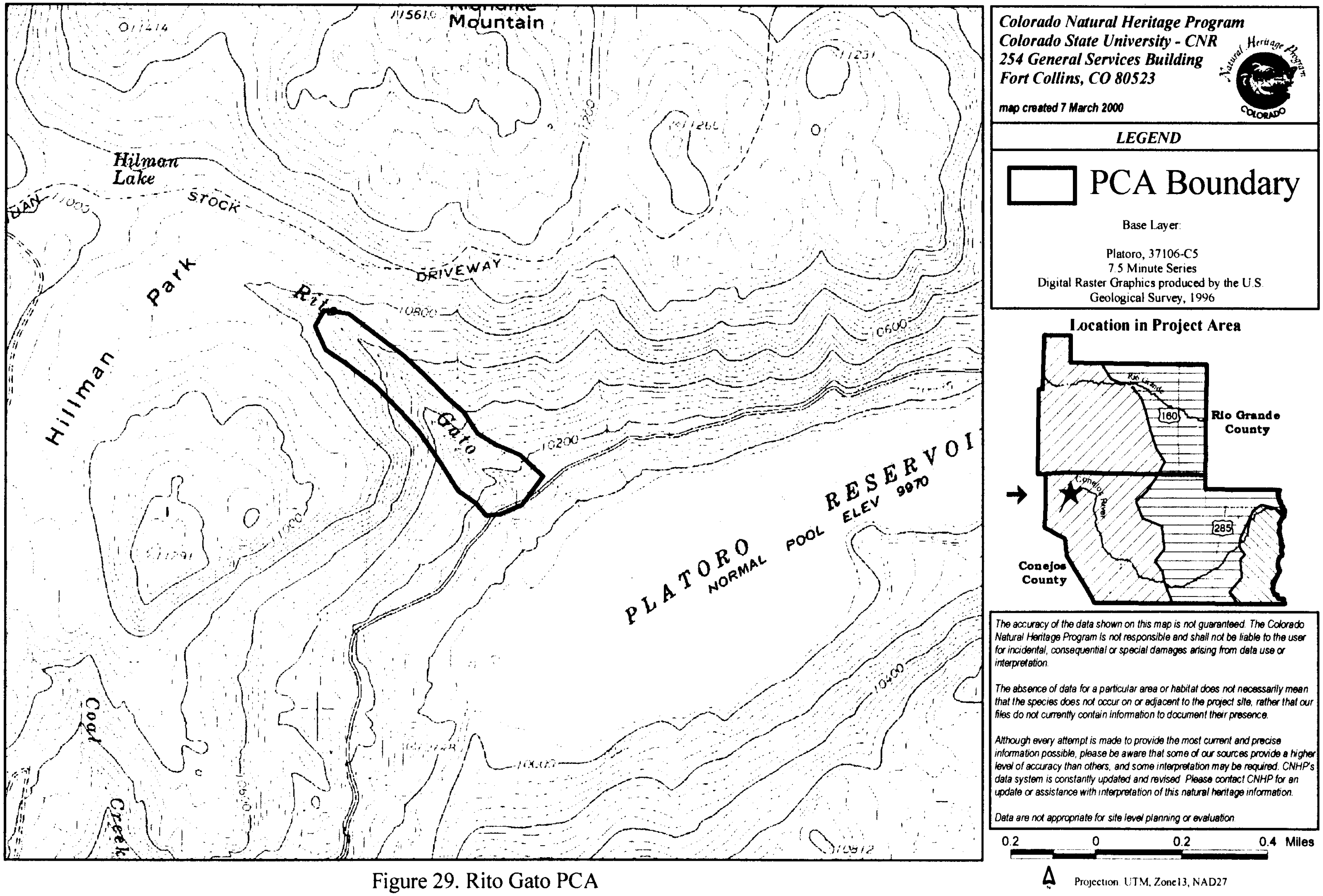


Figure 29. Rito Gato PCA

Alamosa River Reference Sites

Early explorers who came to the San Luis Valley in the late 1800's noted that the Alamosa River was a sinuous, marshy stream with cottonwoods and willows only occurring in periodic patches (Essington 1996). Early records also indicate that marshy areas along the Conejos River were more frequent than they are today (Essington 1996). From such descriptions it is fairly obvious to those familiar with the Alamosa River that it no longer retains any of the above characteristics. For example, most of the stream channel below Terrace Reservoir has been channelized; water flows in the river are dependent on the water withdrawal system (i.e., Terrace Reservoir and water diversions); water quality is poor due to excess heavy metal loads from upstream abandoned mine drainage; and grazing and agriculture have altered plant species composition and vegetation structure in wetland and riparian areas. Thus, identification of actual natural biological reference conditions was very difficult. The reference sites presented below (Figure 30) were chosen to best represent (1) historical conditions as described by early explorers, and (2) current conditions in which ecosystem processes are intact. Given the amount of human induced alterations within the watershed, the latter is probably the best representation of feasible restoration goals.

Spring Creek at Greenie Mountain PCA: A nice example of a sinuous, marshy stream occurs within the Spring Creek at Greenie Mountain PCA, specifically, the area just east of where Spring Creek crosses Colorado Highway 15. Here, the creek exhibits a slow, meandering flow allowing productive stands of sedges (*Carex* spp.), rushes (*Juncus* spp.), and slough grass (*Beckmannia syzigachne*) to establish across a relatively broad floodplain. The floodplain is bounded on each side by slightly higher ground dominated by greasewood (*Sarcobatus vermiculatus*). Although a main channel is discernable, flow in Spring Creek exhibits a "sheet flow" pattern where the entire area between the two banks is flooded with slow moving water. Historically, perennial flow from the springs probably kept this area semi-permanently, if not permanently, flooded. Current hydrological inputs are via the Monte Vista Canal and do appear to keep this area permanently flooded. Any fluctuation in water levels, however, do not appear to be long enough or during the right time of year (e.g., spring) to allow woody vegetation to establish within the floodplain.

The Alamosa River may have contained stretches where the sinuous nature of the river and hydrological inputs from numerous springs (which today no longer flow) kept many areas permanently flooded and did not allow woody vegetation to establish within the floodplain. This, of course, was prior to the construction of Terrace Reservoir, the implementation of numerous water diversions, and the channelization of the streambed. Restoring sinuous, marshy reaches back to the Alamosa River may be limited by the current water withdrawal system. Nonetheless, if water rights could be obtained for such a project, Spring Creek (despite its small size) may assist ecologists in determining the relationship between hydrological flows and vegetation structure and species composition.

Hot Creek/La Jara Creek Confluence: Early explorers also noted pockets of cottonwood and willow along the Alamosa River. Thus, while some stretches of the Alamosa River may have been marshy (possibly due to numerous springs near the river) other stretches were likely subjected to greater fluctuations in water levels. These fluctuations may have allowed cottonwood and willow species to establish along the stream banks (cottonwood and willow seeds typically require bare, moist soil to germinate). Beavers also help create conditions in which woody vegetation could potentially persist. For example, once a beaver pond fills in with sediment, the river would eventually cut a new channel around the dam. This leaves old stream channels and a sediment-filled pond that could potentially become established by woody vegetation.

The Hot Creek/La Jara Creek Confluence site provides a nice example of such ecosystem dynamics. The spatial distribution of different vegetation types and the diversity in vegetation structure make this an excellent biological reference location. The beaver dams have impounded permanent water over an extensive area, precluding the establishment of woody vegetation in many locations. However, coyote willow (*Salix exigua*) is found along portions of the main drainage and within and around abandoned stream channels. This site is probably more typical of historic conditions than the Spring Creek site. After physical restoration efforts have increased the elevation of the streambed, the reintroduction of beaver could greatly assist in restoring the Alamosa River back to a natural functioning system. As long as a buffer exists between the river and adjacent management activities (i.e., grazing, agriculture, etc.), such efforts would not inhibit management activities along the river.

Alamosa River at De la Luz Cemetery: Although this site is downstream of Terrace Reservoir, the river still maintains somewhat of a natural meandering pattern in this location. Downstream activities such as channelization and water diversions have impacted this site but not to the degree to which is has affected other reaches further downstream. For example, there is an irrigation headgate at this site that currently is many feet above the river. However, local water tables have not been drained to the point where they can no longer support riparian and wetland vegetation. Overall structural diversity is excellent with large narrowleaf cottonwood (*Populus angustifolia*) and aspen (*Populus tremuloides*) trees, thickets of willow (*Salix exigua*, *S. monticola*), thinleaf alder (*Alnus incana*), and other shrubs interspersed with various types of herbaceous species (e.g., submergent, emergent, and wet meadow species). The reference location at this site extends further upstream than the boundaries of this particular PCA.

McIntire Springs: Although McIntire Springs is slightly lower in elevation and sits near the middle of the San Luis Valley, it is an excellent reference site for a healthy, functioning riparian corridor. The riparian and wetland complex found at McIntire Springs is probably much larger than anything that may have occurred along the Alamosa River, however ecosystem processes are very similar. McIntire Springs provides an excellent reference for structural diversity of vegetation, species diversity, and relatively intact fluvial processes.

<u>Conejos River at Canon</u>: (This site is not a PCA but was identified as a Targeted Inventory Area). No site visit was made to this particular location, however a roadside survey and aerial photographs indicated that vegetation structure and fluvial processes were well represented. Further investigation of this location as a potential reference site should be conducted.

Although most of the reference sites listed above would be excellent sources for cottonwood and willow cuttings, higher survival rates might be obtained by limiting collections to those sites along the Alamosa River. Due to the amount of natural and anthropogenic sources of heavy metals in the river, cottonwood and willow trees that are currently surviving under these conditions would probably be the best candidates for planting. These local genotypes may have evolved with an ability to sustain any stresses associated with heavy metals. Planting cuttings from locations where they were not subjected to such heavy metal loads and thus have not been exposed to associated stresses could result in high mortality rates. Thus, it is suggested that local genotypes (plants growing along the Alamosa River) be used whenever possible.

All of these reference sites should be used collectively, since, together, they all represent what was historically a diverse river system (e.g., some reaches may have been very sinuous and marshy while others may have had large stands of cottonwood or thickets of willow.).

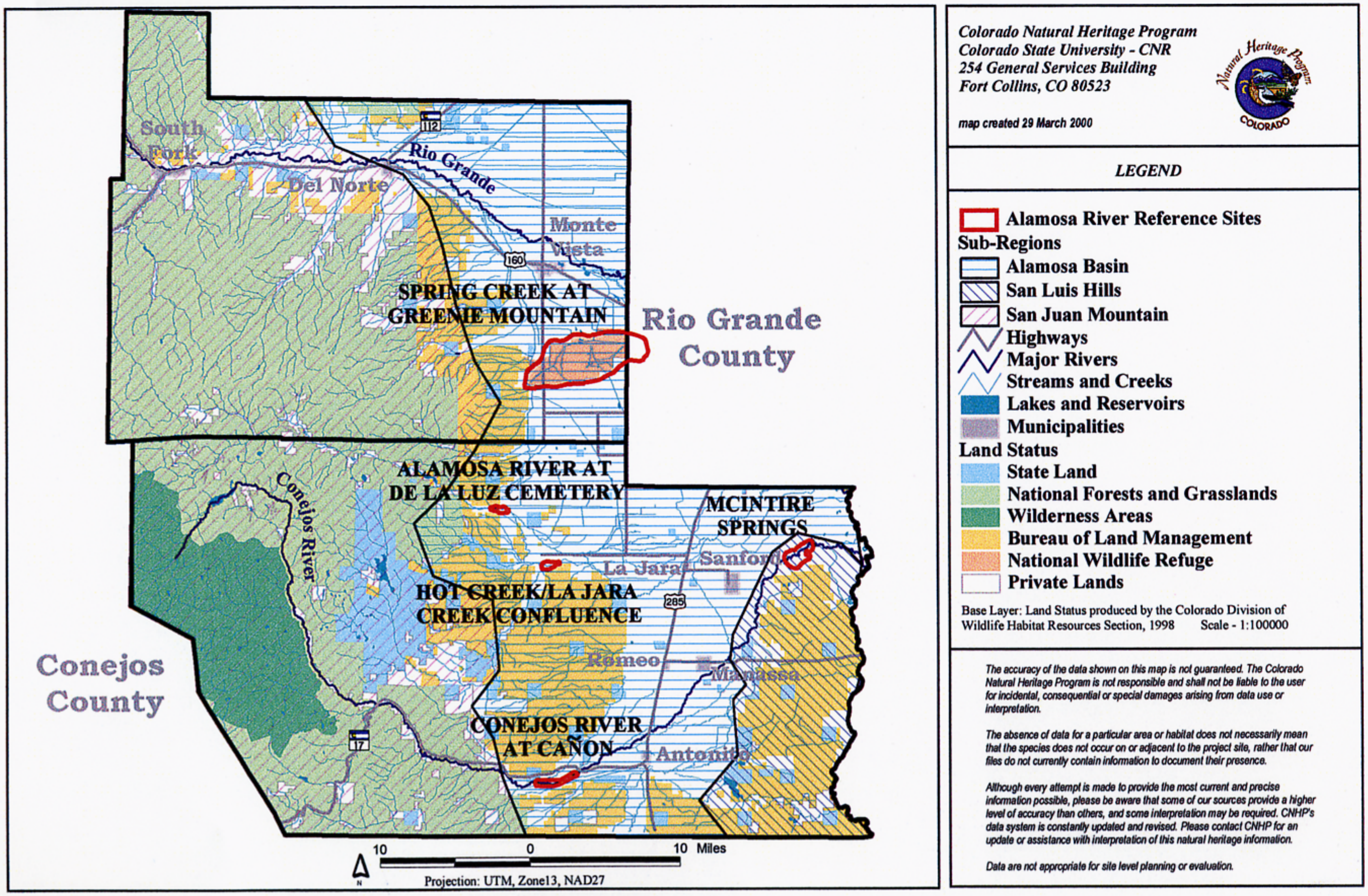


Figure 30. Alamosa River Reference Sites

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