

Survey of Critical Biological Resources Grand County, Colorado

2006



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Cover photographs (clockwise): Middle Park sagebrush habitat (D. Culver), Gore Range from Byers Peak (D. Culver), East Fork of Troublesome Creek (J. Jones), and kettle ponds (D. Culver).

EXECUTIVE SUMMARY

Citizens and land managers of Grand County are concerned about issues of wildlife habitat, water resources, open space, and conservation of their unique natural surroundings. They recognize the need to plan for the conservation of the plants, animals and plant communities that are native to Grand County. They also recognize that with limited economic resources, it is important to prioritize conservation efforts. The need for information on the locations of the most significant biological resources of the area is urgent due to changing land use patterns. The economy has shifted from agriculture to a recreation-based industry. The tourism industry depends heavily on the large natural areas of the County. Proactive and informed planning decisions are necessary so that the rural and agricultural character and culture of Grand County is preserved. The need to retain the intrinsic values of the landscape that provides both economic and environmental assests for County residents and visitors is essential.

In 2005, Grand County contracted with Colorado State University and the Colorado Natural Heritage Program (CNHP) to survey for critical biological resources in Grand County with funding provided by Grand County, Great Outdoors Colorado, Colorado Division of Wildlife, and the Colorado State Forest. A wetland and riparian survey, funded by the Colorado Department of Natural Resources via a U.S. Environmental Protection Agency, Region 8 Wetland Program Grant and a Survey for Seeps and Springs, funded by the Bureau of Land Management were conducted concurrently. The objective of both projects was to provide a data resource for managers, planners, and the citizens of Grand County for conducting proactive planning. This document should be considered a tool for managing lands that support rare, imperiled and/or sensitive plants, animals, and significant plant communities.

The goal of the project was to systematically identify the locations of rare species, significant natural plant communities, and their habitat (potential conservations areas). This project identified biologically significant areas to be considered in future planning development as part of the Grand County's Master Plan (1998).

In March 2005, CNHP and its stakeholders identified potential areas for significant plants, animals, wetlands, and uplands. Areas that were expected to contain significant elements were delineated as "Targeted Inventory Areas" (TIAs). These areas were prioritized based on the relative rarity of the elements expected to be found there and the area's ability to maintain viable populations of those elements. Field surveys were conducted within the TIAs and areas found to contain significant elements were delineated as Potential Conservation Areas (PCAs).

Results of the survey confirm that there are many areas with high biological significance in Grand County. There are several extremely rare plants that depend on these areas for survival. All together, 43 rare or imperiled plant species, 18 rare or imperiled animal species, and 66 wetland and upland plant communities of concern were documented in Grand County. Natural history summaries for plants, animals, and most plant communities are presented in the final section of this report. Despite the best efforts during one field season, it is likely that some elements that are present in the County were not documented, due to either lack of access, phenology (reproductive timing) of species, or time constraints.

CNHP identified 53 PCAs in Grand County. Of the 53 PCAs, seven are of outstanding biodiversity significance (B1), two are of very high significance (B2), 29 are of high significance (B3), and 15 are of moderate significance (B4). These PCAs represent the best examples of targeted species and plant communities and their ecological processes observed on private and public lands visited in 2005. *The PCA boundaries delineated in this report do not confer any regulatory protection of the site, nor do they automatically recommend exclusion of all activity.*

All of the PCAs presented in this report represent unique opportunities for Grand County and its stakeholders to conserve significant components of the natural heritage of Grand County, and each is worthy of conservation attention. Several PCAs stand out as being highly significant, such as Horse Gulch, Kremmling, Red Dirt Creek at Hinman Reservoir, Rock Creek and Troublesome Creek PCAs where the world's only known populations of Osterhout's milkvetch (*Astragalus osterhoutii*) and Penland's penstemon (*Penstemon penlandii*) occur. County records for dropleaf buckwheat (*Eriogonum exilifolium*), a globally vulnerable plant, and three-tip sagebrush (*Artemisia tripartita*) were also documented. The only known extreme rich fen (high pH and conductivity) for Grand County and several intermediate (neutral pH) fens and glacial kettle ponds were found to harbor globally rare wetland-dependent plant communities such as American manna grass (*Glyceria grandis*) herbaceous vegetation.

In addition to the PCAs, three Sites of Local Significance (SLS) are profiled within this report to encourage restoration and conservation of these areas. A SLS is a site which includes good examples of species or natural communities that are too small or whose biological or ecological significance is not great enough to be considered exemplary in a statewide context. However, they do contribute to the character of the local area and the overall local diversity of plants and communities present, and therefore warrant consideration at some level for planning consideration.

In 1999, the Grand County Lands Conservation Plan identified seven landscape units as high priority conservation areas. As part of this project, the PCAs were crosswalked with the applicable landscape units. The most biologically significant landscape units are: the Colorado River Headwaters, Parshall to Kremmling, and the Muddy Creek Corridor due to the documentation of globally rare plants and plant communities.

Grand County is truly unique with an amazing richness of rare fauna and flora well worth preserving for future generations. Overall, the concentration and quality of imperiled elements and habitats attest to the fact that conservation efforts in Grand County will have both statewide and global significance.

The results of the survey will be provided to the stakeholders and to the public on the CNHP website (www.cnhp.colostate.edu).

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INTRODUCTION

Grand County is home to a vast array of plants, animals, and natural plant communities, but the numbers, diversity, and habitat needs of these organisms are not fully understood. Landowners, local and state governments, and federal agencies, particularly in rapidly growing parts of the County, are expressing a desire to better understand their natural heritage resources. The Colorado Natural Heritage Program (CNHP) approached this project with the intent of addressing this need.

The *Survey of Critical Biological Resources in Grand County* is part of an ongoing biological survey of Colorado counties conducted by CNHP. To date, similar inventories have been conducted in all or parts of 27 Colorado counties. In 2005, Grand County contracted with Colorado State University and CNHP to identify biologically significant areas within Grand County. Identification of sites containing natural heritage resources will allow conservation of these resources for future generations and proactive planning to avoid conflicts in the future between developers and natural resource managers.

The *Survey of Critical Biological Resources in Grand County* used the methods that are employed worldwide throughout Natural Heritage Programs and Conservation Data Centers. The primary focus was to identify the locations of the plant and animal populations and plant communities on CNHP's list of rare and imperiled elements of biodiversity, assess their conservation value, and systematically prioritize these for conservation action.

The locations of biologically significant areas 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 (e.g., interviews of local experts; and
- 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, and 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 recommend exclusion of 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 as part of this project, but is encouraged for future projects. 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 Natural Heritage Program 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 significance) to B5 (general or statewide significance). These ranks are based on the conservation (imperilment or rarity) ranks for each element and the element occurrence ranks (viability 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. Based on current knowledge, the sites in this report represent areas CNHP recommends for protection in order to preserve the natural heritage of Grand County.

In addition to presenting prioritized PCAs, this report also includes a section with summaries of plants, animals, and plant communities that are known to be found within the PCAs.

THE NATURAL HERITAGE NETWORK RANKING SYSTEM

Just as ancient artifacts and historic buildings represent our cultural heritage, a diversity of plant and animal species and their habitats represent our “natural heritage.” Colorado’s natural heritage encompasses a wide variety of ecosystems from tallgrass prairie and shortgrass high plains to alpine cirques and rugged peaks, from canyon lands and sagebrush deserts to dense subalpine spruce-fir forests and wide-open tundra.

These widely diversified habitats are determined by water availability, temperature extremes, altitude, geologic history, and land use history. The species that inhabit each of these ecosystems have adapted to the specific set of conditions found there. Because human influence today touches every part of the Colorado environment, we are responsible for understanding our impacts and carefully planning our actions to ensure our natural heritage persists for future generations.

Some generalist species, like house finches, have flourished over the last century, having adapted to habitats altered by humans. However, many other species are specialized to survive in vulnerable Colorado habitats; among them are Bell’s twinpod (a wildflower), the greenback cutthroat trout, and the Pawnee montane skipper (a butterfly). These species have special requirements for survival that may be threatened by incompatible land management practices and competition from non-native species. Many of these species have become imperiled not only in Colorado, but also throughout their range of distribution. Some species exist in less than five populations in the entire world. The decline of these specialized species often indicates disruptions that could permanently alter entire ecosystems. Thus, recognition and protection of rare and imperiled species is crucial to preserving Colorado’s diverse natural heritage.

Colorado is inhabited by some 800 vertebrate species and subspecies, and tens of thousands of invertebrate species. In addition, the state has approximately 4,300 species of plants and more than 450 recognized plant communities that represent terrestrial and wetland ecosystems. It is this rich natural heritage that has provided the basis for Colorado’s diverse economy. Some components of this heritage have always been rare, while others have become imperiled with human-induced changes in the landscape. This decline in biological diversity 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 biological diversity has been recognized for decades in the scientific community. However, many conservation efforts made in this country were not based upon preserving biological diversity; 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 biological diversity Dr. Robert Jenkins of The Nature Conservancy pioneered the Natural Heritage Methodology in the early 1970s.

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 rarity or imperilment of a species, the quality of its populations, and the importance of associated conservation sites, the methodology can facilitate the prioritization of conservation efforts so the most rare and imperiled species may be preserved first. As the scientific community realized that plant communities are equally important as individual species, this methodology has 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. The 85 Natural Heritage Network data centers are located in each of the 50 U.S. states, 11 Canadian provinces and territories, and many countries and territories in Latin America and the Caribbean. This network enables scientists to monitor the status of species from a state, national, and global perspective. Information collected by the Natural Heritage Programs can provide a means to protect species before the need for legal endangerment status arises. It can also enable 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 single-celled organisms such as bacteria and protists through the multicellular kingdoms of plants and animals. 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 between these levels. All levels are necessary for the continued survival of species and plant communities, and many are important for the well being of humans.

The biological diversity of an area can be described at four levels:

Genetic Diversity — the genetic variation within a population and among populations of a plant or animal species. The genetic makeup of a species varies 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. Once lost, this unique genetic information cannot be reclaimed.

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

Community Diversity — the variety of plant communities within an area that represent the range of species relationships and inter-dependence. These communities may be diagnostic of or even restricted to an area.

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.

The conservation of biological diversity should 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 and the results of their activities are also closely linked to all levels of this hierarchy and are integral parts of most landscapes. We at the Colorado Natural Heritage Program believe that a healthy natural environment and a healthy human environment go hand in hand, and that recognition of the most imperiled species is an important step in comprehensive conservation planning.

Colorado's Natural Heritage Program

To place this document in context, it is useful to understand the history and functions of the Colorado Natural Heritage Program (CNHP).

CNHP is the state's primary comprehensive biological diversity data center, gathering information and field observations to help develop statewide conservation priorities. After operating in the Colorado Division of Parks and Outdoor Recreation for 14 years, the Program was relocated to the University of Colorado Museum in 1992, and then to the College of Natural Resources at Colorado State University in 1994, where it has operated since.

The multi-disciplinary team of scientists, planners, and information managers at CNHP gathers comprehensive information on the 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.

All Natural Heritage Programs house data about imperiled species and are implementing use of the Biodiversity Tracking and Conservation System (BIOTICS) developed by NatureServe. This database includes taxonomic group, global and state rarity ranks, federal and state legal status, observation source, observation date, county, township, range, watershed, and other relevant facts and observations. BIOTICS also has an ArcView based mapping program for digitizing and mapping occurrences of rare plants,

animals, and plant communities. These rare species and plant communities are referred to as “elements of natural diversity” or simply “elements.”

Concentrating on site-specific data for each element enables CNHP to evaluate the significance of each location for the conservation of biological diversity in Colorado and in the nation. By using species imperilment ranks and quality ratings for each location, priorities can be established to guide conservation action. A continually updated locational database and priority-setting system such as that maintained by CNHP provides an effective, proactive land-planning tool.

To assist in biological diversity conservation efforts, CNHP scientists strive to answer questions like the following:

- What species and ecological communities exist in the area of interest?
- Which are at greatest risk of extinction or are otherwise significant from a conservation perspective?
- What are their biological and ecological characteristics, and where are these priority species or communities found?
- What is the species’ condition at these locations, and what processes or activities are sustaining or threatening them?
- Where are the most important sites to protect?
- Who owns or manages those places deemed most important to protect, and what may be threatening the biodiversity at those places?
- What actions are needed for the protection of those sites and the significant elements of biological diversity they contain?
- How can we measure our progress toward conservation goals?

CNHP has effective working relationships with several state and federal agencies, including the Colorado Department of Natural Resources, the Colorado Division of Wildlife, the Bureau of Land Management, and the U.S. Forest Service. Numerous local governments and private entities, such as consulting firms, educators, landowners, county commissioners, and non-profit organizations, also work closely with CNHP. Use of the data by many different individuals and organizations encourages a cooperative and proactive approach to conservation, thereby reducing the potential for conflict.

The Natural Heritage Ranking System

Key to the functioning of Natural Heritage Programs is the concept of setting priorities for gathering information and conducting inventories. The number of possible facts and observations that can be gathered about the natural world is essentially limitless. The

financial and human resources available to gather such information are not. Because biological inventories tend to be under-funded, there is a premium on devising systems that are both effective in providing information that meets users' needs and efficient in gathering that information. The cornerstone of Natural Heritage inventories is the use of a ranking system to achieve these twin objectives of effectiveness and efficiency.

Ranking species and ecological communities according to their imperilment status provides guidance for where Natural Heritage Programs should focus their information-gathering activities. For species deemed secure, only general information needs to be maintained by Natural Heritage Programs. Fortunately, the more common and secure species constitute the majority of most groups of organisms. On the other hand, for those species that are by their nature rare, more detailed information is needed. Because of these species' rarity, gathering comprehensive and detailed population data can be less daunting than gathering similarly comprehensive information on more abundant species.

To determine the status of species within Colorado, CNHP gathers information on plants, animals, and plant communities. Each of these elements of natural diversity is assigned a rank that indicates its relative degree of imperilment on a five-point scale (for example, 1 = extremely rare/imperiled, 5 = abundant/secure). The primary criterion for ranking elements is the number of occurrences (in other words, the number of known distinct localities or populations). This factor is weighted more heavily than other factors because an element found in one place is more imperiled than something found in twenty-one places. Also of importance are the size of the geographic range, the number of individuals, the trends in both population and distribution, identifiable threats, and the number of protected occurrences.

Element imperilment ranks are assigned both in terms of the element's degree of imperilment within Colorado (its State-rank or S-rank) and the element's imperilment over its entire range (its Global-rank or G-rank). Taken together, these two ranks indicate the degree of imperilment of an element. For example, the lynx, which is thought to be secure in northern North America but is known from less than five current locations in Colorado, is ranked G5 S1 (globally-secure, but critically imperiled in this state). The Rocky Mountain Columbine, which is known only in Colorado from about 30 locations, is ranked a G3 S3 (vulnerable both in the state and globally, since it only occurs in Colorado and then in small numbers). Further, a tiger beetle that is only known from one location in the world at the Great Sand Dunes National Monument is ranked G1 S1 (critically imperiled both in the state and globally, because it exists in a single location). CNHP actively collects, maps, and electronically processes specific occurrence information for animal and plant species considered extremely imperiled to vulnerable in the state (S1 - S3). Several factors, such as rarity, evolutionary distinctiveness, and endemism (specificity of habitat requirements), contribute to the conservation priority of each species. Certain species 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," for example S1B, indicate that the rank applies only to the status of breeding occurrences. Similarly, ranks followed by an "N," for example S4N, refer to non-breeding status, typically during migration and winter. Elements without this notation are believed to be year-round residents within the state.

Table 1. Definition of Natural Heritage Imperilment Ranks

G/S1	Critically imperiled globally/state because of rarity (5 or fewer occurrences in the world/state; or 1,000 or fewer individuals), or because some factor of its biology makes it especially vulnerable to extinction.
G/S2	Imperiled globally/state because of rarity (6 to 20 occurrences, or 1,000 to 3,000 individuals), or because other factors demonstrably make 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, or 3,000 to 10,000 individuals).
G/S4	Apparently secure globally/state, though it may be quite rare in parts of its range, especially at the periphery. Usually more than 100 occurrences and 10,000 individuals.
G/S5	Demonstrably secure globally/state, though it may be quite rare in parts of its range, especially at the periphery.
G/SX	Presumed extinct globally, or extirpated within the state.
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 usually not verified for an extended period of time.
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 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.

Note: Where two numbers appear in a state or global rank (for example, S2S3), the actual rank of the element is uncertain, but falls within the stated range.

Legal Designations for Rare Species

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 Statutes 33-2-105 Article 2. In addition, the U.S. Forest Service recognizes some species as “Sensitive,” as does the Bureau of Land Management. Table 2 defines the special status assigned by these agencies and provides a key to abbreviations used by CNHP.

Table 2. Federal and State Agency Special Designations for Rare Species

Federal Status:	
1. U.S. Fish and Wildlife Service (58 Federal Register 51147, 1993) and (61 Federal Register 7598, 1996)	
LE	Listed Endangered: defined as a species, subspecies, or variety in danger of extinction throughout all or a significant portion of its range.
LT	Listed Threatened: defined as a species, subspecies, or variety likely to become endangered in the foreseeable future throughout all or a significant portion of its range.
P	Proposed: taxa formally proposed for listing as Endangered or Threatened (a proposal has been published in the Federal Register, but not a final rule).
C	Candidate: taxa for which substantial biological information exists on file to support proposals to list them as endangered or threatened, but no proposal has been published yet in the Federal Register.
PDL	Proposed for delisting.
XN	Nonessential experimental population.
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: Significant current or predicted downward trends in population numbers or density. 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.
4. State Status:	
The Colorado Division of Wildlife has developed categories of imperilment for non-game species (refer to the Colorado Division of Wildlife’s Chapter 10 – Nongame Wildlife of the Wildlife Commission's regulations). The categories being used and the associated CNHP codes are provided below.	
E	Endangered: those species or subspecies of native wildlife whose prospects for survival or recruitment within this state are in jeopardy, as determined by the Commission.
T	Threatened: those species or subspecies of native wildlife which, as determined by the Commission, are not in immediate jeopardy of extinction but are vulnerable because they exist in such small numbers, are so extremely restricted in their range, or are experiencing such low recruitment or survival that they may become extinct.
SC	Special Concern: those species or subspecies of native wildlife that have been removed from the state threatened or endangered list within the last five years; are proposed for federal listing (or are a federal listing “candidate species”) and are not already state listed; have experienced, based on the best available data, a downward trend in numbers or distribution lasting at least five years that may lead to an endangered or threatened status; or are otherwise determined to be vulnerable in Colorado.

Element Occurrences and their Ranking

Actual locations of elements, whether they are 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. To prioritize element occurrences for a given species, an element occurrence rank (EO-Rank) is assigned according to the ecological quality of the occurrences 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:

Size – a measure of the area or abundance of the element’s occurrence. Takes into account factors such as area of occupancy, population abundance, population density, population fluctuation, and minimum dynamic area (which is the area needed to ensure survival or re-establishment of an element after natural disturbance). This factor for an occurrence is evaluated relative to other known, and/or presumed viable, examples.

Condition/Quality – an integrated measure of the composition, structure, and biotic interactions that characterize the occurrence. This includes measures such as reproduction, age structure, biological composition (such as the presence of exotic versus native species), structure (for example, canopy, understory, and ground cover in a forest community), and biotic interactions (such as levels of competition, predation, and disease).

Landscape Context – an integrated measure of two factors: the dominant environmental regimes and processes that establish and maintain the element, and connectivity. Dominant environmental regimes and processes include herbivory, hydrologic and water chemistry regimes (surface and groundwater), geomorphic processes, climatic regimes (temperature and precipitation), fire regimes, and many kinds of natural disturbances. Connectivity includes such factors as a species having access to habitats and resources needed for life cycle completion, fragmentation of ecological communities and systems, and the ability of the species to respond to environmental change through dispersal, migration, or re-colonization.

Each of these factors is rated on a scale of A through D, with A representing an excellent rank and D representing a poor rank. These ranks for each factor are then averaged to determine an appropriate EO-Rank for the occurrence. If not enough information is available to rank an element occurrence, an EO-Rank of E is assigned. EO-Ranks and their definitions are summarized in Table 3.

Table 3. Element Occurrence Ranks and their Definitions

A	Excellent viability.
B	Good viability
C	Fair viability.
D	Poor viability.
H	Historic: known from historical record, but not verified for an extended period of time.
X	Extirpated (extinct within the state).
E	Extant: the occurrence does exist but not enough information is available to rank.
F	Failed to find: the occurrence could not be relocated.

Potential Conservation Areas

In order to successfully protect populations or occurrences, it is helpful to delineate Potential Conservation Areas (PCAs). 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. Potential Conservation Areas may include a single occurrence of a rare element, or a suite of rare element occurrences or significant features.

The PCA is designed to identify a land area that can provide the habitat and ecological processes upon which a particular element occurrence, or suite of element occurrences, depends for its continued existence. The best available knowledge about each species' life history is used in conjunction with information about topographic, geomorphic, and hydrologic features; vegetative cover; and current and potential land uses. In developing the boundaries of a PCA, CNHP scientists consider a number of factors that include, but are not limited to:

- ecological processes necessary to maintain or improve existing conditions;
- species movement and migration corridors;
- maintenance of surface water quality within the PCA and the surrounding watershed;
- maintenance of the hydrologic integrity of the groundwater;
- land intended to buffer the PCA against future changes in the use of surrounding lands;
- exclusion or control of invasive exotic species;
- land necessary for management or monitoring activities.

The boundaries presented are meant to be used for conservation planning purposes and have no legal status. The proposed boundary does not automatically recommend exclusion of all activity. Rather, the boundaries designate ecologically significant areas in which land managers may wish to consider how specific activities or land use changes within or near the PCA affect the natural heritage resources and sensitive species on which the PCA is based. Please note that these boundaries are based on our best estimate of the primary area supporting the long-term survival of targeted species and plant communities. A thorough analysis of the human context and potential stresses has not been conducted. However, CNHP's conservation planning staff is available to assist with these types of analyses where conservation priority and local interest warrant additional research.

Off-Site Considerations

Frequently, all necessary ecological processes cannot be contained within a PCA of reasonable size. For example, taken to the extreme, the threat of ozone depletion could expand every PCA to include the entire planet. The boundaries described in this report indicate the immediate, and therefore most important, area to be considered for protection. Continued landscape level conservation efforts that may extend far beyond PCA boundaries are necessary as well. This will involve regional efforts in addition to coordination and cooperation with private landowners, neighboring land planners, and state and federal agencies.

Ranking of Potential Conservation Areas

CNHP uses element and element occurrence ranks to assess the overall biological diversity significance of a PCA, which may include one or many element occurrences. Based on these ranks, each PCA is assigned a biological diversity rank (or B-rank). See Table 4 for a summary of these B-ranks.

Table 4. Natural Heritage Program Biological Diversity Ranks and their Definitions

B1	Outstanding Significance (indispensable): only known occurrence of an element A-ranked occurrence of a G1 element (or at least C-ranked if best available occurrence) concentration of A- or B-ranked occurrences of G1 or G2 elements (four or more)
B2	Very High Significance: B- or C-ranked occurrence of a G1 element A- or B-ranked occurrence of a G2 element One of the most outstanding (for example, among the five best) occurrences rangewide (at least A- or B-ranked) of a G3 element. Concentration of A- or B-ranked G3 elements (four or more) Concentration of C-ranked G2 elements (four or more)
B3	High Significance: C-ranked occurrence of a G2 element A- or B-ranked occurrence of a G3 element D-ranked occurrence of a G1 element (if best available occurrence) Up to five of the best occurrences of a G4 or G5 community (at least A- or B-ranked) in an ecoregion (requires consultation with other experts)
B4	Moderate Significance: Other A- or B-ranked occurrences of a G4 or G5 community C-ranked occurrence of a G3 element A- or B-ranked occurrence of a G4 or G5 S1 species (or at least C-ranked if it is the only state, provincial, national, or ecoregional occurrence) Concentration of A- or B-ranked occurrences of G4 or G5 N1-N2, S1-S2 elements (four or more) D-ranked occurrence of a G2 element At least C-ranked occurrence of a disjunct G4 or G5 element Concentration of excellent or good occurrences (A- or B-ranked) of G4 S1 or G5 S1 elements (four or more)
B5	General or State-wide Biological Diversity Significance: good or marginal occurrence of common community types and globally secure S1 or S2 species.

Protection Urgency Ranks

Protection urgency ranks (P-ranks) refer to the timeframe in which it is recommended that conservation protection occur. In most cases, this rank refers to the need for a major change of protective status (for example agency special area designations or ownership). The urgency for protection rating reflects the need to take legal, political, or other administrative measures to protect the area. Table 5 summarizes the P-ranks and their definitions.

Table 5. Natural Heritage Program Protection Urgency Ranks and their Definitions

P1	Protection actions needed immediately. It is estimated that current stresses may reduce the viability of the elements in the PCA within 1 year.
P2	Protection actions may be needed within 5 years. It is estimated that current stresses may reduce the viability of the elements in the PCA within this approximate timeframe.
P3	Protection actions may be needed, but probably not within the next 5 years. It is estimated that current stresses may reduce the viability of the elements in the PCA if protection action is not taken.
P4	No protection actions are needed in the foreseeable future.
P5	Land protection is complete and no protection actions are needed.

A protection action involves increasing the current level of protection accorded one or more tracts within a potential conservation area. It may also include activities such as educational or public relations campaigns, or collaborative planning efforts with public or private entities, to minimize adverse impacts to element occurrences at a site. It does not include management actions. Situations that may require a protection action may include the following

- Forces that threaten the existence of one or more element occurrences at a PCA. For example, development that would destroy, degrade or seriously compromise the long-term viability of an element occurrence; or timber, range, recreational, or hydrologic management that is incompatible with an element occurrence's existence;
- The inability to undertake a management action in the absence of a protection action; for example, obtaining a management agreement;
- In extraordinary circumstances, a prospective change in ownership or management that will make future protection actions more difficult.

Management Urgency Ranks

Management urgency ranks (M-ranks) indicate the timeframe in which it is recommended that a change occur in management of the PCA. This rank refers to the need for management in contrast to protection (for example, increased fire frequency, decreased grazing, weed control, etc.). The urgency for management rating focuses on land use management or land stewardship action required to maintain element occurrences at the potential conservation area.

A management action may include biological management (prescribed burning, removal of exotics, mowing, etc.) or people and site management (building barriers, re-routing trails, patrolling for collectors, hunters, or trespassers, etc.). Management action does not

include legal, political, or administrative measures taken to protect a potential conservation area. Table 6 summarizes M-ranks and their definitions.

Table 6. Natural Heritage Program Management Urgency Ranks and their Definitions

M1	Management actions may be required within one year or the element occurrences could be lost or irretrievably degraded.
M2	New management actions may be needed within 5 years to prevent the loss of the element occurrences within the PCA.
M3	New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.
M4	Current management seems to favor the persistence of the elements in the PCA, but management actions may be needed in the future to maintain the current quality of the element occurrences.
M5	No management needs are known or anticipated in the PCA.

Sites of Local Significance

Sites of Local Significance (SLS) are sites that include good examples of species or natural communities that are too small or whose biological or ecological significance is not great enough to be considered exemplary in a statewide context, therefore not meeting the minimum criteria for a PCA. However, they do contribute to the character of the local area and the overall local diversity of plants and communities present, and therefore warrant consideration at some planning level. SLS typically include sites that were surveyed at the landowner or an agency's request due to needs for management or threats but do not contain tracked species or communities. In some cases they are based on plot data where the full extent of a community is not known and the surveyed areas do not meet the minimum size requirement for an occurrence.

WETLAND DEFINITIONS, REGULATIONS, AND CONDITIONAL ASSESSMENTS

Wetland Definitions

The federal 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 this definition, 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 regulatory purposes, a wetland boundary must be determined according to the 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. *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979) 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.

CNHP adheres to 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. For example, riparian areas, which often do not meet all three of the Corps’ criteria, perform many of the same functions as other wetland types, including maintenance of water quality, storage of floodwaters, and enhancement of biodiversity, especially in the western United States (National Research Council 1995). Thus, the U.S. Fish and Wildlife Service wetland definition is more suitable to CNHP’s objective of identifying ecologically significant wetlands.

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. 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.

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 Mapping in Colorado

National Wetland Inventory Maps

The U.S. Fish and Wildlife Service has conducted wetland inventories for the nation. The Cowardin et al. (1979) classification system provides the basic mapping units for the U.S. National Wetlands Inventory (NWI). 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.

In Colorado, the U.S. Fish and Wildlife Service, Region 6 has digital information available in the San Luis Valley, along the Front Range, and Montezuma County. The digital data is based on aerial photography from the the 1980s (USFWS NWI 2004). Printed maps are available for most of the state <http://www.fws.gov/nwi/>

Colorado Division of Wildlife Riparian Maps

The following sections are summarized from DOW's Riparian web page (<http://ndis1.nrel.colostate.edu/riparian/riparian.htm>):

The Colorado Division of Wildlife (DOW) has been involved with mapping riparian vegetation since 1990. Initially, it started out as a cooperative project with the Pike/San Isabel National Forest and Comanche/Cimarron National Grasslands in southern Colorado. At the time, the Forest Service had the funding and the desire to map riparian vegetation but lacked a Geographic Information System (GIS) necessary to digitally process the information. The DOW lacked the funding but had the desire and the GIS expertise. As a result, an interagency cooperative project was developed that mapped

approximately 200 USGS quadrangle maps over a six year period from 1990-1996. The only limitation of this project, due to the source of the funding, was that the delineation ended at the Forest Service's administrative boundary.

The DOW uses NAPP (National Aerial Photography Program) aerial infrared photographs to map riparian vegetation. These photos are flown at a height of 20,000 feet and purchased from the USGS as a 9" x 9" film positive at a nominal scale of 1:40,000. These photos are obtained in stereo to allow for 3-D viewing that aids in the mapping process. Riparian vegetation is mapped on a 7.5' Quadrangle basis at a scale of 1:24,000. Approximately ten aerial photos per quad are needed for stereo overlay. Potential riparian habitats are not delineated. Mixed communities are delineated when obvious spectral differences in vegetation can be discerned within a common area. The status of the DOW Riparian Maps can be found at:

<http://ndis1.nrel.colostate.edu/riparian/StatusMap.html>

Wetland Functions and Ecological Services

Wetland functions are natural processes of wetlands that continue regardless of their perceived value to humans (Novitzki et al. 1996). These include;

- storage of water;
- transformation of nutrients;
- growth of living matter; and
- diversity of wetland plants.

Ecological services are the wetland functions that are valued by society. For example, biogeochemical cycling (which includes retention and supply) is an ecological function whereas nutrient removal/retention is an ecological service to society. Also, overbank flooding/subsurface water storage is an ecological function whereas flood abatement/flood-flow alteration is an important ecological service.

Ecological services are typically the value people place on wetlands that is the primary factor determining whether a wetland remains intact or is converted for some other use (National Audubon Society 1993). The actual value attached to any given function or value listed above depends on the needs and perceptions of society (National Research Council 1995).

Wetland Condition Assessment

For past county wetland survey and assessment projects, CNHP utilized a qualitative, descriptive functional assessment based on the best professional judgment of CNHP ecologists while incorporating some of the principles of the hydrogeomorphic (HGM) assessment method. The assessment was used to provide a rapid determination of each wetland's functional integrity. This functional assessment method used various qualitative indicators of structure, composition, and land use to represent and estimate the degree to which a function was being performed. This, as well as most functional assessments, requires the following assumptions: (1) the combination of variables adequately represents the function and (2) their combination results in an estimated "amount" of the function being performed. The result is that most functional assessments are not rapid and do not directly measure functions (Cole in press).

Condition assessments are 'holistic' in that they consider *ecological integrity* to be an "integrating super-function" (Fennessy et al. 2004). Condition assessments or ecological integrity assessments provide insight into the integrity of a wetland's natural ecological functions that are directly related to the underlying integrity of biotic and abiotic processes. In other words, a wetland with excellent ecological integrity will perform all of its functions at full levels expected for its wetland class or type. Ecological integrity assessments are simply concerned with measuring the condition of the wetland and assume that ecological functions follow a similar trend. This assumption may not be true for all functions, especially ecological services or those functions which provide specific societal value. For example, ecological services such as flood abatement or water quality improvement may still be performed even if ecological integrity has been compromised. However, given that CNHP is attempting to identify and prioritize ecologically significant wetlands it seemed more pertinent to focus the assessment on ecological integrity or condition of each wetland rather than specific ecological functions, services or values.

The element occurrence rank (see CNHP methodology section) used by CNHP is a rapid assessment of the condition of on-site and adjacent biotic and abiotic processes that support and maintain the element. This method was used to assess wetland condition for this report. Recently, NatureServe and CNHP (Faber-Langendoen et al. 2005) revised this method making it more transparent and repeatable. The revised method, tentatively called Ecological Integrity Assessment Scorecards, will be used in future projects to assess wetland condition.

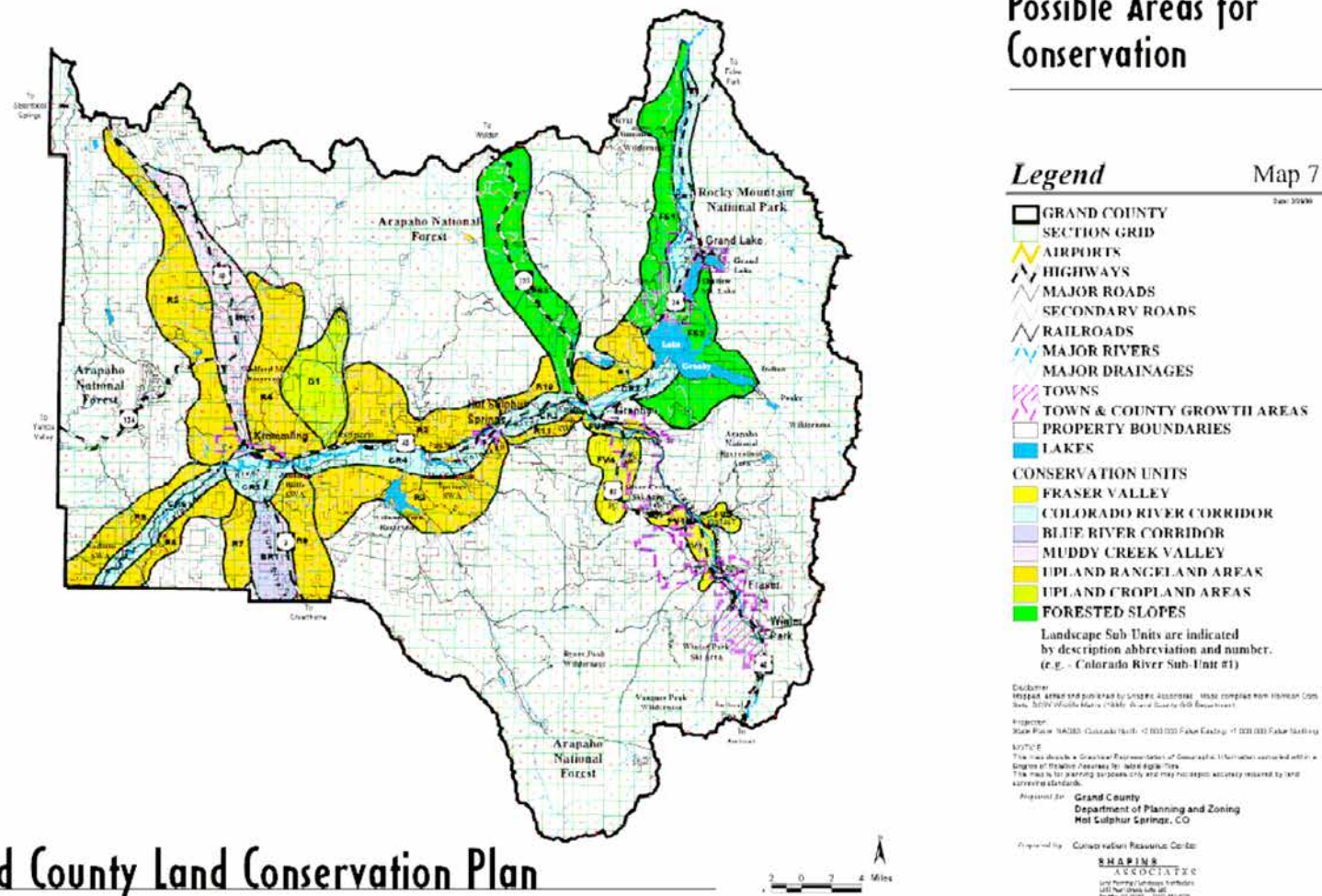
GRAND COUNTY LANDS CONSERVATION PLAN

In 1998, Great Outdoors Colorado provided funding to the Grand County Department of Planning and Zoning to produce the *Lands Conservation Plan* (Shapins Associates, Inc. 1999). This document was structured to guide future land conservation for protecting sensitive natural, scenic, and cultural resources, and to promote compatible land use practices throughout the County. Part of this analysis included identification of seven landscape units that are high priority areas for conservation as well as providing a framework for developing a system of protected lands. The broadly-defined landscape unit depicts an area of similar resource characteristics and conditions without regard to individual ownership boundaries. Further generalization of the landscape unit provides for connectivity to form a landscape system. These units include:

1. Fraser Valley
2. Colorado River Corridor
3. Blue River Corridor
4. Muddy Creek Valley
5. Upland Slopes and Range Land Areas
6. Upland Cropland Areas
7. Forested Slopes

For detailed description of each landscape unit, see *Lands Conservation Plan* (Shapins Associates, Inc. 1999) (Figure 1).

The landscape units are similar to CNHP's Ecological Systems (Rondeau 2001) (see Project Background) but at a coarser scale. For this report, the PCAs were crosswalked with the appropriate landscape unit to identify specific conservation targets.



Grand County Land Conservation Plan

Figure 1. Grand County Land Conservation Plan Landscape Units.

PROJECT BACKGROUND

Location of the Study Area

Grand County is named after the Grand River, the original name for the upper part of the Colorado River (Figure 2). It encompasses approximately 1,874 square miles (485,347 hectares) of north central Colorado and ranges in elevation from 7,300 feet (2190 meters), where the Colorado River cuts through the Gore Range at Gore Canyon, to 13,553 feet (4066 meters) at the summit of Pettingell Peak in the Front Range. Counties that border Grand County clockwise from the north are: Jackson, Larimer, Boulder, Gilpin, Clear Creek, Summit, Eagle, and Routt. The principal mountain ranges are: Rabbit Ears Range, Front Range, and Gore Range. The Continental Divide defines the northern and eastern County lines while the Gore Range delineates the southwest boundary. Middle Park intermountain basin (see “Hydrology” for further information) is surrounded by these mountain ranges (Figure 3).



Figure 2. Location of Grand County in Colorado.

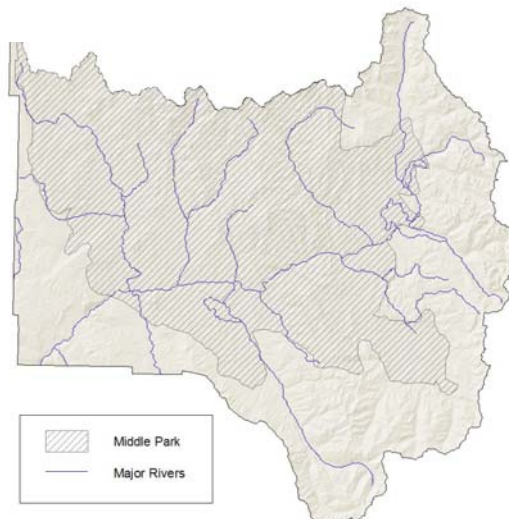


Figure 3. Location of Middle Park in Grand County.

Ecoregion

Grand County is located entirely within the Southern Rocky Mountain ecoregion as defined by The Nature Conservancy (Neeley et al. 2001) (Figure 4). This ecoregion includes two major mountain systems and the intervening valleys and parks from southern Wyoming to northern New Mexico. The major ecological zones are alpine, subalpine, upper montane, lower montane, foothill, and sagebrush shrubland (Neely et al. 2001). Glacial activity and resulting meltwaters have shaped much of the Southern Rocky Mountain ecoregion, and therefore Grand County, into high rugged mountains, plateaus, alpine cirques, glacial moraines, and broad valleys.

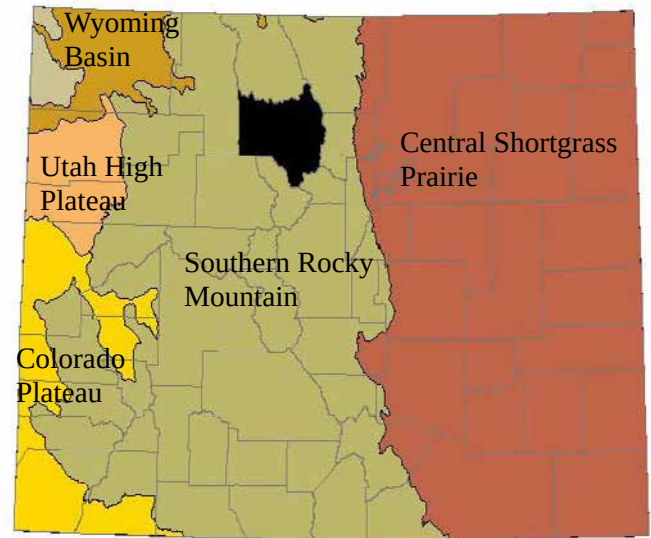


Figure 4. Colorado Ecoregions.

Hydrology

Grand County is located in the Upper Colorado River watershed. Its headwaters reside on the Continental Divide in Rocky Mountain National Park. Major tributaries include the Fraser River, Williams Fork River, Willow Creek, Blue River, Troublesome Creek, and Muddy Creek (Figure 5). The Fraser River flows north from its headwaters at Berthoud Pass through the towns of Winter Park and Fraser, Fraser Canyon, and the Town of and Granby where it joins with the Colorado River just above Windy Gap Reservoir. The Williams Fork River originates from the Williams Fork Mountains and flows northwest into Williams Fork Reservoir. Willow Creek originates in the Rabbit Ears Range and flows south to Willow Creek Reservoir. The Blue River flows north from the Mosquito Range in Summit County into the Green Mountain Reservoir. The Blue River continues to flow north to join the Colorado River and Muddy Creek at the Town of Kremmling. Muddy Creek is dammed at Wolford Mountain Reservoir, a water storage project owned and operated by the Colorado River District.

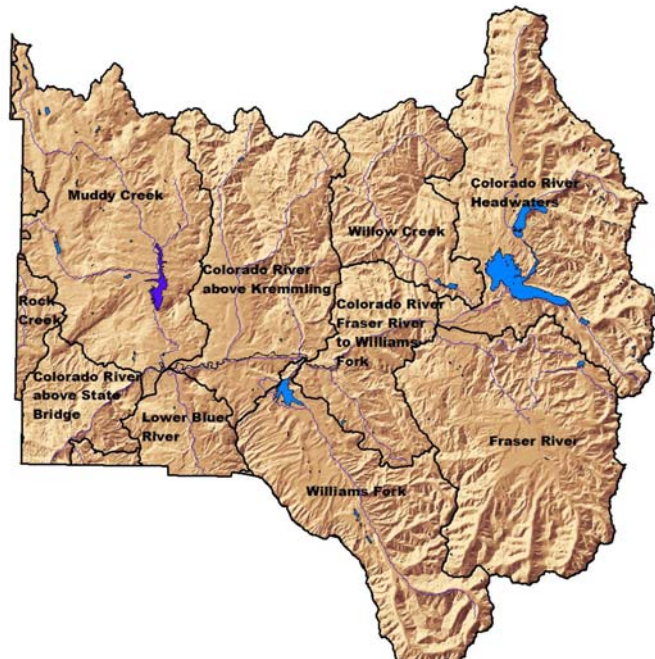


Figure 5. Major Rivers, Lakes, Reservoirs, and Watersheds in Grand County.

Middle Park and North Park represent a single structural basin, approximately 70 miles long and 35 miles wide in Grand and Jackson counties. The Rabbit Ears Range bisects the basin, creating two separate ground-water basins and topographic drainages. The Middle Park Basin has three sub-basins: Troublesome (principal), Fraser, and Granby. Troublesome sub-basin lies on the east side of the Williams Fork Mountains along Troublesome Creek, south of the Colorado River, the Fraser sub-basin extends from Winter Park to northwest of Fraser, and the Granby sub-basin extends from Granby north and south (Topper et al. 2003).

Grand County's groundwater hydrology is divided into two categories: Troublesome Formation and Mesozoic Age Aquifers. The Troublesome Formation represents the most important bedrock aquifer for Middle Park. This formation is as thick as 1,000 feet in the Granby area and has an estimated groundwater volume (including alluvium) between 1.6 and 2.7 million acre feet. Mesozoic Age Aquifers are found in the underlying Mesozoic rocks (Cretaceous and Jurassic age). On the margins of Middle Park, these aquifers can supply water since drilling depths are minimized. As of March 27, 2002, the Division of Water Resource (DWR) reports more than 4,000 completed wells in Grand County including alluvial, sedimentary bedrock, crystalline rock, and volcanic rock wells (Topper et al. 2003).

There are four DWR stations located along the Colorado River in Grand County. The first is located below Baker Gulch and Grand Lake. This station records a stream flow range of 4 to 900 cubic feet per second (cfs) with a February average of 7.19 cfs and a June average of 310 cfs (CSDR 2005). The second station is located near Granby. This station records a range of 20-3,000 cfs with a February average of 37.6 cfs and a June average of 506 cfs (CSDR 2005). The third station on the Colorado River is located at Windy Gap Reservoir. This station records a range of 60-4500 cfs with a January average of 77.4 cfs and a June average of 862 cfs (CSDR 2005). The final Colorado River DWR station for Grand County is located near Kremmling. This station records a range of flows between 300 and 15,000 cfs with a February average of 49.3 cfs and a June average of 3,541 cfs (CSDR 2005).

Geology

The varied physical characteristics of Grand County are derived from geology that consists of a base of crystalline Precambrian rocks underneath thousands of feet of sedimentary rocks. The Jurassic Morrison Formation, clay shale and mudstone with sandstone above and below, is the deepest of these sedimentary layers. Dakota Sandstone

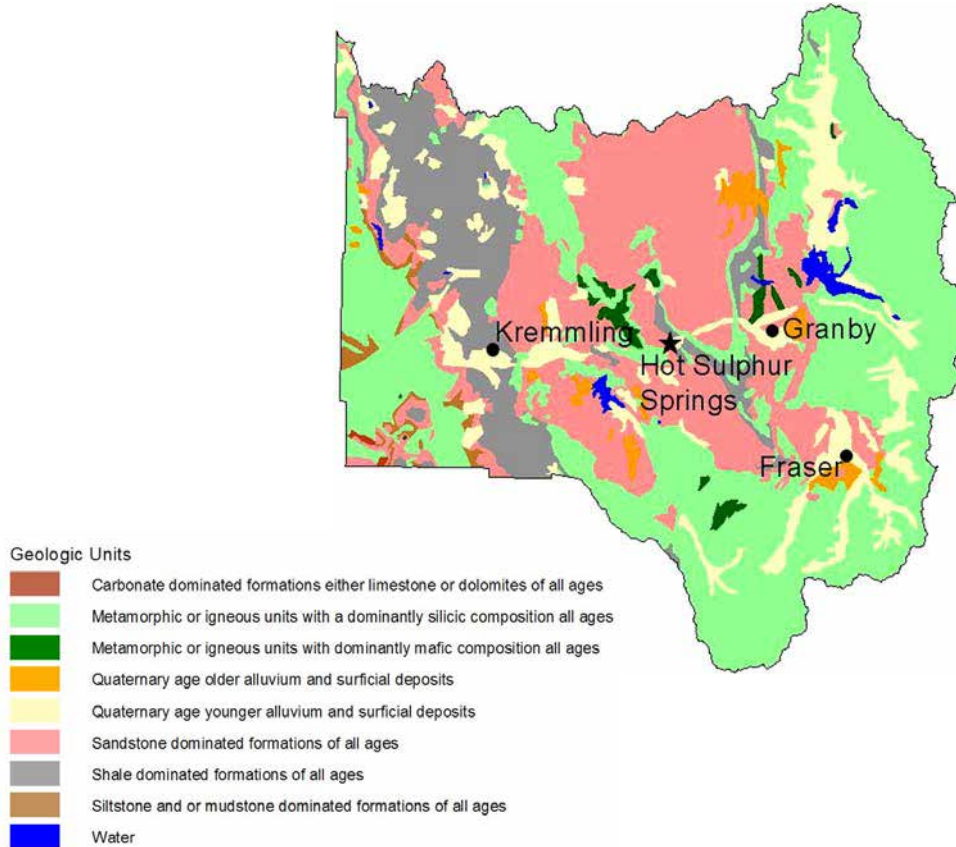


Figure 6. Generalized Geology of Grand County (Greene 1992).

with its local basal conglomerate, a middle shaly and thin-bedded sandstone unit, is next. Lying on top of this is Benton Shale, dark, fissile shale with a sandy zone at the top.

The Niobrara Formation, a basal limestone and dark, brittle, thin-bedded calcareous shale, follows. The Niobrara Formation then eases into Pierre Shale, a dark gray to brown shale containing considerable sandstone. On top of all this sedimentary rock rests on the Tertiary Middle Park Formation, a layer of volcanic materials with a thicker upper layer of grit, sandstone, conglomerate and shale. The upper most layers of the continental materials consist of poorly consolidated mudstone, conglomerate lenses, shale, clay, sandstone, and interbedded volcanic material (Tweto 1957, as cited in Topper et al. 2003) (Figure 6).

Soils

The soils of Grand County can be divided into three broad categories; 1) high mountains and alpine slopes, 2) mountainsides and ridges, and 3) low terraces and flood plains. Soils on the high mountains and alpine slopes make up about 45% of Grand County. These soils range from nearly level to very steep and are well drained. Typical vegetation consists of lodgepole pine, spruce-fir, and alpine grasses and forbs from low to high elevation respectively. Mountainsides, ridges and alluvial soil make up about 27% of the County's soils. These soils are also well drained and can be found on gentle to steep slopes, dominated by sagebrush and bunch grasses. Finally, soils on low terraces, flood plains and adjacent fans, side slopes, and ridges make up the remaining 28%. The soils are nearly level to very steep and can be found along the Colorado River and its tributaries. These soils can be poorly drained, particularly those in floodplains. Terraced soils are well drained, typically utilized for agriculture where irrigation is available (USDA Soil Conservation Service 1983).

Climate

The climate of Grand County is generally sunny year-round. Middle Park temperatures tend to be cooler than the rest of the County. Average summer temperatures range from the low 80°F to the low 40°F (WRCC 2005). Average winter temperatures range from the upper 20°F to 0°F (WRCC 2005). The County's average rainfall and snowfall is approximately 12 inches and 128.5 inches a year respectively (WRCC 2005) (Figure 6). Winter Park, located along the Continental Divide, has average summer highs and lows of 78°F and 33°F and average winter highs and lows of 30°F and 2°F (WRCC 2005) (Figure 7). In addition, Winter Parks boasts an average 365 inches of precipitation a year, mostly in snowfall (WRCC 2005).

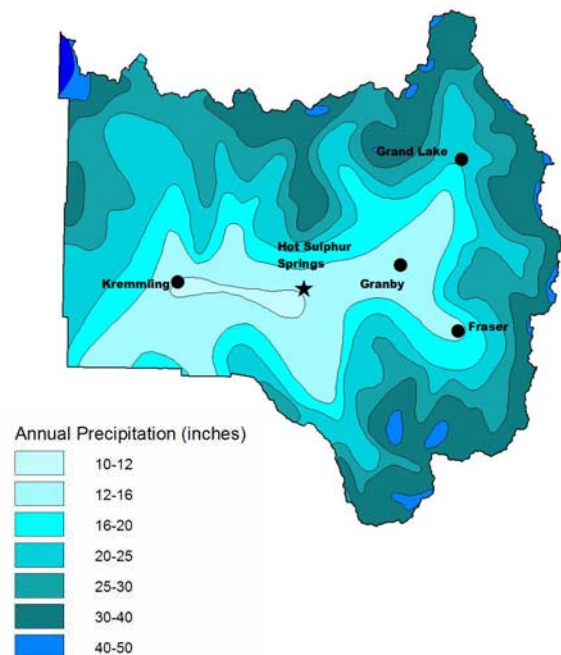


Figure 7. Average Annual Precipitation in Grand County.

Population

The estimated population of Grand County in 2004 was 13,253, a 6.52 % increase from the 2000 estimate of 12,442 (US Census Bureau 2004). The towns and their 2000 census population for Grand County are: Kremmling (1,578), Granby (1,525), Grand Lake (447), Fraser (910), Winter Park (662), and Hot Sulphur Springs (521 (Figure 8).

Land Ownership

Approximately 28% of Grand County is privately owned; the majority of private lands are located within Middle Park. About 70% of the land in Grand County is publicly owned. The Arapaho-Roosevelt and Routt National Forests manage 47% of the land in Grand County where the predominant uses

are wildlife habitats, timber and livestock foraging, and many outdoor recreation activities (Shapins Associates, Inc. 1999). Bureau of Land Management lands, located mainly in the western portion of the County comprise approximately 12%. The Colorado Division of Wildlife manages six State Wildlife Areas; Red Mountain, Junction Butte, Hot Sulphur Springs, Kemp – Breeze, and Radium, and Williams Fork Reservoir (Figure 9) making up approximately 4% of the land while National Park Service lands make up the remaining 8% of the land.

Land Use

Historically, the County's economy was based on agriculture and livestock activities. Presently, the economy is largely based on recreation and tourism. The Kremmling area offers excellent hunting, fishing and boating, and is largely known as a place for outdoor enthusiasts. Granby, Fraser, and Winter Park are all located only one hour from Denver and possess easily accessible fishing and hiking in the summer, and snowmobiling, tubing, and skiing in the winter. Hot Sulphur Springs, the County Seat and the County's oldest town, established in 1874, is home to the Hot Sulphur Springs Spa and Resort.

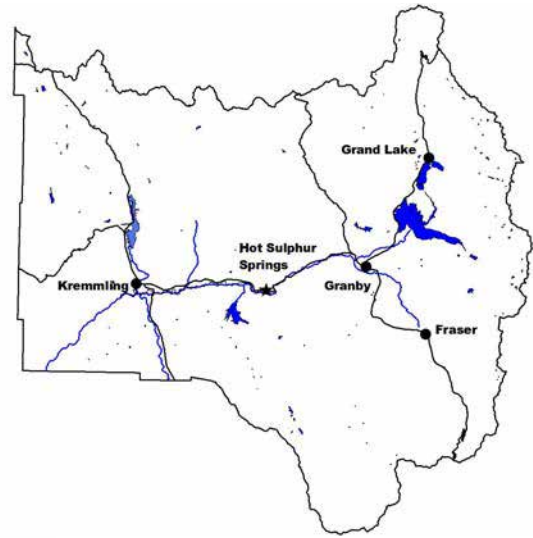


Figure 8. Grand County Towns and Municipalities.

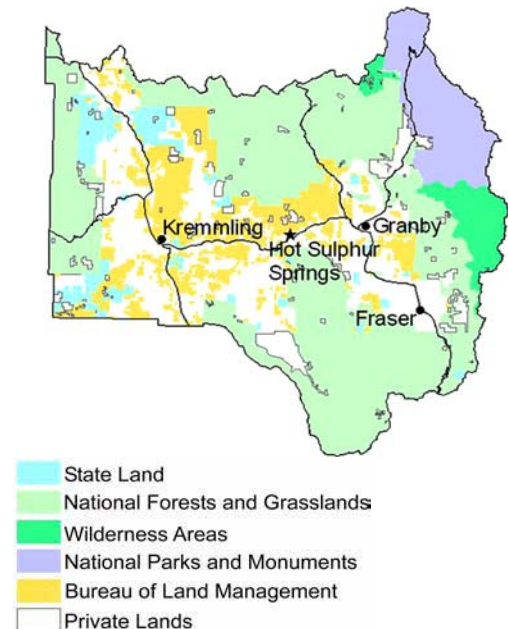


Figure 9. Land Ownership in Grand County.

Ecological Systems (adapted from Rondeau 2001)

The diversity of climate, geology, elevation, and soils within Grand County leads to a wide range of ecological systems, spanning from alpine tundra at the highest elevations to mountain and big sagebrush shrubland occupying the lowest elevations on the west side (Figure 10). Ecological systems are dynamic assemblages of plant and animal communities that occur together on the landscape, unified by similar ecological processes (e.g. climate as moderated by elevation and natural disturbance processes) and/or underlying abiotic environmental factors or gradients (e.g. bedrock geology and hydrology) (Comer et al. 2003).

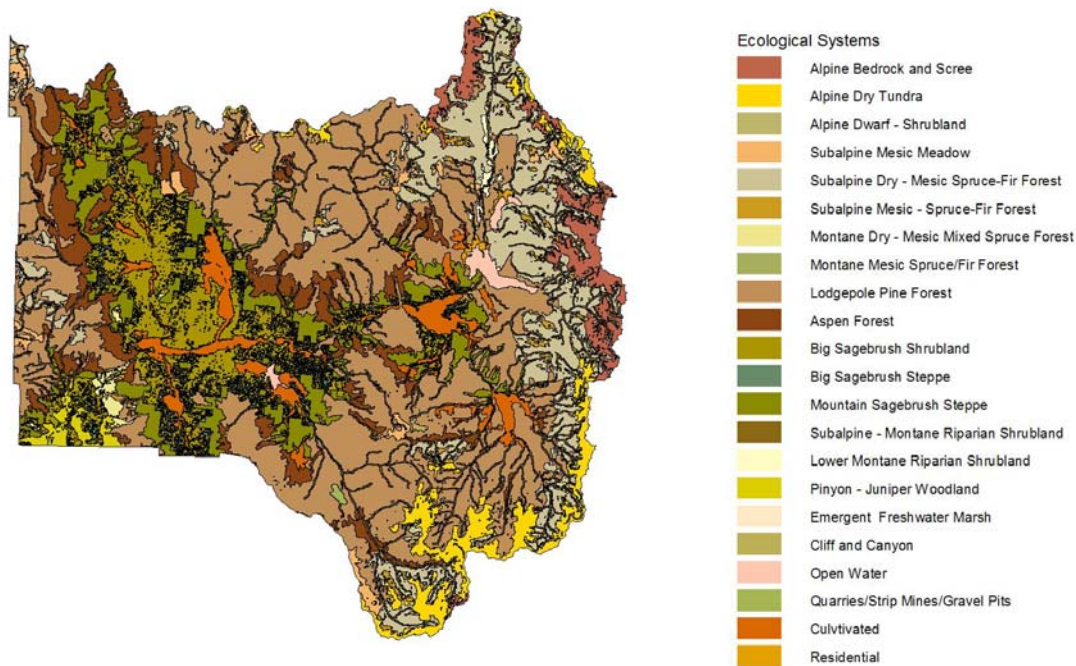


Figure 10. Ecological Systems of Grand County.

The biodiversity of ecological systems in Grand County are best described along a steep elevation gradient. At the highest elevations, alpine tundra dominated by cushion plants grades into subalpine forests dominated by Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*), which in turn grade into upper montane forests of lodgepole (*Pinus contorta*) or limber pine (*Pinus flexilis*). Lower montane forests are strongly dominated by lodgepole pine, especially on dry slopes, although Douglas-fir (*Pseudotsuga menziesii*) can intermingle on moister, often north-facing slopes with aspen (*Populus tremuloides*). The basins between mountain ranges are characterized by mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and Wyoming big sagebrush (*A. tridentata* ssp. *wyomingensis*) shrublands, which dominate the clayey soils within Middle Park. Scattered throughout the County are riparian forest and shrubland and other wetland types such as, depressional (fens, kettle ponds) and freshwater marshes.

Alpine Bedrock and Scree and Dry Tundra

These ecological systems comprise approximately 4% of Grand County's alpine, occurring at only the highest elevations (12,500-13,550 feet). The primary ecological

processes include: snow retention and wind desiccation. The system is commonly comprised of a mosaic of large patch plant communities that are dominated by sedges, grasses, and forbs. Dominant species include: boreal sagebrush (*Artemisia arctica*), blackroot sedge (*Carex elynoides*), dry spike sedge (*Carex foenea*), curly sedge (*Carex rupestris*), tufted hairgrass (*Deschampsia cespitosa*), sheep fescue (*Festuca brachyphylla*), Ross' avens (*Geum rossii*), bog sedge (*Kobresia myosuroides*), and alpine clover (*Trifolium dasyphyllum*). Vegetation in these areas is controlled by snow retention, wind desiccation, and a short growing season. The major threats to this system are global warming and surface disturbances such as roads, mining, and degradation from current and historic sheep grazing. Viable populations of White-tailed Ptarmigan (*Lagopus leucurus*), American Pipit (*Anthus spinolétta*) and Brown-capped Rosy-Finch (*Leucosticte australis*) may be indicators of a healthy and adequately large alpine ecosystem. Brown-capped Rosy-Finch, a Southern Rocky Mountains endemic, nests in vertical cliffs and crags of the tundra and feed in the surrounding area. They often use snowfields for feeding, especially when strong winds cross snowfields the updrafts are cut off and insects fall stunned on the snow surface, creating an abundant food source (Nelson 1998). In addition, Pika (*Ochotona princeps*) and yellow-bellied marmot (*Marmota flaviventris*) are common year-round alpine mammals. Both have been experiencing population declines due to the increase of global temperatures (Krajick 2004).

Alpine Dwarf Shrubland

Alpine dwarf shrubland system occurs in only .05% at the highest elevations in the County, usually above 12,000 feet, primarily on gentle slopes and depressions where the soil has become relatively stabilized and the water supply is more or less constant. Plant cover ranges from 15-50%, while exposed rocks are prevalent. Dominant species include: Arctic willow (*Salix arctica*), net-leaf willow (*S. reticulata*), twinflower sandwort (*Minuartia obtusiloba*), Rocky Mountain nailwort (*Paronychia pulvinata*), goldbloom saxifrage (*Saxifraga chrysantha*), moss campion (*Silene acaulis*), primroses (*Polemonium* spp.), and buckwheats (*Eriogonum* spp.). White-tailed Ptarmigan (*Lagopus leucurus*), Brown-capped Rosy Finch (*Leucosticte australis*), and American Pipit (*Anthus spinolétta*) use this system at different times in their life cycle and have been chosen as indicators of a healthy occurrence of alpine systems. Major threats to this system are global warming and fragmentation by roads and degradation through mining and ski development.

Subalpine Mesic Meadow

Subalpine wet meadow ecological system occupies approximately .70% of land cover in Grand County. This system is widely distributed both in elevation and latitude and confined to specific environments defined primarily by hydrology. Water levels in this system are often at or near the ground surface for much (or all) of the growing season, but also may fluctuate considerably throughout the year. Physical disturbance during inundation (e.g., during flood events) may be significant for the structure and composition.

This system often occurs as a mosaic of several plant associations with varying dominant herbaceous species that include: slimstem reedgrass (*Calamagrostis stricta*), white marsh marigold (*Caltha leptosepala*), heartleaf bittercress (*Cardamine cordifolia*), sheep sedge (*Carex illota*), small wing sedge (*Carex microptera*), mountain sedge (*Carex scopulorum*), native sedge (*Carex vernacular*), tufted hairgrass (*Deschampsia cespitosa*), fewflower spikerush (*Eleocharis quinqueflora*), small floating mannagrass (*Glyceria borealis*), and Parry's clover (*Trifolium parryi*). Often alpine dwarf shrublands, especially those dominated by willows (*Salix* spp.), are immediately adjacent to the wet meadows. The surrounding landscape often contains other wetland systems, e.g., riparian shrublands, or a variety of upland systems from grasslands to forest.

Spruce-Fir Forest

Approximately 8% of Grand County is classified as an Englemann spruce-subalpine fir (*Picea engelmannii*-*Abies lasiocarpa*) forest ecological system. Spruce-fir dominated stands occur on all but the most xeric sites above 9,000 feet and in cool, sheltered valleys at elevations as low as 8,200 feet. The relative dominance of the two canopy tree species and the understory composition vary substantially over a gradient from excessively moist to xeric sites (Peet 1981). The mesic spruce-fir type occurs on cool, sheltered, but well-drained sites and is one of the most widespread forest types in the subalpine zone. In lower elevations, the spruce-fir types give way, often along abrupt fire-induced boundaries, delineated by lodgepole pine or aspen-dominated forests.

Fire, spruce-beetle outbreaks, avalanches, and wind all play an important role in shaping the dynamics of spruce-fir forests. Fires in the subalpine forest are typically stand replacing, resulting in the extensive exposure of mineral soil and initiating the development of new forests. Fifty year return interval for high intensity surface fires and 100-400 years return interval for crown fires which cover 1,000 to 10,000 acres are noted for this ecological system (Peet 1981, Habeck and Mutch 1973). Spruce beetle (*Dendroctonus rufipennis*) outbreaks may be as significant as fire in the development of spruce-fir forests. In addition to fires and beetle kill, wind disturbance in spruce-fir forests has been well documented (Schaupp et al. 1999).

Pine marten (*Martes americana*) is mostly a spruce-fir obligate that requires a healthy and sizeable occurrence of old growth forest. Therefore a viable population of pine marten has been chosen as an indicator of a healthy and viable occurrence of the spruce-fir system.

Lodgepole Pine Forest

Lodgepole pine (*Pinus contorta*) forest system occupies over 20% of the County. Lodgepole pine forests generally occur between 8,000-10,000 feet from gentle to steep slopes on all aspects. This system consists of extensive stands of pure lodgepole pine or, to a lesser extent, stands in association with other conifer species. Lodgepole pine is a successional species par excellence but may be climax under certain edaphic conditions, especially cold microclimate and thin, excessively drained soils (Hess and Alexander 1986). Lodgepole pine is shade intolerant and is an aggressive pioneer developing on sites recently opened up due to fire, insects, disease, windstorms, clearcutting, or other

major stand removing disturbance. Lodgepole pine stands that are 350 to 400 years old exist but are uncommon (Mehl 1992). The average life span of lodgepole pine is probably closer to 250 years or less because of the frequency of stand replacing disturbances such as fire (Mehl 1992). Fires are more frequent in lodgepole pine than spruce-fir as they occur in a warmer and drier environment.

Shrub and herbaceous layers are often poorly developed in lodgepole pine forests, and plant species diversity is low probably related to the single age class and dense canopy of many stands. Common plants include: russet buffaloberry (*Sherperdia canadensis*), creeping juniper (*Juniperus communis*), kinnikinnick (*Arctostaphylos uva-ursi*), and grouse whortleberry (*Vaccinium scoparium*). Brown Creeper (*Certhia americana*), Williamson's Sapsucker (*Sphyrapicus thyroideus*), Boreal Owl (*Aegolius funereus*), Three-toed Woodpecker (*Picoides tridactylus*), and Gray Jay (*Perisoreus canadensis*) are indicators of a functioning lodgepole pine system.

In Colorado, mountain pine beetles (*Dendroctonus ponderosae*) primarily attack ponderosa and lodgepole pines. The beetles carry a bluestain fungus that infects their chosen trees. The fungus spreads through and clogs the tree's water-transporting vessels while beetle larvae eat the tree's inner bark. The fungus and the larvae's activities interrupt the tree's nutritional system, causing the tree's death. The current mountain pine beetle outbreak, which started in a few small areas in the 1990s, has affected over 425,000 acres in 2005, primarily in lodgepole pine forests of north-central Colorado. Winter Park, Granby and Fraser in Grand County; Vail Valley in Eagle County; and parts of Summit, Jackson and Routt counties saw remarkable rates of mountain pine beetle expansion in 2005. In particular, the areas around Lake Granby and the Williams Fork Valley continue to have increased tree mortality. Other sites in Grand County are diminishing in population due to depletion of the host material for this insect (CDNR 2005).

Aspen Forest

Aspen (*Populus tremuloides*) forest system (5%) is found throughout the County between 8,000-10,000 feet in elevation. Aspen forest is a matrix community usually maintained by fires. It usually occurs as a mosaic of many plant associations and may be surrounded by a diverse array of other systems, including grasslands, wetlands, and coniferous forests. Aspen is usually a seral tree in climax sub-alpine fir associations at the higher elevations. In such situations it may dominate the forest community for many decades following severe disturbance, such as fire or clear-cutting, but will gradually decline as the conifers become reestablished. At lower elevations aspen can occur either as a temporary dominant seral species in a variety of climax conifer associations, or it can achieve permanent dominance as the climax forest type. The environmental conditions related to aspen's role as a seral and as a climax species remain ill-defined (Mueggler and Campbell 1986).

The aspen ecosystem is rich in number and species of animals, especially in comparison to associated coniferous forest types. This natural species diversity and richness has been both increased and influenced by the introduction of domestic livestock. Typical understory species include: Rocky Mountain maple (*Acer glabrum*), alder (*Alnus*

incana), snowberry (*Symphoricarpos oreophilus*), twinberry honeysuckle (*Lonicera involucrata*), russet buffaloberry (*Shepherdia canadensis*), brome grass (*Bromus* sp.), bluegrass (*Poa* sp.), and fescue (*Festuca* sp.). The high value of the aspen type as a forage resource for livestock and as forage and cover for wildlife makes the subject of animal impacts important to understanding and management of this ecosystem (DeByle and Winokur 1985).

Sagebrush Shrubland and Steppes

Sagebrush shrubland and steppe ecological systems occupy over half, approximately 55%, of Grand County. Middle Park is one of the largest, continuous sagebrush stands in the Southern Rocky Mountain ecoregion. The dominant shrubs include: Wyoming and mountain big sagebrush (*Artemesia tridentata* ssp. *wyomingensis*, *A. tridentata* ssp. *vaseyana*), with occasional rabbitbrush (*Chrysothamnus* spp., *Ericameria nauseosa*), antelope bitterbrush (*Purshia tridentata*), and winterfat (*Krascheninnikovia lanata*). Dominant herbaceous species include: Idaho fescue (*Festuca idahoensis*), Thurber fescue (*F. thurberi*), Great Basin wildrye (*Leymus cinereus*), bluebunch wheatgrass (*Pseudoroegneria spicata*), needle and thread grass (*Stipa comata*), western wheatgrass (*Pascopyrum smithii*), elk sedge (*Carex geyeri*), and blue grama (*Bouteloua gracilis*).

Pre-settlement stand-replacing fire frequency was 40-60 years, with smaller fires every 20-25 years (Wright et al. 1979 as cited in Johnston 1997). Repeated burning every few years or burning in summer will deplete a stand of perennial grasses and allow weeds, invasive forbs, and cheatgrass (*Bromus tectorum*) to increase (Wright et al. 1979 as cited in Johnston 1997). The dominance of cheatgrass increases the likelihood of fire in mixed sagebrush-cheatgrass sites (Bunting et al. 1987 as cited in Johnston 1997). Following fire, sagebrush must reestablish itself by seeds, therefore growth is slow and recovery is slow (Bunting et al. 1997 as cited in Johnston 1997). Fire favors shrubs like rubber rabbitbrush (*Ericameria nauseosus*) that can re-sprout after fire (Wambolt et al. 1999). However, fire suppression of the montane grasslands could lead to its conversion to sagebrush shrublands.

The Greater Sage-grouse (*Centrocercus urophasianus*) is a sagebrush obligate; the importance of sagebrush as a source of food and cover has been well established (Braun et al. 1977, Connelly et al. 2000 as cited in Connelly et al. 2004). The viability of Greater Sage-grouse depends on large, continuous blocks of viable sagebrush habitat (Braun et al. 1977). Greater Sage-grouse nests are generally located within a 2 mile radius around the strutting ground (Crawford et al. 2004, Apa 2005). Sagebrush control by prescribed burning can be used to enhance Greater Sage-grouse habitat by reducing sagebrush canopy cover where dense sagebrush canopy cover limits understory forbs and grasses. Livestock grazing may positively or negatively affect Greater Sage-grouse and their habitat, depending on the timing and intensity of grazing. Chemical and mechanical treatments intended to provide increased quantities of grass forage for livestock have indirectly reduced the acceptability of sagebrush rangelands for the Greater Sage-grouse (Beck and Mitchell 2000). Other sagebrush shrubland obligates include: Columbian Sharp-tailed Grouse (*Tympanuchus phasianellus columbianus*), Sage Sparrow (*Amphispiza belli*) and Brewer's Sparrow (*Spizella breweri*).

Pinyon-Juniper Woodland

Pinyon-juniper (*Pinus edulis-Juniperus scopulorum*) woodland ecological system occupies approximately .40% in Grand County, primarily in the southwestern portion of the County. The stands exhibit considerable diversity in appearance and composition. Stands may consist of all ages or one age (Mehl 1992). Dominant trees are often 400 years old (Mehl 1992). Trees 800 to 1000 years old have been recorded (Mehl 1992). Some stands may have closed canopies with single or both tree species, with little or no understory. Many stands are open with widely scattered trees of one or both species with a wide variety of understory vegetation. In Grand County, common herbaceous plants include: blue gramma (*Bouteloua gracilis*), bluebunch wheatgrass (*Pseudoroegneria spicata*), Fendler's bluegrass (*Poa fendleriana*), and needle and thread grass (*Stipa comata*).

The pinyon-juniper woodland is a shade intolerant, climax cover type remaining on the site until disturbed by fire. When disturbed by fire it will revert to grasses and eventually return to pinyon-juniper woodland (Mehl 1992).

Montane/Subalpine Riparian Shrubland

Montane/subalpine riparian shrubland ecological system can be either a linear or small patch system, confined to specific environments occurring on floodplains or terraces of rivers and streams and shallow broad valleys. Even though the montane/subalpine riparian shrubland ecological system occupies less than 1% of Grand County, it provides vital habitat for brooding, foraging, nesting, and migration for the majority of birds and mammals. In Grand County, this system often occurs as a mosaic of multiple communities that are shrub dominated. The dominant shrubs include: alder (*Alnus incana*), red-osier dogwood (*Cornus sericea*), Bebb's, Booth's, short-fruited, Drummond's, strappleaf, Geyer's, Rocky Mountain, Plane-leaf, and Wolf willows (*Salix bebbiana*, *S. boothii*, *S. brachycarpa*, *S. drummondiana*, *S. eriocephala*, *S. geyeriana*, *S. moniticola*, *S. planifolia*, and *S. wolfii*). Generally the upland vegetation surrounding these riparian systems consist of either conifer or aspen forests, while adjacent riparian systems range from herbaceous dominated communities to tree dominated communities.

Beaver (*Castor canadensis*) is the primary user as well as maintainer of this system. In addition to the beaver, the primary abiotic ecological process necessary to maintain this ecological system is hydrology and more specifically surface flow. Annual and episodic flooding is important in maintaining this system. Alteration of the flooding regime due to water impoundment, diversions, etc. may produce changes to plant composition as well as community composition (Kittel et al. 1999). River otter (*Lutra canadensis*), re-established in the 1970s by the Colorado Division of Wildlife, needs healthy riparian habitat, where aquatic animals like crayfish, frogs, fish, young muskrats and beavers are favored foods.

Emergent Freshwater Marsh

Freshwater marsh ecological system occupies only .04% of Grand County. This system is defined primarily by hydrology. Marshes are frequently or continually inundated with

water depths up to 7 feet. In Grand County, marshes occur from Middle Park to Grand Lake. Many are located in natural depressions such as kettle ponds or as fringes around lakes and reservoirs. Soils have characteristics that result from long periods of anaerobic conditions, e.g., gleying and redoxidation indicators. Marshes are characterized by herbaceous vegetation adapted to saturated soil conditions. In Grand County, typical plants are: pond lily (*Nuphar lutea* ssp. *polysepala*), *Eleocharis palustris*, floating manna-grass (*Glyceria borealis*), water crowfoot (*Ranunculus* sp.), bladderwort (*Utricularia* sp.), pondweeds (*Potamogeton* spp.), duckweed (*Lemna minor*), and narrowleaf bur-reed (*Sparganium angustifolium*). Primary threats to marsh systems include: changes in water quality/quantity, diversions, and invasive species.

Fauna

As with the ecological systems, the varied topography and climate in Grand County lead to a diversity of fauna. No vertebrates (at the species level) are endemic to the study area (Armstrong 1972, Ferris and Brown 1981, Woodling 1985, Andrews and Righter 1992, Hammerson 1999).

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

The mixture of bird species in Grand County is very diverse. Species typical of the alpine region include; White-tailed Ptarmigan (*Lagopus leucurus*) and Brown-capped Rosy-Finch (*Leucosticte australis*). Typical inhabitants in spruce-fir and lodgepole forests include a large number of passerine birds such as jays, chickadees, thrushes, tanagers and finches, as well as the Boreal Owl (*Aegolius funereus*) are all known to breed in Grand County. Raptors, including Bald eagle (*Haliaeetus leucocephalus*), Osprey (*Pandion haliaetus*) are found within the lake and river areas, as are waterfowl and some shorebirds. In Middle Park, the Greater Sage-grouse (*Centrocercus urophasianus*) and the Columbian Sharp-tailed Grouse (*Tympanuchus phasianellus columbianus*) are found in sagebrush shrublands, as is the Sage Sparrow (*Amphispiza belli*).

Fish in Grand County range from the State Species of Concern, Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*) to several game fish such as brook trout (*Salvelinus fontinalis*), German brown trout (*Salmo trutta*), lake trout (*Salvelinus namaycush*), Northern pike (*Esox lucius*) and even Kokanee salmon (*Oncorhynchus nerka*) have been introduced to several reservoirs for sport fishing.

Amphibians are uncommon in Grand County. The Northern leopard frog (*Rana pipiens*) has been documented in Muddy Creek and is likely in similar rivers. The boreal toad (*Bufo boreas boreas*) is a State listed Endangered species. Historic accounts are

numerous throughout Grand County at elevations between 8,000 to 12,000 feet, however populations have declined, globally. A boreal toad survey was conducted as part of this project, see Results section. The wood frog (*Rana sylvatica*) is wide-ranging amphibian, found throughout North America. In Colorado, a disjunct population lies in Jackson and Grand counties approximately 450 miles southwest of the closest continuous population (Horstman 2000).

Mammals that are adapted to the low palatability and summer moisture of the sagebrush shrublands of Middle Park include: desert cottontail (*Sylvilagus audubonii*), Wyoming ground squirrel (*Spermophilus elegans*), kangaroo rat (*Dipodomys* spp.), and shrew (*Sorex* spp.) seem to thrive in this environment. Pinon-juniper woodlands provide rich food resource of pinon nuts for many mammals. Rock squirrel (*Spermophilus variegates*) and several species of mice (*Peromyscus* spp.), especially the pinon mouse (*Peromyscus truei*) occur in areas with large rocks and well developed woodlands. Montane forests mammals use conifers for food and shelter, many feed on the cambium layer and stems and make their nests or roost sites on the trees. Bats, common porcupine (*Erethizon dorsatum*), least and Colorado chipmunks (*Tamias minimus*, *T. quadrivittatus*) feed on fruits, nuts, berries, seeds, leaves, and stems. Subalpine forests support a number of mammalian species. Adaptations to harsh winters include; hibernation e.g., yellow-bellied marmot (*Marmota flaviventris*), seasonal color change, e.g., snowshoe hare (*Lepus species*), use of runways beneath the snow (mice and shrews) and use of windswept, snowfree ridges e.g., mountain goat (*Oreamnos americanus*). Wolverine (*Gulo gulo*) and lynx (*Lynx lynx*), boreal forest predators, are restricted in Colorado to this ecosystem. In lieu of hibernation, the American pika (*Ochotona princes*) stores hay piles of alpine grasses and forbs, which become critical in the event of late snowmelt. Wetlands riparian ecosystems support American beaver (*Castor canadensis*) and the muskrat (*Ondatra zibethicus*) both are dependent on river corridors for shelter and food (Fitzgerald et al. 1994). In the 1970's, near the Town of Grand Lake, the Division of Wildlife re-introduced the river otter (*Lutra canadensis*).

Conservation Assessment

Potential Impacts to Biological Diversity in Grand County

General threats that may affect biodiversity on a large, landscape-level scale in Grand County are summarized below. CNHP understands that the issues discussed below are often important parts of a healthy economy and contribute to the well being of our society. The general impacts to biodiversity are mentioned with the hope that good planning can minimize the impacts where critical habitat resides.

Hydrological Modifications

The Colorado-Big Thompson Project is a major supplier of water to eastern Colorado and is therefore of major concern to Grand County (Figure 11). The Colorado-Big Thompson Project, one of the largest water diversion systems in the world, transports Colorado River water over the Continental Divide to the Colorado's eastern slope and plains. This project, completed in 1947, carries water over 250 miles providing supplemental irrigation to about 720,000 acres of land in addition to water for municipal and industrial use, hydroelectric power, and water-oriented recreation opportunities (NCWCD 2005). Grand County is currently in negotiations with Front Range water entities to protect vital minimum stream flows. It is most important that these minimum stream flows remain intact to ensure the integrity of all the associated ecosystems in Grand County.

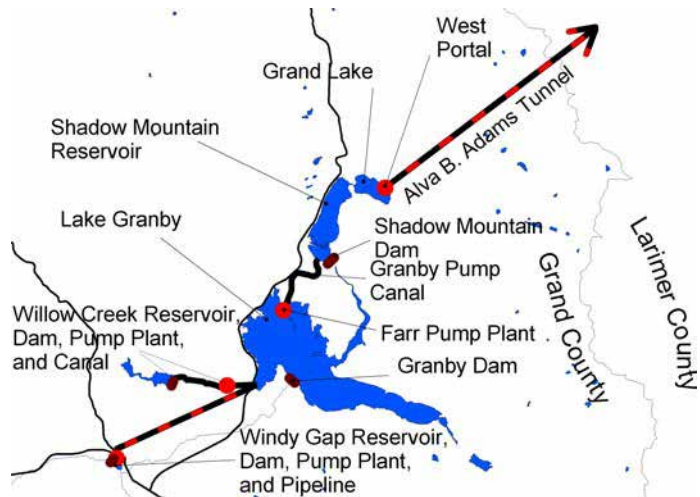


Figure 11. Colorado-Big Thompson Project, Grand County.

Project infrastructure has significantly altered the hydrology of Grand County. Five reservoirs; Shadow Mountain Lake, Lake Granby, Green Mountain, Windy Gap, and Wolford Mountain, seven dams; Shadow Mountain, Grand Lake, Granby, Green Mountain Reservoir, Willow Creek, Windy Gap, and Ritschard, numerous canals, pump stations and powerplants, and a 9.75-foot-diameter, 13 mile long tunnel that extends from the Town of Grand Lake to Mary's Lake on the east side of the Continental Divide, were all constructed specifically for the Colorado-Big Thompson Project.

Portions of water from the Windy Gap and Willow Creek reservoirs are pumped into the Willow Creek Supply Canal where it flows into Lake Granby and pumped into Lake Granby, then into a canal that flows back eastward into Shadow Mountain Reservoir, which also collects water from the North Fork of the Colorado River. Water from

Shadow Mountain Lake is pumped into Grand Lake where the Alva B. Adams tunnel begins, sending water 13 miles eastward to Mary's Lake, over the Continental Divide into Larimer County (USBR 2005).

In 2002 and 2003, the Fraser River was listed as the third most endangered river in the United States due to water diversions (American Rivers 2005). Currently, the Denver Water Board siphons nearly 65% of the Fraser River's flow through its Northern Delivery system. Denver has further plans to increase their diversions by 18,000 acre feet, which will bring their total share of the river to approximately 85% (American Rivers 2005). The Draft Environmental Impact Statement (DEIS) for this planned additional diversion should be released in 2006 (American Rivers 2005). Pollution, most likely related to low flows, is also a major threat to the Fraser River (American Rivers 2005). The water flow below the Moffat Tunnel needs to be sufficient enough to adequately dilute the effluent from wastewater treatment plants in the towns of Winter Park and Fraser relying on the river for water, as do ranches and farms downstream (American Rivers 2005).

Flow regulation has other negative consequences as well. Seasonal flooding is restricted, thus preventing the creation of geomorphic settings (point bars, oxbows, etc.) (Rood and Mahoney 1993). Since different plant communities require different settings, biodiversity is decreased due to the reduction of geomorphic settings. The cumulative effects from dams, reservoirs, and channels are a shift away from diverse multi-aged riparian woodland to mature single aged forest canopies. Rivers with highly regulated flows create problems for vegetation that requires flooding to reproduce, such as cottonwood trees (Rood and Mahoney 1993).

Hydrologic alteration projects within Grand County continue to increase. Wolford Mountain Reservoir, located six miles northeast of Kremmling, is one of Colorado's newest reservoirs completed in 1996 and exemplifies the continued expansion of the Colorado-Big Thompson Project. The Ritschard Dam restrains the Muddy Creek to form this reservoir that flooded 1,550 acres of riparian habitat, as well as known occurrences of the Federally Listed Endangered Osterhout's milkvetch (*Astragalus osterhoutii*) (Dawson 1999).

Development

Commercial and residential development is a serious threat to biodiversity because habitat loss due to development is considered irreversible. The stresses of development can include: habitat loss and fragmentation, non-native species introduction, fire suppression, and domestic animals (Oxley et al. 1974, Coleman and Temple 1994). Since 70% of the land in Grand County is public, the area could be seen as relatively safe from extensive development. However, land isolated or surrounded by developed areas is in danger of being acquisitioned and developed into golf courses, ski areas, resort communities, and vacation homes.

Mining

Grand County has a long history of mining. Arizoba Mine, Beaver Mica Mine, Big Dike Lode, Blue Ridge Mine, Bobtail Mine, El Kebir Mine, Elk Mountain Mine, Happy

Dreams Mine, Hartman Mine, High Lonesome Mine, La Plata Mine, Mitchell Mine, Monarch Mine, Ruth Group of Claims Smith Creek Mine, and Wolverine Mine are all historic mines located in Grand County.

The Henderson Mine is the only active mining operation in Grand County. The mine is located east of the Continental Divide in Clear Creek County and the mill, connected by the world's largest conveyor of its kind, is located 15 miles to the west in Grand County. The Henderson Mine is the world's largest producers of molybdenum (commonly referred to as "moly") producing on average 30.1 million pounds from 6.9 million tons of ore a year. Moly is metal used to strengthen steel and occurs in veins and fractures within Tertiary-age Red Mountain Stock, a quartz monzonite intrusive. Moly mining in the area began during World War I, but the Henderson Mine has only been in operation since 1976. However, since that time the mine has extracted more than 160 million tons of ore and produced over 770 million pounds of moly (Climax 2005).

Livestock Grazing

Ranching pursuits originally brought settlers to the area that is now known as Grand County. Even now, ranching is one of the major economic drivers, second only to tourism. The long-term and improper use of land for livestock can lead to stream bank erosion, stream incising, water table lowering, channel morphology altering, plant regeneration impairment, the establishment of non-native species, shifting of community structure and composition, water quality degradation, and general diminishment of riparian and wetland functions (Windell et al. 1986).

Logging

Timber extraction has long been a practice of the National Forest Service, which monitors the practice closely. However, the majority of logging operations require a substantial network of roads, for this reason alone it warrants additional attention (see "Roads" for further information).

Recreation

Recreation and tourism in Grand County is such a large part of the economy that tourists generally outnumber the permanent residents, especially during weekend and holidays. The County has long been known as a "sportsman's paradise" where excellent hunting, fishing, hiking and backpacking abounds in the summer, and skiing and snowmobiling in the winter. Winter Park Ski Area/Mary Jane and SolVista Ski Resorts, along with the Arapaho-Roosevelt National Forest, are some of the most popular winter and summer destinations for Front Range recreational users.

Roads

Roads are the physical representation of the above mentioned threats to biodiversity. They are a logical progression of development, required in the practices of hydrological modification, mining and logging, and they are a major cause of invasion of non-native plant species and habitat fragmentation. Biological threats associated with roads include: invasion of non-native species, increased impacts of domestic animals (dogs and cats), fragmentation of habitats, erosion, pollution, and road mortality (Noss et al. 1997). In

addition, roads function as conduits, barriers, habitats, sources, and sinks for many species (Foreman 1995). Water runoff from roadways can contain heavy metals and sediments that may impact local vegetation. Road networks inhibit important interior species because they interrupt horizontal ecological flows and alter the spatial pattern of the landscape (Forman and Alexander 1998).

The effects of roads on wildlife can be attributed to both crossing roads (due to roadkill) and not crossing, or avoidance of roads. Traffic noise, visual disturbance, pollutants, and predators along roads are all variables in avoidance of roads (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

Invasion of non-native species is one of the major threats to biodiversity worldwide and Grand County is no different. Noxious non-native plant species tend to be early colonizers of disturbed areas, regardless of the source, that out-compete natives forming monocultures (Young 1981). Some of the non-native plant species that can be found in Grand County are: burdock (*Arcticum minus*), Canada thistle (*Cirsium arvense*), common dandelion (*Taraxacum officinale*), hounds tongue (*Cynoglossum officinale*), Kentucky bluegrass (*Poa pratensis*), musk thistle (*Cardus nutans*), orchard grass (*Dactylis glomerata*), oxeye daisy (*Chrysanthemum leucanthemum*), red clover (*Trifolium pretense*), Redtop (*Agrostis gigantea*), Russian knapweed (*Centaurea repens*), smooth brome (*Bromus inermis*), cheatgrass (*Bromus tectorum*) timothy (*Phlem pretense*), white-dutch clover (*Trifolium repens*), white sweet clover (*Melilotus officinalis*), and yellow sweet clover (*Melilotus lupulina*).

Fragmentation and Edge Effects

In an ecological context, edges are the outer boundary of an ecosystem where it abruptly grades into another type of habitat (Forman and Gordon 1986). These edges can be created by both human influence (roads, timber harvesting, agricultural and rangeland practices etc.) and natural processes (fires, floods, avalanches, etc.). Introduction of non-native species is a major result of human induced edges because such species are early colonizers adapt at surviving in disturbed areas (Young 1981). Edges become more abundant as the development and fragmentation of large landscapes continues. This threatens the existence of specialist species, reduces the mobility of large mammals or migratory waterbirds that require these large landscapes, and increases non-native species.

Recommended Conservation Strategies

Conservation Strategies can be classified as three major types:

1. Land protection accomplished through conservation easements, land exchanges, long term leases, purchase of mineral or grazing rights, acquisition, or government regulation;
2. Management of the land influenced so that significant resources are protected; and
3. Public education about the significant ecological values of the county to engender support for land use decisions that protect these values.

The first step in facilitating any of the conservation strategies suggested above is to identify the significant elements of biodiversity and their locations in the county. This report provides information necessary for this first step. The next step is to use this information to conserve these elements and the areas that support them. The PCA descriptions within this report provide protection and management suggestions for most areas identified during the survey. However, some general recommendations for conservation of biological diversity in Grand County are given here.

1. Develop and implement a plan for protecting the Potential Conservation Areas profiled in this report, with most attention directed toward areas with a biodiversity rank of B1, B2 and B3. The PCAs in this report provide a basic framework for implementing a comprehensive conservation program. The B1, B2 and B3 sites, because they have global biological significance, are in need of priority attention. Consider incentive-based programs such as purchasing development rights or outright purchase from willing owners of land for significant sites that are in need of protection. Support local organizations, such as land trusts, in purchasing or acquiring conservation easements for protection of biological diversity or open space. Explore opportunities to form partnerships to access state and federal funding for conservation projects. Continue to promote cooperation among local entities to preserve the county's biodiversity. Encourage county leadership to institutionalize consideration of significant biological resources in land use planning.

2. Use this report in the review of proposed activities in or near Potential Conservation Areas to determine whether or not activities adversely affect elements of biodiversity. All of the PCAs presented contain elements of biodiversity of state or global significance. Weighing the biodiversity represented by PCAs should allow planners and biologists to consider natural resource conservation when making land use decisions according to the Grand County Master Plan (1998) and the Grand County Lands Conservation Plan (Shapins Associates, Inc. 1999).

Certain land uses on or near a site may affect the element(s) present there. Range-restricted species may be especially vulnerable to habitat destruction, while 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 are considered, they should be compared to the maps presented herein (also available in GIS format). 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. CNHP routinely conducts site-specific environmental reviews and should be considered a valuable resource. Also, CNHP is continually updating biodiversity data throughout the state and can provide up-to-date information in the area of concern. To contact CNHP's Environmental Review Coordinator call (970) 491-7331. Other key partners, such as the Colorado Division of Wildlife, can be valuable resources as well, particularly in evaluating potential impacts to biological resources not tracked by CNHP (e.g., game species).

3. Recognize the importance of larger, contiguous natural communities.

While the PCAs identified in this report contain known locations of significant elements of natural diversity, protection of large areas in each vegetation type, especially where these are connected, may ensure that we do not lose species that have not yet been located. Grand County supports one of the largest, continuous sagebrush shrublands known in the western U.S. The Greater Sage-grouse, Columbian Sharp-tailed Sage-grouse, and other sagebrush obligates require this habitat to ensure their viability. Large, contiguous old growth spruce-fir forests are also important for not only pine martens, elk, deer, and moose, but for future generations to enjoy. Working to protect large blocks of land in each of the major vegetation types in the county and avoiding fragmenting large natural areas unnecessarily with roads, trails, etc. is encouraged. Although large migrating animals like deer and elk are not tracked by CNHP as rare species, they are part of our natural diversity, and their needs for winter range and access to protected corridors to food and water should be taken into consideration. Fragmentation of the landscape also affects smaller animals and plants, opening more edge habitats and introducing exotic species. Encourage cluster developments that designate large common areas for preservation of natural communities, as an alternative to scattering residences over the landscape with a house on each 35-acre parcel. Work with developers early in the planning process to educate them about the benefits of retaining natural areas. Locate trails and roads to minimize impacts on native plants and animals. See Forman and Alexander (1998) for an excellent review of the literature on the ecological effects of roads. See *Planning Trails with Wildlife in Mind* published by the State Trails Program (Colorado Department of Natural Resources 1998) for suggestions regarding planning trails with minimum impacts to wildlife.

4. Increase efforts to protect biodiversity by promoting cooperation and incentives among landowners, pertinent government agencies, and non-profit conservation organizations. Involve all stakeholders in land use planning. The long-term protection of natural diversity in Grand County will be facilitated by the cooperation of private landowners, businesses, 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. By developing incentives that encourage biodiversity considerations in land-use planning, the likelihood of conserving biodiversity should increase. Such incentives will make planning for conservation a higher priority for private and public entities.

5. Promote wise management of the biodiversity resources that exist within Potential Conservation Areas. Development of a site-specific conservation plan is a necessary component of the long-term protection of a PCA. Because some of the most serious impacts to Grand County's ecosystems are at a large scale (e.g., altered hydrology, residential and commercial 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, the Colorado Division of Wildlife, the Natural Resources Conservation Service, The Nature Conservancy, and various academic institutions. With the current rate of population growth in Colorado, rare and imperiled species will likely decline if not given appropriate protection or management attention.

Coordinate with managers of public parks or other public lands that support sensitive biological resources. Engage local citizens, groups, and organizations (e.g., schools, CSU Cooperative Extension, 4-H clubs, Colorado Native Plant Society, and Audubon Society) in assisting with management and monitoring projects on public lands. Make a concerted effort to involve individual landowners in conservation dialogue, as applicable.

6. Stay informed and involved in public land management decisions. Approximately 70% of Grand County is publicly owned. The Forest Service owns approximately 50% and the National Park Service approximately 8%. The State and the Bureau of Land Management own approximately 4% and 12%, respectively. Many of the PCAs in Grand County are on public land and may be protected from development, but not from incompatible uses. Even ownership is not always secure, since federal and state agencies are becoming more and more involved in land exchanges. Encourage protection for the most biologically significant sites on public lands by implementing compatible management activities designated in Forest Management Plans, Grazing Management Plans, etc.

7. Continue inventories and monitoring where necessary, including inventories for species that cannot be surveyed adequately in one field season and continue inventories on lands that CNHP could not access in 2005. Not all targeted inventory areas can be surveyed in one field season due to several factors, including 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 were not documented during the survey. Thus, it is recommended that this report and the data included within it serve as a guide for subsequent surveys of Grand County.

8. Continue to take a proactive approach to weed and exotic species control.

Recognize that weeds affect both agriculture and native plant communities. 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, exotic, invasive species such as tamarisk, Russian olive, dalmation toadflax, purple loosestrife, and non-native fish species. Further, natural area managers, public agencies, and private landowners should be encouraged to remove these species from their properties. Enforce the use of weed-free forage on horse trails. Encourage the use of native species for revegetation and landscaping efforts. Ideally, seed should be locally harvested. This includes any seeding done on county road right-of-ways. 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://www.parks.state.co.us/home/publications.asp>.

9. Encourage public education functions and publications. A significant early step in the process of conserving biodiversity is educating local citizens and other stakeholders on the value that such areas offer the public. As described in this report, Grand County is rich in animal and plant diversity and includes some of the most unique environments in Colorado. Conveying the value and function of these habitats and the species that inhabit them to the public can generate greater interest in conserving lands. Conducting forums or presentations that highlight the biodiversity of Grand County should increase awareness of the uniqueness of the habitats within the county. Similarly, providing educational pamphlets or newsletters that explain why these areas are so valuable can increase public interest and support for biodiversity conservation. Consider developing a community conservation website to provide information on natural resource, biological diversity, and conservation opportunities in Grand County. Enlist the assistance of local media in public education efforts.

10. Develop and implement comprehensive program to address wetland loss. In conjunction with the information contained in this report, information regarding the degree and trend of loss for all wetland types (i.e., salt meadows, emergent marshes, riparian forests, seeps/springs, etc.) should be sought and utilized to design and implement a comprehensive approach to the management and protection of Grand County wetlands. Encourage and support statewide wetland protection efforts such as the Division of Wildlife's Wetlands Program. County governments are encouraged to support research efforts on wetlands to aid in their conservation. Countywide education on the importance of wetlands could be implemented through the county extension service or other local agencies. Encourage communication and cooperation with landowners regarding protection of wetlands in Grand County.

METHODS

The methods for assessing and prioritizing conservation needs over a large area, such as a county, are necessarily diverse. CNHP follows a general method that is continuously being developed specifically for this purpose. The *Survey for Critical Biological Resources in Grand County* was conducted in several steps summarized below. Additionally, input from Grand County and its stakeholders was sought at all stages.

Collect Available Information

CNHP databases were updated with information regarding the known locations of species and significant plant communities within Grand County. A variety of sources were searched for this information. The Colorado State University museums and herbarium were searched, as were plant and animal collections at the University of Colorado, Rocky Mountain Herbarium, and local private collections. Both general and specific literature sources were incorporated into CNHP databases, either in the form of locational information or as biological data pertaining to a species in general. Other information was gathered to help locate additional occurrences of natural heritage elements. Such information covers basic species and community biology including range, habitat, phenology (reproductive timing), food sources, and substrates. This information was also entered into CNHP databases. DOW riparian maps were used as additional tools for identification of wetland and riparian habitats.

Identify Rare or Imperiled Species and Significant Plant Communities with the Potential to Occur in the County

The information collected in the previous step was used to refine a list of potential species and natural plant communities and to refine our search areas. In general, species and plant communities that have been recorded from Grand County or from adjacent counties are included in this list. Over 150 rare species and significant plant communities were targeted in this survey. Given the limited amount of time and funding, a specific subset of species and communities were the priority of our inventory efforts. These elements were considered to be a priority because of their high level of biological significance (G1-G3) and/or because they are known to occur in areas that are subject to various development pressures such as hydrological alterations and residential development.

Identify Targeted Inventory Areas

Survey sites were chosen based on their likelihood of harboring rare or imperiled species or significant plant communities (see Map 1). Previously documented locations were targeted, and additional potential areas were chosen using available information sources. Areas with potentially high natural values were selected using soil surveys, geology maps, vegetation surveys, personal recommendations from knowledgeable local residents, and numerous roadside surveys by our field scientists.

Using the biological information stored in the CNHP databases, areas having the highest potential for supporting specific elements were identified. Those chosen for survey sites appeared to be in the most natural condition. In general, this means those sites that are

the largest, least fragmented, and relatively free of visible disturbances such as roads, trails, fences, and quarries were identified.

The above information was used to delineate Targeted Inventory Areas (TIAs) that were believed to have relatively high probability of harboring significant natural resources. These areas focused on private lands. Additional TIAs were identified by Grand County and its stakeholders.

Roadside surveys were useful in further resolving the natural condition of these areas. The condition of shrublands is especially difficult to discern from aerial photographs, and a quick survey from the road can reveal such aspects as weed infestation or vegetation composition.

Because there were limited resources to address an overwhelming number of potential sites, surveys for all elements were prioritized by the degree of imperilment. For example, the species with Natural Heritage Program ranks of G1-G3 were the primary target of our inventory efforts. Although species with lower Natural Heritage Program ranks were not the main focus of inventory efforts, many of these species occupy similar habitats as the targeted species, and were searched for and documented if encountered.

Contact Landowners

Obtaining permission to conduct surveys on private property was essential to this project. Once survey sites were chosen, land ownership of these areas was determined using GIS land ownership coverage obtained from Grand County assessor office or stakeholders. Landowners were then either contacted by phone or in person. If landowners could not be contacted, or if permission to access the property was denied, this was recorded and the site was not visited. **Under no circumstances were private properties surveyed without landowner permission.**

Conduct Field Surveys

Survey sites where access could be obtained were visited at the appropriate time as dictated by the seasonal occurrence (or phenology) of the individual elements. It was essential that surveys took place during a time when the targeted elements were detectable. For instance, breeding birds cannot be surveyed outside of the breeding season, and plants are often not identifiable without flowers or fruit that are only present during certain times of the year.

The methods used in the surveys vary according to the elements that were being targeted. In most cases, the appropriate habitats were visually searched in a systematic fashion that would attempt to cover the area as thoroughly as possible in the given time. Some types of organisms require special techniques to document their presence. These are summarized below:

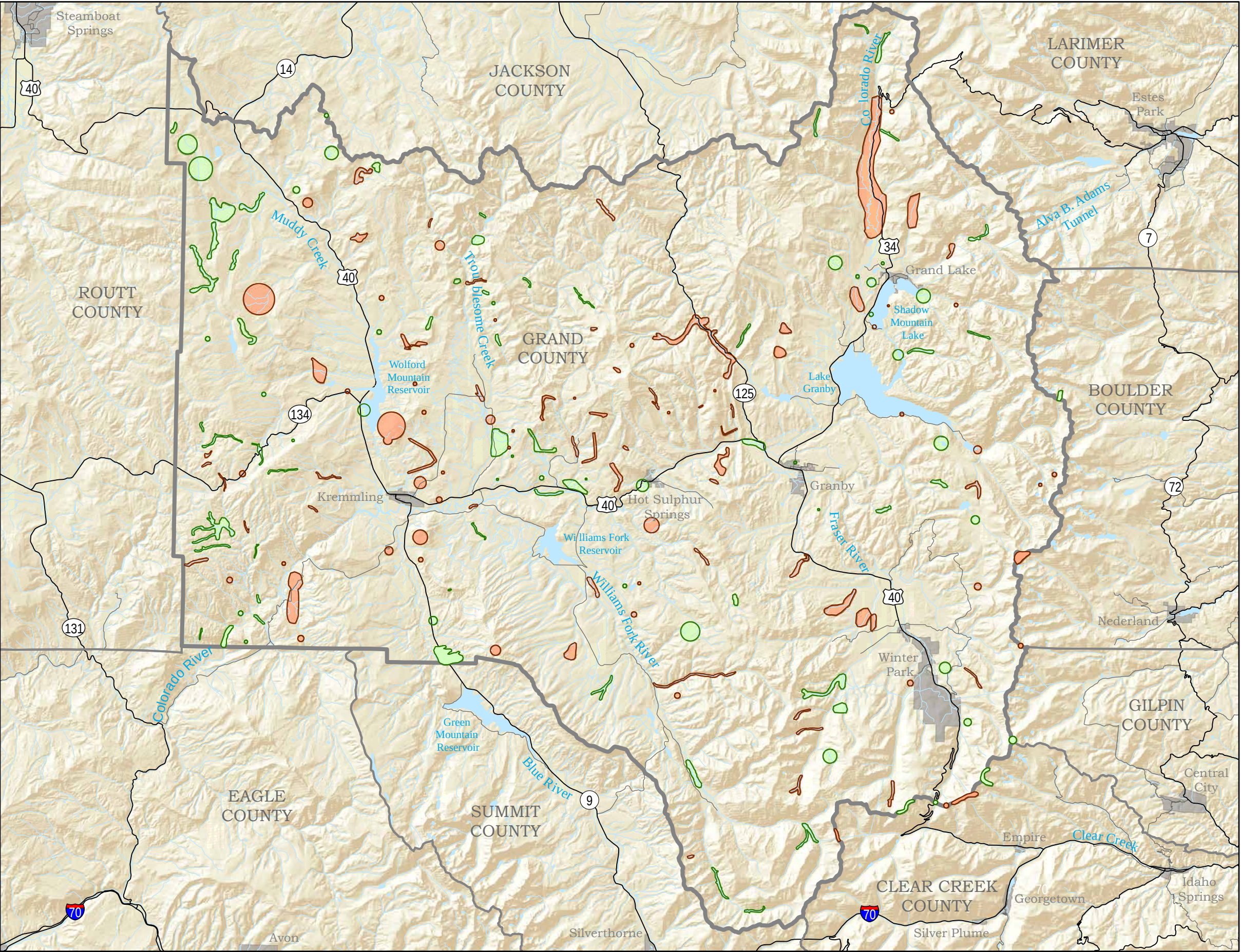
- Plants: visual observation
- Plant communities: visual observation
- Amphibians: visual observation and capture using aquatic dip nets
- Birds: visual observation or identification by song or call

Where necessary and permitted, voucher specimens were collected and deposited in local university museums and herbaria.

When a rare species or significant plant community was discovered, its precise location and known extent was recorded with a global positioning system (GPS) unit. Other data recorded at each occurrence include numbers observed, breeding status, habitat description, disturbance features, observable threats, and potential protection and management needs. The overall significance of each occurrence, relative to others of the same element, was estimated by rating the size of the population or community, the condition or naturalness of the habitat, and the landscape context (its connectivity and its ease or difficulty of protecting) of the occurrence. These factors are combined into an element occurrence rank, useful in refining conservation priorities. See the previous section on Natural Heritage Program Methodology for more about element occurrence ranking.

Site visits and assessments were conducted on the following two levels:

1. Roadside or adjacent land assessments. Many of the sites could be viewed at a distance from a public road. 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 can include ditching, adventive plant species, plant species indicative of intensive livestock use, stream bank destabilization, major hydrologic alterations, extensive 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 assessments were the preferred method, as it is the only technique that can yield high-confidence statements concerning the known or potential presence of rare and imperiled elements or excellent examples of common natural communities. On-site assessments are also the most resource intensive because of the effort required to contact landowners. In a few 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.



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Map Date: 5/10/2006

Legend

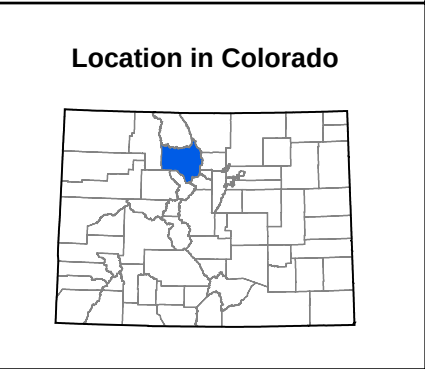
CNHP Targeted Inventory Areas

Visited
Not Visited

Colorado Base Data

- Counties
- Municipalities
- Lakes, Reservoirs
- Rivers, Streams, Creeks
- Highways
- Major Roads

Digital Elevation Model Produced by the U.S.G.S.



Targeted Inventory Areas are believed to have a relatively high probability of harboring significant biological resources.

N

0 2.5 5 10 Miles

Map 1. Targeted Inventory Areas in Grand County

General Field Information

- A list of all plant associations in the wetland complex, including the amount of area covered by plant communities using International Classification of Terrestrial Vegetation (Comer et al. 2003) or CNHP's Statewide Wetland Classification (Carsey et al. 2003a).
- Vegetation data for each major plant association were collected using visual ocular estimates of species cover in a representative portion of the plant association.
- A sketch of the site layout, with distribution of plant community types (this was generally done on the 7.5-min. USGS topographic map, but occasionally for clarity a separate map was drawn on the site survey form)
- UTM coordinates from Garmin GPS 12 Personal Navigator
- Elevation (from 7.5-min. USGS topographic maps and GPS)
- Current and historic land use (e.g., grazing, logging, recreational use) when apparent
- Notes on geology and geomorphology
- Reference photos of the site
- Indicators of disturbance such as logging, grazing, off-road use, flooding, etc.

Natural Heritage Information

- A 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

- Water source
- Hydroperiod
- Water chemistry (pH and conductivity)
- General soils description (these are based on either a detailed description of a soil profile in the field (e.g., horizons, texture, color, cobble size, percent mottling)

Delineate Potential Conservation Areas

The objective for this survey was to delineate and prioritize specific areas for conservation efforts. The purpose of the PCA is to identify a land area that can provide the habitat and ecological processes upon which a particular element occurrence, or suite of element occurrences, depends for its continued existence. The best available knowledge about each species' life history is used in conjunction with information about topographic, geomorphic, and hydrologic features; vegetative cover, and current and potential land uses. In developing the boundaries of a PCA, CNHP scientists consider a number of factors that include, but are not limited to:

- ecological processes necessary to maintain or improve existing conditions;
- species movement and migration corridors;
- maintenance of surface water quality within the PCA and surrounding watershed;
- maintenance of the hydrologic integrity of the groundwater;
- land intended to buffer the PCA against future changes in the use of surrounding lands;
- exclusion or control of invasive exotic species; and
- land necessary for management or monitoring activities.

RESULTS

Results of the 2005 Grand County survey confirm that there are many areas with high biological significance. Several extremely rare plants and animals depend on these areas for survival (Table 7). A total of 43 rare or imperiled plant species, 18 rare or imperiled animal species, and 66 plant communities of concern were either documented from other data sources or from the 2005 fieldwork.

CNHP has identified 53 Potential Conservation Areas (PCAs) in Grand County (Table 8, Map 2). Of the 53 PCAs presented in this report,

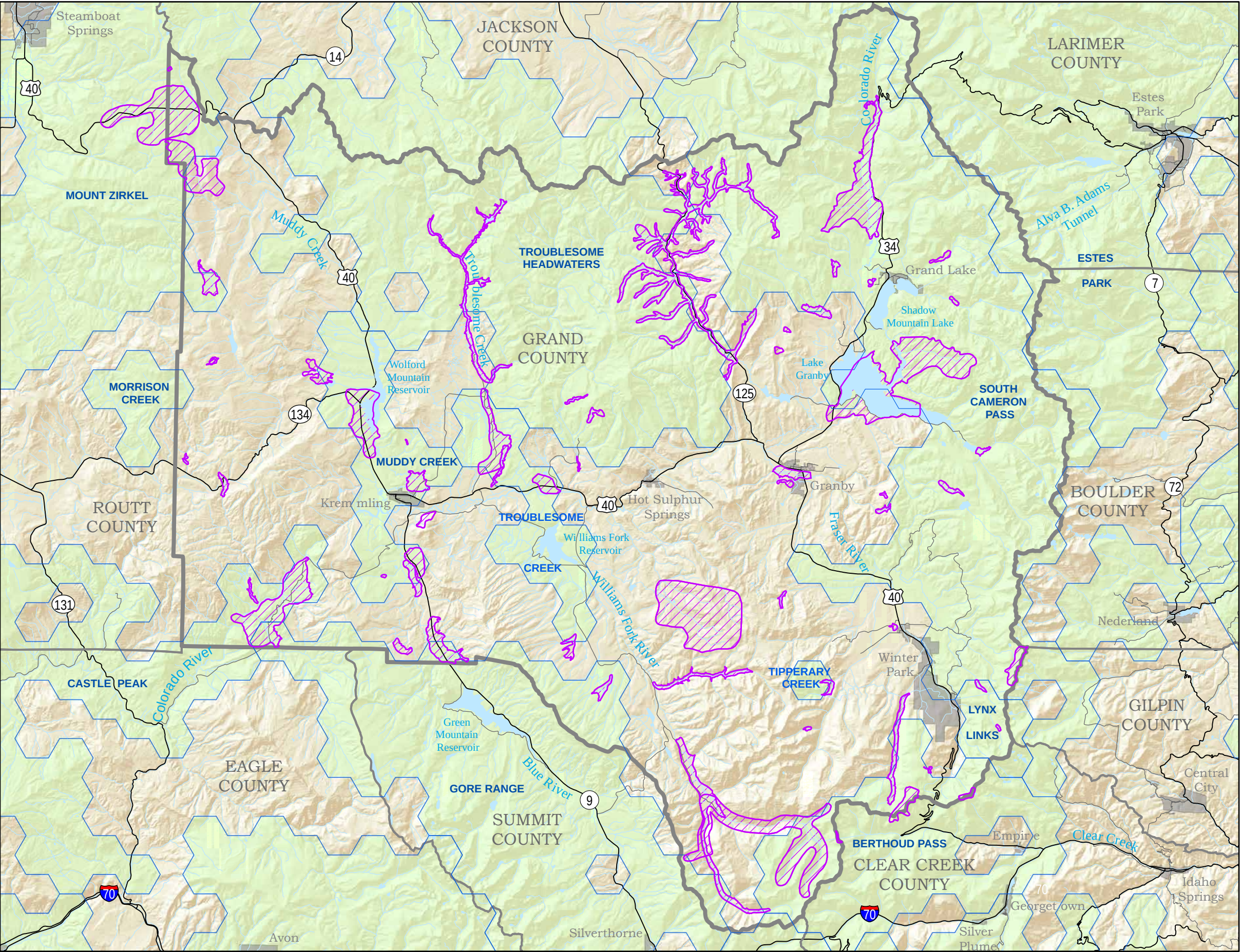
- Seven are of outstanding biodiversity significance (B1),
- Two are of very high significance (B2),
- Twenty nine are of high significance (B3), and
- Fifteen are of moderate significance (B4).

All of the B1 sites were driven by populations of the Federally Listed Endangered plants; Osterhout's milkvetch (*Astragalus osterhoutii*) and Penland's penstemon (*Penstemon penlandii*). All B1 PCAs were visited and thoroughly surveyed; in most cases the boundaries were enlarged to encompass newly documented sub-populations. Two of the B2 sites support good occurrences of the globally imperiled American mannagrass (*Glyceria grandis*) herbaceous vegetation. This wetland plant association is found only in wetlands with saturated soils, typically with standing water throughout the summer. The majority of the B3 sites were based on excellent to good occurrences of riparian shrub and forest plant associations.

Three sites visited during the survey are presented as Sites of Local Significance (SLS). These sites may not meet the criteria for inclusion into CNHP's Biodiversity Tracking and Conservation Data System (BIOTICS), but contribute to the local biological diversity and character of the region, and warrant consideration when planning management activities.

Grand County is truly unique with an amazing richness of rare fauna and flora well worth preserving for future generations. Overall, the concentration and quality of imperiled elements and habitats attest to the fact that conservation efforts in Grand County will have both statewide and global significance. This is substantiated by conservation assessments conducted by other agencies. For example, The Nature Conservancy (TNC) has completed assessments of the Southern Rocky Mountains ecoregion (Neeley et al. 2001) and outlined 13 TNC Southern Rocky Mountain projects with important conservation values in Grand County (Map 2):

Morrison Creek, Muddy Creek, South Cameron Pass, Tipperary Creek, Troublesome Creek, Troublesome Creek Headwaters, Castle Peak, Berthoud Pass, Lynx Links, Mount Zirkel, Estes Park, Gore Range, and Grays/Torrey.



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Map Date: 5/10/2006

Legend

The Nature Conservancy

Portfolio Sites

Colorado Natural Heritage Program

Potential Conservation Areas (PCAs)

Colorado Base Data

- Counties
- Municipalities
- Lakes, Reservoirs
- Rivers, Streams, Creeks
- Highways
- Major Roads

Digital Elevation Model Produced by the U.S.G.S.

Location in Colorado

The inset map shows the state of Colorado with its county boundaries. Grand County is highlighted in blue, indicating its location within the state.

PCAs represent CNHP's best estimate of the primary area supporting long-term survival of targeted species, subspecies and natural communities.

N

0 2.5 5 10 Miles

Map 2. The Nature Conservancy Portfolio Sites in Grand County

Significant Elements Associated with Wetlands and Riparian Areas

Table 7 presents CNHP elements of biological significance known to occur in or associated with wetlands and riparian areas in the Potential Conservation Areas (PCAs) in this report. This is not a comprehensive list of all elements of biological significance known to occur in Grand County, but rather only includes those elements associated with PCAs that are significant enough to be archived in CNHP's Biodiversity Tracking and Conservation Data System (BIOTICS).

For a key to Federal and State Status Codes, please refer to the table of Federal and State Agency special designations for rare species, within the section of the report entitled "The Natural Heritage Network and Ranking System".

Table 7. Colorado Natural Heritage Elements Known From Grand County (as of 12/2005).

Scientific Name	Common Names	Global Rank	State Rank	US ESA	Federal Sensitive List	State Sensitive List
Amphibians						
<i>Bufo boreas</i>	Western toad (Southern Rocky Mountains)	G4T1Q	S1	C	FS	E
<i>Rana sylvatica</i>	wood frog	G5	S3		FS	
Birds						
<i>Aegolius funereus</i>	Boreal Owl	G5	S2			
<i>Amphispiza belli</i>	Sage Sparrow	G5	S3B		FS	
<i>Centrocercus urophasianus</i>	Greater Sage-grouse	G4	S4		BLM	SC
<i>Grus canadensis tabida</i>	Greater Sandhill Crane	G5T4	S2B			SC
<i>Haliaeetus leucocephalus</i>	Bald Eagle	G4	S1B,S3 N	LT		
<i>Lagopus leucurus</i>	White-tailed Ptarmigan	G5	S4		FS	
<i>Leucosticte australis</i>	Brown-capped Rosy-Finch	G4	S3B,S4 N			
<i>Tympanuchus phasianellus columbianus</i>	Columbian Sharp-tailed Grouse	G4T3	S2		FS/BLM	
Fish						
<i>Gila robusta</i>	roundtail chub	G3	S2		BLM	SC

Scientific Name	Common Names	Global Rank	State Rank	US ESA	Federal Sensitive List	State Sensitive List
<i>Oncorhynchus clarki pleuriticus</i>	Colorado River cutthroat trout	G4T3	S3		FS/BLM	SC
Insects						
<i>Callophrys mossii schryveri</i>	Schryver's elfin	G4T3	S2S3			
<i>Erebia pawlowskii</i>	yellow dotted alpine	G5	S3			
<i>Oeneis jutta reducta</i>	Rocky Mountain jutta artic	G5T4	S1			
Mammals						
<i>Gulo gulo</i>	wolverine	G4	S1		FS	E
<i>Lynx canadensis</i>	Canada lynx	G5	S1	LT		E
<i>Sorex hoyi montanus</i>	pygmy shrew	G5T2T3	S2		FS	
Plant Communities						
<i>Abies lasiocarpa</i> / <i>Mertensia ciliata</i> forest	subalpine fir / bluebells forest	G5	S5			
<i>Alnus incana</i> - <i>Salix</i> (<i>monticola</i> , <i>lucida</i> , <i>ligulifolia</i>) shrubland	thinleaf alder- mixed willow (mountain willow, shining willow, strapleaf willow) shrubland	G3	S3			
<i>Alnus incana</i> - <i>Salix drummondiana</i> shrubland	thinleaf alder - Drummond willow shrubland	G3	S3			
<i>Alnus incana</i> / <i>Cornus sericea</i> shrubland	thinleaf alder / red-osier dogwood shrubland	G3G4	S3			
<i>Alnus incana</i> / mesic forbs shrubland	thinleaf alder / mesic forbs shrubland	G3	S3			
<i>Amelanchier utahensis</i> / <i>Pseudoroegneria spicata</i> shrubland	Utah Serviceberry / blue bunch wheat grass shrubland	G2G3	S2S3			
<i>Artemisia cana</i> ssp. <i>viscidula</i> / <i>Festuca thurberi</i> shrubland	silver sagebrush / Thurber fescue shrubland	G2	S1			
<i>Artemisia tridentata</i> ssp. <i>tridentata</i> / <i>Sarcobatus vermiculatus</i> shrubland	big sagebrush/ greasewood shrubland	G3	S3			
<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> / <i>Pseudoroegneria spicata</i> shrub herbaceous vegetation	Wyoming sagebrush / blue bunch wheat grass shrub herbaceous vegetation	G4	S3?			

Scientific Name	Common Names	Global Rank	State Rank	US ESA	Federal Sensitive List	State Sensitive List
<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> / <i>Pascopyrum smithii</i> shrubland	Wyoming sagebrush / Western wheat grass shrubland	G4	S3			
<i>Betula nana</i> / mesic forbs - mesic graminoids shrubland	bog birch / mesic forbs-graminoid shrubland	G3G4	S3			
<i>Calamagrostis canadensis</i> herbaceous vegetation	bluejoint reedgrass herbaceous vegetation	G4	S4			
<i>Carex aquatilis</i> - <i>Carex utriculata</i> perched wetland	water sedge-beaked sedge herbaceous vegetation	G3	S3			
<i>Carex aquatilis</i> herbaceous vegetation	water sedge herbaceous vegetation	G5	S4			
<i>Carex foenea</i> herbaceous vegetation	dry spike sedge herbaceous vegetation	GU	S1?			
<i>Carex pellita</i> herbaceous vegetation	wooly sedge herbaceous vegetation	G3	S3			
<i>Carex rupestris</i> - <i>Geum rossii</i> herbaceous vegetation	curly sedge - Ross' avens herbaceous vegetation	G4	S4			
<i>Carex simulata</i> herbaceous vegetation	analogue sedge herbaceous vegetation	G4	S3			
<i>Carex utriculata</i> perched wetland	beaked sedge perched wetland	G3?	S3			
<i>Danthonia intermedia</i> herbaceous vegetation	timber oatgrass herbaceous vegetation	G2G3	S2S3			
<i>Deschampsia caespitosa</i> herbaceous vegetation	tufted hairgrass herbaceous vegetation	G4	S4			
<i>Distichlis spicata</i> herbaceous vegetation	inland saltgrass herbaceous vegetation	G5	S5			
<i>Eleocharis quinqueflora</i> - <i>Triglochin</i> spp. herbaceous vegetation	few-flowered spikerush-arrowgrass herbaceous vegetation	GU	S2			
<i>Eleocharis quinqueflora</i> - <i>Triglochin</i> spp. herbaceous vegetation	few-flowered spikerush-arrowgrass herbaceous vegetation	GU	S2			
<i>Eleocharis quinqueflora</i> herbaceous vegetation	few-flowered spikerush herbaceous vegetation	G4	S3S4			
<i>Glyceria grandis</i> herbaceous vegetation	American mannagrass herbaceous vegetation	G2?	S2			

Scientific Name	Common Names	Global Rank	State Rank	US ESA	Federal Sensitive List	State Sensitive List
<i>Juniperus scopulorum</i> / <i>Pseudoroegneria spicata</i> woodland	Rocky Mountain juniper /blue bunch wheatgrass woodland	G4	S2S3			
<i>Kobresia myosuroides</i> - <i>Geum rossii</i> herbaceous vegetation	bog sedge-Ross avens herbaceous vegetation	G5	S5			
<i>Paronychia pulvinata</i> - <i>Silene acaulis</i> dwarf shrubland	Rocky Mountain nailwort-moss campion shrubland	G5	S5			
<i>Picea engelmannii</i> / <i>Caltha leptosepala</i> forest	Engelmann spruce / marsh marigold forest	G3?	S1			
<i>Picea engelmannii</i> / <i>Equisetum arvense</i> forest	Engelmann spruce / horsetail forest	G4	S2			
<i>Picea engelmannii</i> / <i>Polemonium pulcherrimum</i> forest	Engelmann spruce / western polemonium forest	G5	S4			
<i>Picea pungens</i> / <i>Alnus incana</i> woodland	Colorado blue spruce / thinleaf alder woodland	G3	S3			
<i>Pinus contorta</i> / <i>Shepherdia canadensis</i> forest	lodgepole pine / russett buffaloberry forest	G3G4	S3S4			
<i>Pinus contorta</i> / <i>Vaccinium scoparium</i> forest	lodgepole pine / grouse whortleberry forest	G5	S4			
<i>Populus angustifolia</i> - <i>Pseudotsuga menziesii</i> woodland	narrowleaf cottonwood / Douglas fir woodland	G3	S2			
<i>Populus angustifolia</i> / <i>Alnus incana</i> woodland	quaking aspen / thinleaf alder woodland	G3	S3			
<i>Populus angustifolia</i> / <i>Betula occidentalis</i> woodland	narrowleaf cottonwood / river birch woodland	G3	S2			
<i>Populus angustifolia</i> / <i>Salix (monticola, drummondiana, lucida)</i> woodland	narrowleaf cottonwood / mixed willow woodland	G3	S3			
<i>Populus tremuloides</i> / <i>Shepherdia canadensis</i> forest	quaking aspen / russett buffaloberry woodland	G3G4	S3?			
<i>Populus tremuloides</i> / <i>Vaccinium myrtillus</i> forest	quaking aspen / whortleberry forest	G3	S3			
<i>Salix arctica</i> / <i>Geum rossii</i> dwarf shrubland	Arctic willow / Ross's aven dwarf shrubland	G4	S4?			

Scientific Name	Common Names	Global Rank	State Rank	US ESA	Federal Sensitive List	State Sensitive List
<i>Salix boothii</i> / mesic forbs shrubland	Booth willow/ mesic forbs shrubland	G3	S3			
<i>Salix boothii</i> / mesic graminoids shrubland	Booth willow / mesic graminoids shrubland	G3?	S3			
<i>Salix brachycarpa</i> / <i>Geum rossii</i> - <i>Deschampsia caespitosa</i> shrubland	short-fruited willow / Ross's avens-tufted hairgrass shrubland	G4	S3S4			
<i>Salix drummondiana</i> / <i>Calamagrostis canadensis</i> shrubland	Drummond willow/ bluejoint reedgrass shrubland	G3	S3			
<i>Salix drummondiana</i> / <i>Carex aquatilis</i> shrubland	Drummond willow / water sedge shrubland	G2G3	S2S3			
<i>Salix drummondiana</i> / mesic forbs shrubland	Drummond willow / mesic forbs shrubland	G4	S4			
<i>Salix exigua</i> / barren ground shrubland	sandbar willow/ barren ground shrubland	G5	S5			
<i>Salix geyeriana</i> - <i>Salix monticola</i> / <i>Calamagrostis canadensis</i> shrubland	Geyer willow - Mountain willow / bluejoint reedgrass shrubland	G3	S3			
<i>Salix geyeriana</i> / <i>Calamagrostis canadensis</i> shrubland	Geyer willow / bluejoint reedgrass shrubland	G5	S3			
<i>Salix geyeriana</i> / mesic graminoids shrubland	Geyer willow / mesic graminoids shrubland	G3	S3			
<i>Salix geyeriana</i> - <i>Salix monticola</i> / <i>Calamagrostis canadensis</i> shrubland	Geyer willow- Mountain willow / bluejoint reedgrass shrubland	G3	S3			
<i>Salix ligulifolia</i> shrubland	strapleaf willow shrubland	G2G3	S2S3			
<i>Salix monticola</i> / <i>Calamagrostis canadensis</i> shrubland	Mountain willow / bluejoint reedgrass shrubland	G3	S3			
<i>Salix monticola</i> / <i>Carex utriculata</i> shrubland	mountain willow / beaked sedge shrubland	G3	S3			
<i>Salix monticola</i> / mesic forbs shrubland	mountain willow / mesic forbs shrubland	G4	S3			
<i>Salix planifolia</i> / <i>Calamagrostis canadensis</i> shrubland	planeleaf willow / bluejoint reedgrass shrubland	G4	S3			
<i>Salix planifolia</i> / <i>Carex aquatilis</i> shrubland	planeleaf willow / water sedge shrubland	G5	S4			

Scientific Name	Common Names	Global Rank	State Rank	US ESA	Federal Sensitive List	State Sensitive List
<i>Salix planifolia</i> / <i>Carex utriculata</i> shrubland	planeleaf willow / beaked sedge shrubland	G3G4	S2			
<i>Salix planifolia</i> / mesic forbs shrubland	planeleaf willow / mesic forbs shrubland	G4	S4			
<i>Salix wolfii</i> / <i>Calamagrostis canadensis</i> shrubland	wolf willow / bluejoint reedgrass shrubland	G3	S3			
<i>Salix wolfii</i> / <i>Carex aquatilis</i> shrubland	wolf willow / water sedge shrubland	G4	S3			
<i>Salix wolfii</i> / <i>Carex utriculata</i> shrubland	wolf willow / beaked sedge shrubland	G4	S3			
<i>Salix wolfii</i> / mesic forbs shrubland	wolf willow / mesic forbs shrubland	G3	S3			
<i>Scheuchzeria palustris</i> herbaceous vegetation	common threesquare herbaceous vegetation	G3G4	S3			
Plants						
<i>Aquilegia saximontana</i>	Rocky Mountain columbine	G3	S3			
<i>Aster alpinus</i> var. <i>vierhapperi</i>	alpine aster	G5T5	S1			
<i>Astragalus bodinii</i>	Bodin milkvetch	G4	S2			
<i>Astragalus osterhoutii</i>	Osterhout milkvetch	G1	S1	LE		
<i>Botrychium echo</i>	reflected moonwort	G3	S3		FS	
<i>Botrychium hesperium</i>	Western moonwort	G3G4	S2			
<i>Botrychium minganense</i>	Mingan's moonwort	G4	S1			
<i>Botrychium simplex</i>	least grape-fern	G5	S1			
<i>Carex leptalea</i>	bristly-stalk sedge	G5	S1			
<i>Carex limosa</i>	mud sedge	G5	S2			
<i>Carex stenoptila</i>	small-winged sedge	G2	S2?			
<i>Comarum palustre</i>	purple cinquefoil	G5	S 1S2			
<i>Crepsis nana</i>	dwarf alpine hawksbeard	G5	S2			
<i>Cryptogramma stelleri</i>	fragile rockbrake	G5	S2		BLM	
<i>Cypripedium fasciculatum</i>	clustered lady's-slipper	G4	S3		FS	
<i>Cystopteris montana</i>	mountain bladder fern	G5	S1			
<i>Draba crassa</i>	thick-leaf whitlow-grass	G3	S3			
<i>Draba exunguiculata</i>	clawless draba	G2	S2			
<i>Draba fladnizensis</i>	white Arctic whitlow-grass	G4	S2S3			
<i>Draba grayana</i>	Gray's Peak whitlow-grass	G2	S2			
<i>Draba lonchocarpa</i> var. <i>lonchocarpa</i>	lancepod draba	G4T4	S2			

Scientific Name	Common Names	Global Rank	State Rank	US ESA	Federal Sensitive List	State Sensitive List
<i>Draba porsildii</i>	Porsild's whitlow-grass	G3G4	S1			
<i>Drosera rotundifolia</i>	roundleaf sundew	G5	S2		FS	
<i>Dryopteris expansa</i>	spreading woodfern	G5	S1			
<i>Erigeron humilis</i>	low fleabane	G4	S1			
<i>Eriogonum exilifolium</i>	dropleaf buckwheat	G3	S2			
<i>Eriophorum gracile</i>	slender cotton-grass	G5	S2		BLM	
<i>Illiamna crandalli</i>	Crandall's wild-hollyhock	GHQ	SH			
<i>Ipomopsis aggregata</i> ssp. <i>weberi</i>	Weber's scarlet gilia	G5T2	S2		FS	
<i>Juncus vaseyi</i>	Vasey rush	G5?	S1			
<i>Lewisia rediviva</i>	Oregon bitterroot	G5	S2			
<i>Listera borealis</i>	northern twayblade	G4	S2		BLM	
<i>Listera convallaroides</i>	broad-leaved twayblade	G5	S2			
<i>Lomatium nuttallii</i>	Nuttall desert-parsley	G3	S1			
<i>Lycopodium dubium</i>	clubmoss	G?	SU			
<i>Mimulus gemmiparus</i>	Weber's monkey flower	G1	S1		FS	
<i>Parnassia kotzebuei</i>	Kotzebue's grass-of-parnassus	G4	S2			
<i>Penstemon harringtonii</i>	Harrington beardtongue	G3	S3		FS/BLM	
<i>Penstemon penlandii</i>	Penland beardtongue	G1	S1	LE		
<i>Phippsia algida</i>	ice grass	G5	S2			
<i>Potentilla effusa</i> var <i>rupicola</i>	Rocky Mountain cinquefoil	G5?T2	S2		FS	
<i>Ranunculus karelinii</i>	ice cold buttercup	G4G5	S2			
<i>Rubus arcticus</i> ssp. <i>acaulis</i>	nagoonberry	G5T5	S1		FS	

Boreal Toad and Wood Frog Survey

CNHP conducted a survey for the boreal toad (*Bufo boreas boreas*) within and adjacent to the proposed Fraser Valley Parkway project area during the spring and summer breeding season of 2005 (see *Fraser Valley Parkway Boreal Toad Habitat Inventory*, available at www.cnhp.colostate.edu). The objectives of the project were to quantify the amount and quality of habitat, find potential breeding sites, and evaluate historic or current activity of boreal toads along the proposed roadway. A total of five visits to the impacted areas were made between May 20 and July 18, 2005. Results suggest that there is currently no occupied habitat within the surveyed areas. However, GIS analysis found that occupied boreal toad breeding sites are known to occur within a practical dispersal distance, and within the Pole Creek drainage, which will be crossed by the road if the proposed alignment is implemented. Potential breeding and summer habitat is quantified and other landscape qualities such as apparent hibernacula, upland habitat, and suitable water levels are discussed as they pertain to the areas where impacts are most likely to occur. Direct (e.g., road building) and indirect (e.g., associated housing development) impacts on both short and long-term time scales are addressed, along with options for offsetting potential adverse impacts (Gaughan and Grunau 2005).

Additionally, a multi-year, statewide survey for Boreal Toads and other amphibians and reptiles yielded the following results for Grand County (Figure 12) (Doyle and Lambert 2005);

- 1 Boreal Toad (*Bufo boreas boreas*)
- 10 Western Chorus Frogs (*Pseudacris triseriata*)
- 6 Salamanders (*Ambystoma tigrinum*)
- 2 Wood Frogs (*Rana sylvatica*)
- 1 Western Terrestrial Garter Snake (*Thamnophis elegans*)

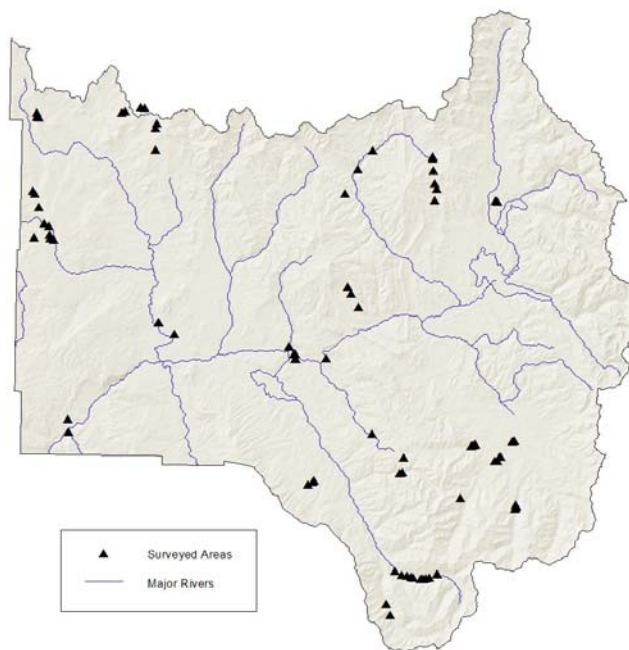


Figure 12. Targeted Survey Sites for Boreal Toads in Grand County.

Grand County Land Conservation Plan Analysis

The analysis of crosswalking the Landscape Units (Table 8) from the Lands Conservation Plan and CNHP's PCAs indicates the most significant areas based on rarity and quality of occurrence within each unit (Table 8).

Table 8. Landscape Units (Shapins Associates, Inc. 1999).

Landscape Unit	Code
<i>Fraser Valley</i>	
• Fraser – Tabernash Meadow	FV1
• Ranch-Cabin-Hamilton Creek Drainage Area	FV2
• North and West of Tabernash	FV3
• Ten Mile / Eight Mile Creek Area	FV4
• Lower Fraser River	FV5
<i>Colorado River Corridor</i>	
• Colorado River Headwaters	CR1
• North of Granby	CR2
• Windy Gap to Hot Sulphur Springs	CR3
• Parshall to Kremmling	CR4
• Colorado River/Blue River Convergence	CR5
• Gore Canyon	CR6
<i>Lower Blue River Corridor</i>	BR1
<i>Muddy Creek Corridor</i>	MC1
<i>Upland Croplands</i>	C1
<i>Uplands Slopes and Range Areas</i>	R 1-11
<i>Forested Slopes</i>	FS 1-3

Table 9. Potential Conservation Areas located in Landscape Units in Grand County.

Landscape Unit	Sub-Unit Code	Potential Conservation Area	Biodiversity Significance
Colorado River Corridor	CR1	Kettle Ponds at Grand Lake	B2
Colorado River Corridor	CR1	Monarch Lake	B3
Colorado River Corridor	CR1	Devils Staircase	B1
Colorado River Corridor	CR1	Cascade Falls	B1
Colorado River Corridor	CR1	Stillwater Creek Tributary	B3
Colorado River Corridor	CR2	South Supply Creek	B4
Colorado River Corridor	CR4	Rock Creek	B1

Landscape Unit	Sub-Unit Code	Potential Conservation Area	Biodiversity Significance
Colorado River Corridor	CR4	Troublesome Creek	B1
Colorado River Corridor	CR4	Battle Creek	B3
Colorado River Corridor	CR4	Keyser Creek	B3
Colorado River Corridor	CR4	South Fork Mule Creek	B3
Colorado River Corridor	CR4	South Fork of the Williams Fork	B3
Colorado River Corridor	CR4	Cow Gulch	B4
Colorado River Corridor	CR4	Lower Corral Creek	B4
Colorado River Corridor	CR4	Upper Troublesome Creek	B2
Colorado River Corridor	CR4	Sulphur Spring	B4
Colorado River Corridor	CR6	Lower Blacktail Creek at Radium	B3
Colorado River Corridor	CR6	Blacktail Creek at Gore Pass	B3
Colorado River Corridor	CR6	Rock Creek at Gore Pass	B3
Forested Slope	FS1-3	Willow Creek Pass	B3
Forested Slope	FS1-3	Dumont Lake	B3
Forested Slope	FS1-3	Buffalo Park	B3
Forested Slope	FS1-3	Carter Fen	B3
Forested Slope	FS1-3	Second Creek at Berthoud Pass	B3
Forested Slope	FS1-3	Upper Williams Fork	B3
Forested Slope	FS1-3	Iron Creek Fen	B4
Forested Slope	FS1-3	Jim Creek Trail	B4
Forested Slope	FS1-3	South Fork of Ranch Creek	B4
Forested Slope	FS1-3	Trail Mountain at Spirit Mountain Ranch	B4
Fraser Valley	FV1	West St. Louis Creek	B4
Fraser Valley	FV1	Behler Creek	B3
Fraser Valley	FV1	Upper Pole Creek	B3
Fraser Valley	FV1	Vasquez Creek	B3
Fraser Valley	FV1	St. Louis Creek at Fraser	B4
Fraser Valley	FV2	Strawberry Creek at Caribou Trail	B3
Fraser Valley	FV2	Road End Seep at Strawberry Creek	B4
Fraser Valley	FV5	Fraser River at Granby	B3
Lower Blue River Corridor	BR1	Miller Gulch	B3

Landscape Unit	Sub-Unit Code	Potential Conservation Area	Biodiversity Significance
Lower Blue River Corridor	BR1	Beaver Creek Mineral Spring at Blue Valley Ranch	B3
Lower Blue River Valley	BR1	Blue River	B4
Muddy Creek Corridor	MC1	First Creek	B3
Muddy Creek Corridor	MC1	East Fork of Fishhook Creek	B4
Muddy Creek Headwaters	MC1	Red Dirt Reservoir	B3
Muddy Creek Valley	MC1	Horse Gulch	B1
Muddy Creek Valley	MC1	Kremmling	B1
Muddy Creek Valley	MC1	Red Dirt Creek at Hinman Reservoir	B1
Upland Slope and Range Land	R1-11	Lawson Butte	B3
Upland Slope and Range Land	R1-11	West Slope of Junction Butte	B3
Upland Slope and Range Land	R1-11	Black Mountain Reservoir	B3
Upland Slopes and Range Land	R1-11	Chalk Bluffs	B3
Alpine	N/A	Jones Pass	B4
Alpine	N/A	Rollins Pass	B4

There are 18 landscape sub-units identified. All but two of the PCAs were cross-referenced with a landscape sub-unit (Table 10). The results indicated that the most biologically significant landscape units are the Colorado River Headwaters (CR1), Parshall to Kremmling (CR4), and the Muddy Creek Corridor (MC1) due to the presence of B1 and B2 PCAs.

Table 10. PCAs with B-Ranks Located with Landscape Sub-Units.

Landscape Sub-Unit	Number of PCAs	B Ranks
CR1	5	B1, B2, B3
CR2	1	B4
CR4	10	B1, B2, B3, B4
CR6	3	B3
FS1-3	10	B2, B3, B4
FV1	5	B3, B4
FV2	2	B3, B4
FV5	1	B3
BR1	3	B3, B4
MC1	6	B1, B3, B4
R1-11	4	B3

Colorado Division of Wildlife Riparian Maps Analysis

Over the years, CNHP has utilized the Division of Wildlife (DOW) riparian maps, when available (for a detailed description see section entitled, Colorado Division of Wildlife Riparian Maps). These maps were used during this survey as additional tools for identification of wetland and riparian habitats located on federal lands. Twelve 7.5 minute USGS quadrangle

coverages (topographic maps) are completed for Grand County and were used for reference during the project: Whiteley Peak (4010634), Hyannis Peak (4010633), Tyler Mountain (4010625), Hinman Reservoir (4010624), Gunsight Pass (4010623), Corral Peaks (4010622), Cabin Creek (4010621), Gore Pass (4010615), Kremmling (4010614), Junction Butte (4010613), Parshall (4010612), and Hot Sulphur Springs (4010611) (Figure 13).

For each vegetation class (Table 11), a single label indicates that the class is

dominant and comprises at least

75% or more of the vegetation. Other vegetation may be present but at less than the Minimum Mapping Unit (MMU) of 1/2 acre. Mixed communities consist of classes that are less than 75% cover with a lesser amount of one or more vegetation classes. The dominant type is annotated first with the lesser type following. For example, if a polygon is attributed as RT1/RS1, the vegetation in the area is less than 75% dominant of any particular class but is a mixed community of aspen and willow with aspen dominant between the two classes. A forward slash (/) is used to separate the dominant/subdominant classes both on the hard copy and within the digital data .

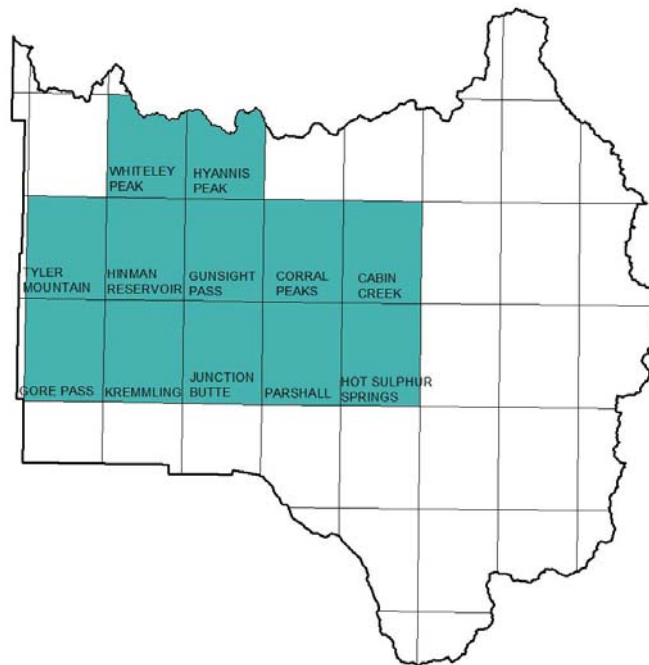


Figure 1312. Completed DOW Riparian Maps for Grand County.

Table 11. DOW Riparian Mapping Classification.

CATEGORY	MAP CODE
RIPARIAN DECIDUOUS TREES	
Riparian Deciduous Tree-General	RT
Riparian Deciduous Tree-Aspen	RT1
Riparian Deciduous Tree-Cottonwood	RT2
Riparian Deciduous Tree-Russian Olive	RT3
Riparian Deciduous Tree-Birch	RT4
Riparian Deciduous Tree-Box elder	RT5
Riparian Deciduous Tree-Green Ash	RT6
Riparian Deciduous Tree-Mulberry	RT7
RIPARIAN EVERGREEN TREES	
Riparian Evergreen Tree-General	RE
Riparian Evergreen Tree-Blue Spruce	RE1
Riparian Evergreen Tree-Engelman Spruce	RE2
Riparian Evergreen Tree-Douglas Fir	RE3
Riparian Evergreen Tree-Lodgepole Pine	RE4
Riparian Evergreen Tree-Spruce/Fir	RE5
Riparian Evergreen Tree-Ponderosa Pine	RE6
Riparian Evergreen Tree-Cedar/Juniper	RE7
Riparian Evergreen Tree-Pinon/Juniper	RE8
RIPARIAN SHRUBS	
Riparian Shrub-General	RS
Riparian Shrub-Willow	RS1
Riparian Shrub-Tamarisk	RS2
Riparian Shrub-Alpine Willow	RS3
Riparian Shrub-Gambel Oak	RS4
Riparian Shrub-Sagebrush	RS5
RIPARIAN HERBACEOUS	
Riparian Herbaceous-General	RH
Riparian Herbaceous-Cattails/Sedges/Rushes (with permanent standing water)	RH1
Riparian Herbaceous-Sedges/Rushes/Mesic Grasses (Waterlogged or Moist Soils)	RH2
OTHER RIPARIAN	
Unvegetated	NV
Sandbar	SB
NON-RIPARIAN	
Upland Tree	UT
Upland Shrub	US
Upland Grass	UG
WATER BODIES	
Open Water-Standing	OW1
Open Water-Riverine	OW2
Open Water-Canal	OW3

Eleven PCAs (six-B1, one-B2, three B3, and one B4) were located on DOW riparian maps (Table 12) (Figures 14-22).

Table 12. CNHP PCAs located on DOW riparian maps for Grand County.

DOW Quad Maps	CNHP PCAs	B Rank ¹	CNHP Plant Community	Global / State Rank ²	DOW Riparian Classification ³
Hinman Reservoir	Red Dirt Creek at Hinman Reservoir	B1	No tracked wetland plant community		RS1, RH2, RH
Hinman Reservoir	Kremmling	B1	No tracked wetland plant community		RH2, RS1, RH2, UG
Kremmling	Kremmling	B1	No tracked wetland plant community		RS1, RH1, RH2, RT2, UG
Kremmling	Horse Gulch	B1	No tracked wetland plant community		RS1, RH2, UG
Parshall	Rock Creek	B1	No tracked wetland plant community		RH, RS1, RH2
Junction Butte	Troublesome Creek	B1	No tracked wetland plant community		RH, RS1, RH2
Gunsight Pass/ Hyannis Peak	Upper Troublesome Creek	B2	<i>Glyceria grandis</i> ; <i>Salix drummondiana</i> / <i>Carex aquatilis</i> ; <i>Alnus incana</i> / mixed willow; <i>Alnus incana</i> – <i>Salix drummondiana</i> ; <i>Salix drummondiana</i> / <i>Calamagrostis canadensis</i>	G2?S2 G2G3S2 G3S3 G3S3 G3S3	RH2, RH, RS1, RT2
Corral Peaks	Black Mountain Reservoir	B3	<i>Alnus incana</i> – <i>Salix drummondiana</i>	G3S3	RS1, RH2
Corral Peaks	First Creek	B3	<i>Alnus incana</i> – <i>Salix drummondiana</i> ; <i>Alnus incana</i> / mixed forb	G3S3 G3S3	RT1
Cabin Creek	Willow Creek Pass	B3	<i>Salix wolfii</i> / <i>Calamagrostis canadensis</i> ; <i>Carex utriculata</i> ; <i>Carex aquatilis</i> – <i>Carex utriculata</i>	G3S2S3 G5S4 G4S4	RH2, RS1, RE, RT2, RS1, OW2, NV
Parshall	Lower Corral Creek	B4	<i>Alnus incana</i> / <i>Cornus sericea</i>	G3G4S3	RH2, RT2, RH

¹See Table 4 for an explanation of Natural Heritage Biological Diversity Ranks (B Ranks)

²See Table 1 for an explanation of Natural Heritage Imperilment Ranks (Global/State Ranks)

³See Table 10 for a key to the Riparian Classification Codes

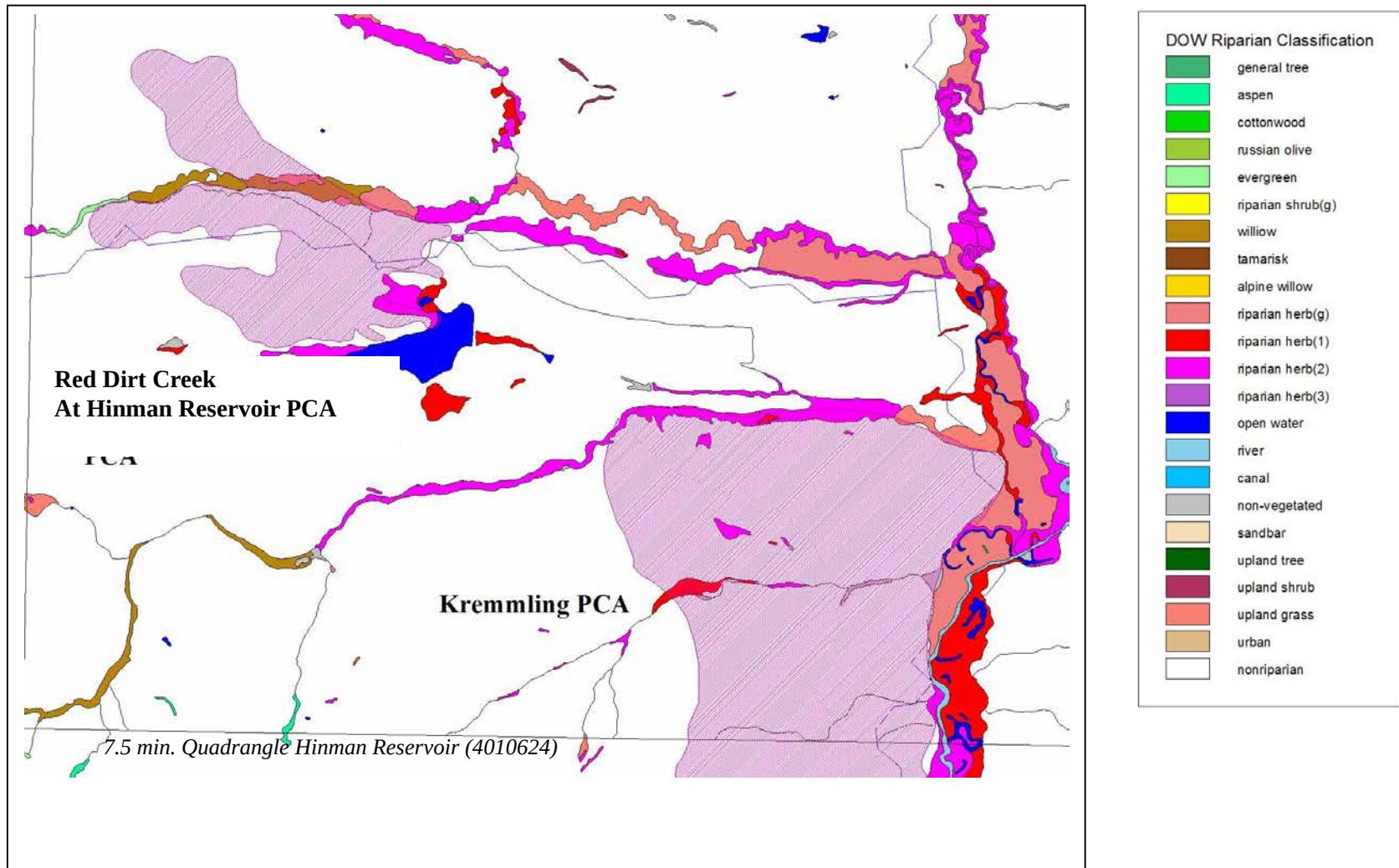


Figure 14. DOW Riparian Map of Red Dirt Creek at Hinman Reservoir and Kremmling PCAs (B1).

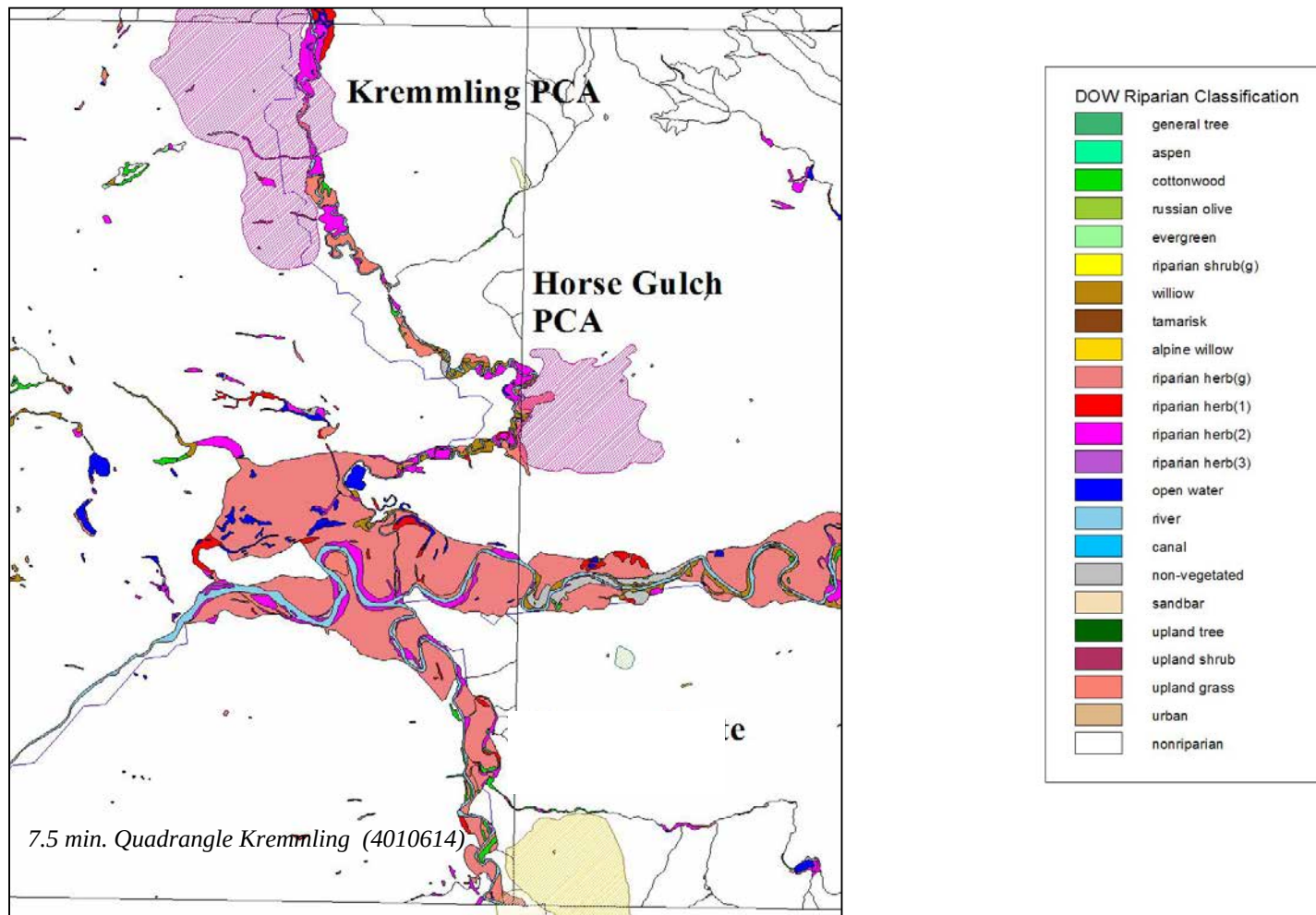


Figure 15. DOW Riparian Map of Kremmling and Horse Gulch PCAs (B1).

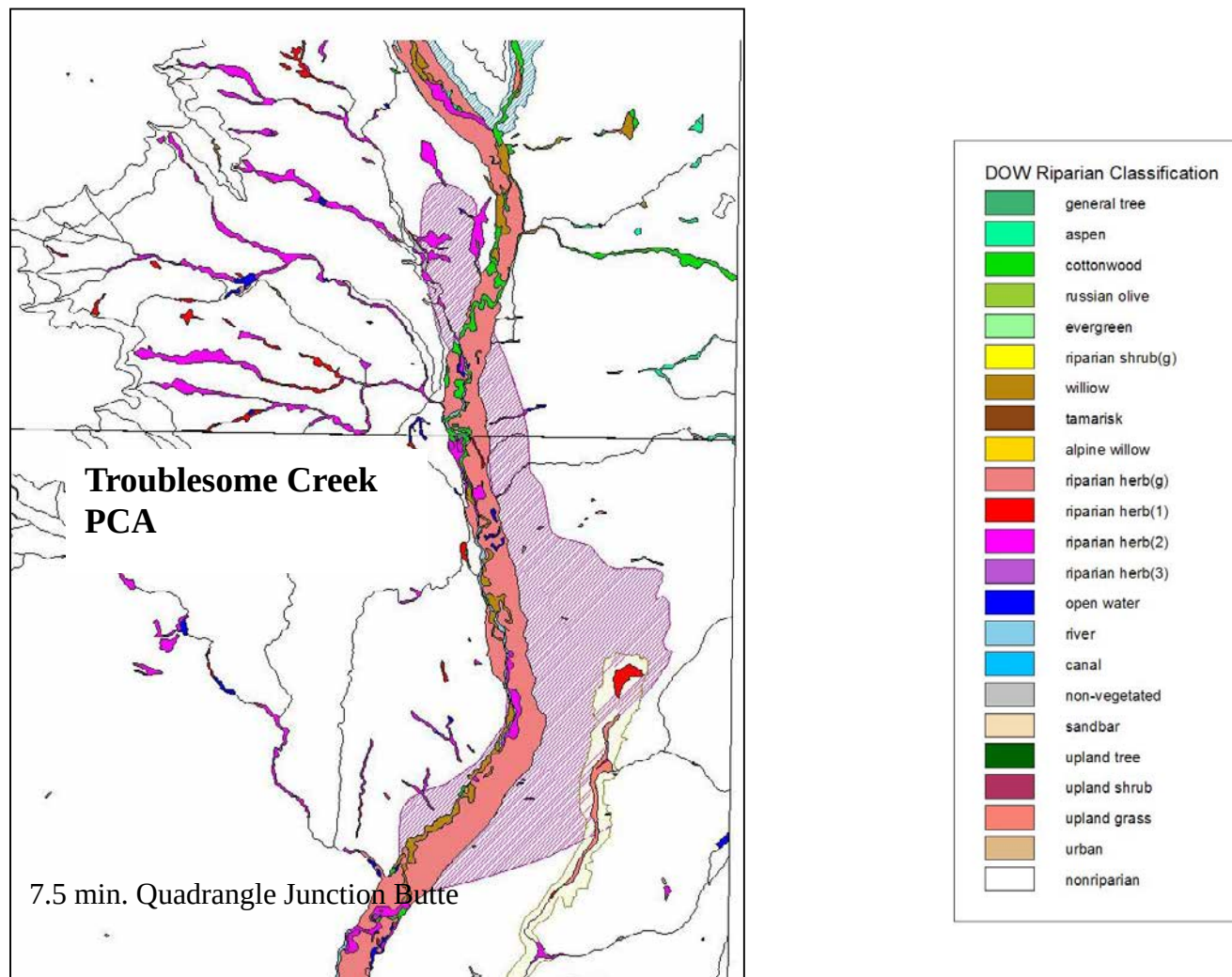


Figure 16. DOW Riparian Map of Troublesome Creek PCA (B1).

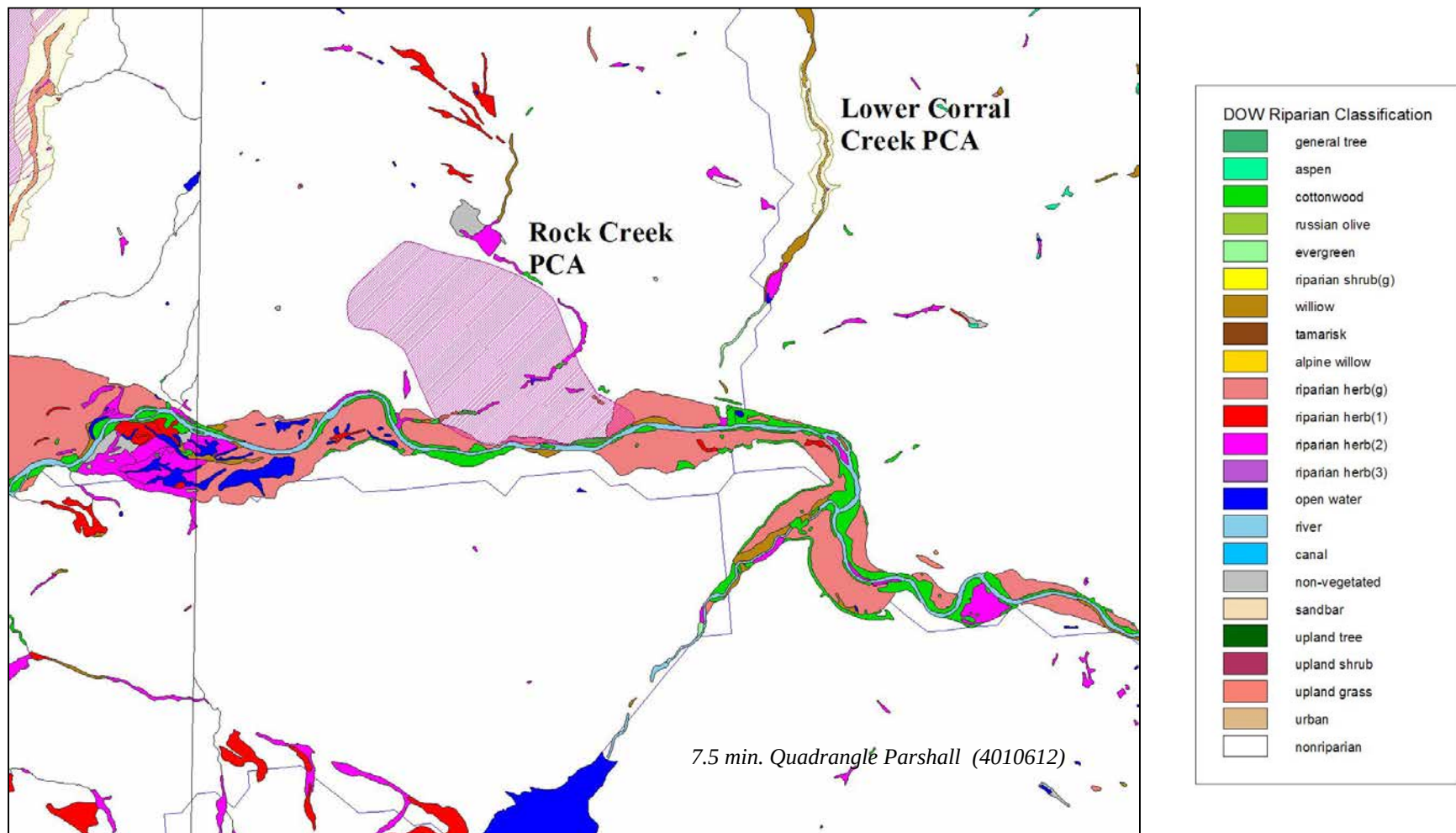


Figure 17. DOW Riparian Map of Rock Creek PCA (B1) and Lower Corral Creek PCA (B4).

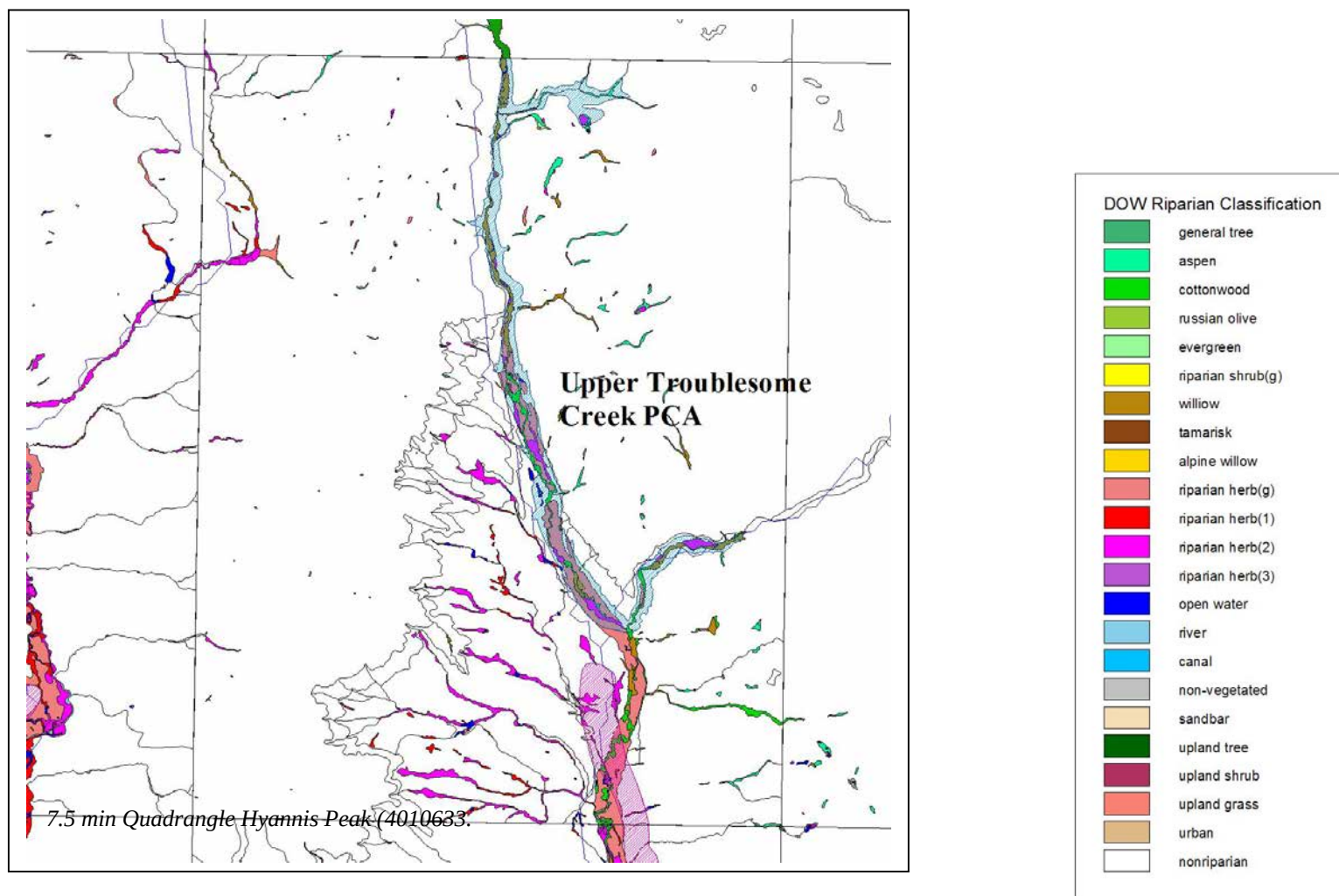


Figure 18. DOW Riparian Map of Upper Troublesome Creek PCA (B2) on Hyannis Peak Quad.

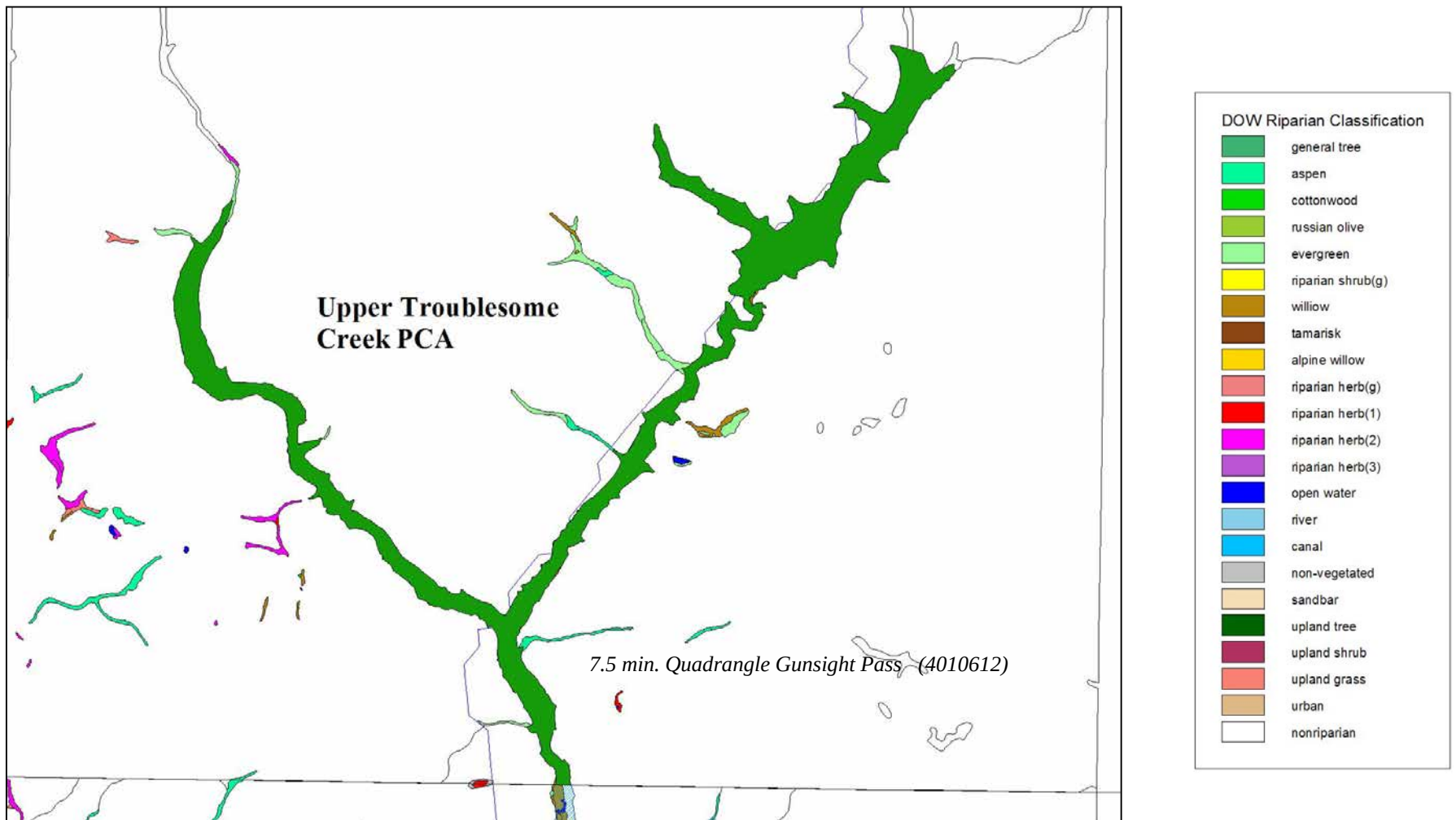


Figure 19. DOW Riparian Map of Upper Troublesome Creek PCA (B2) on Gunsight Pass Quad.

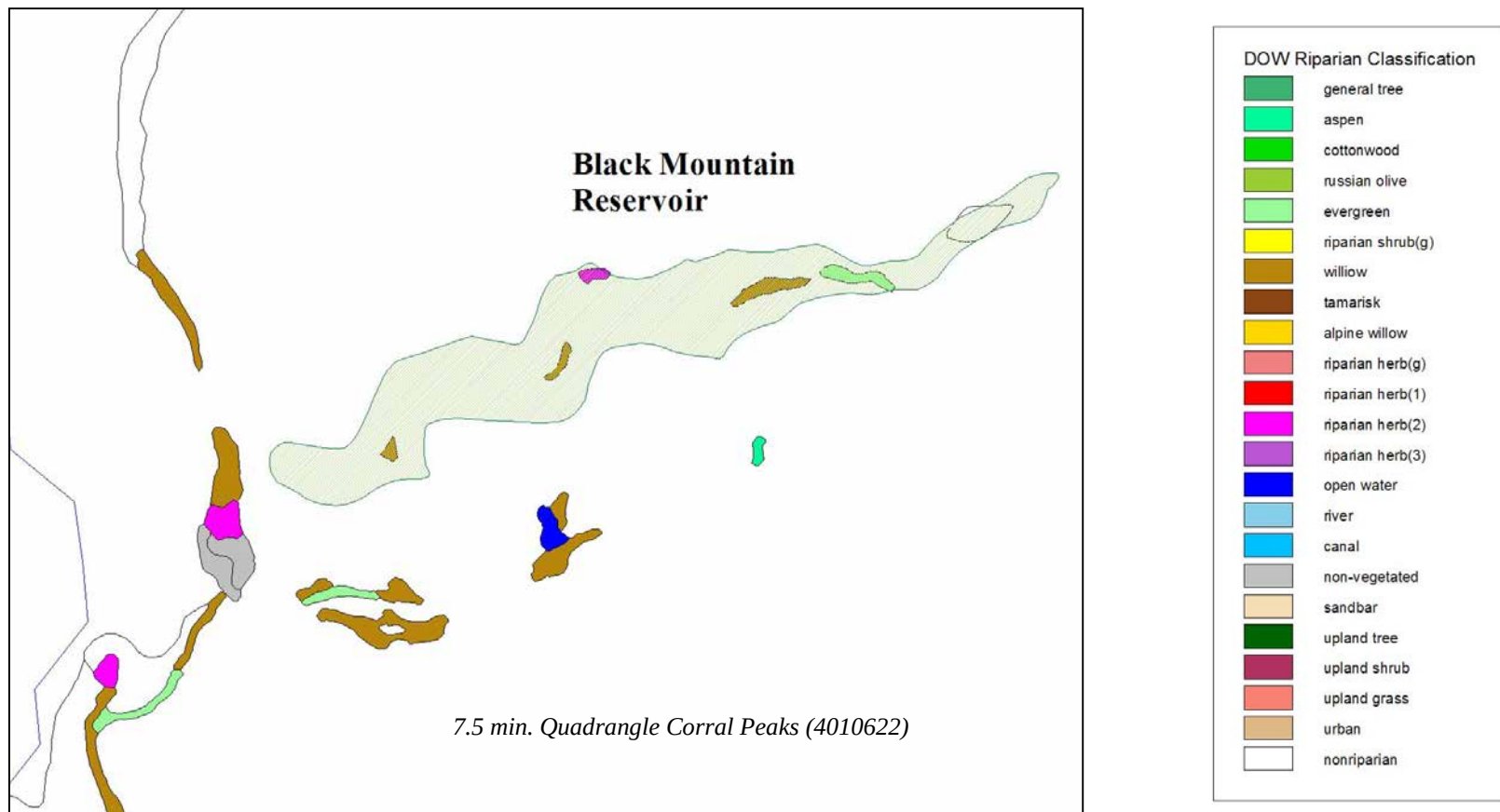


Figure 20. DOW Riparian Map of Black Mountain Reservoir PCA (B3).

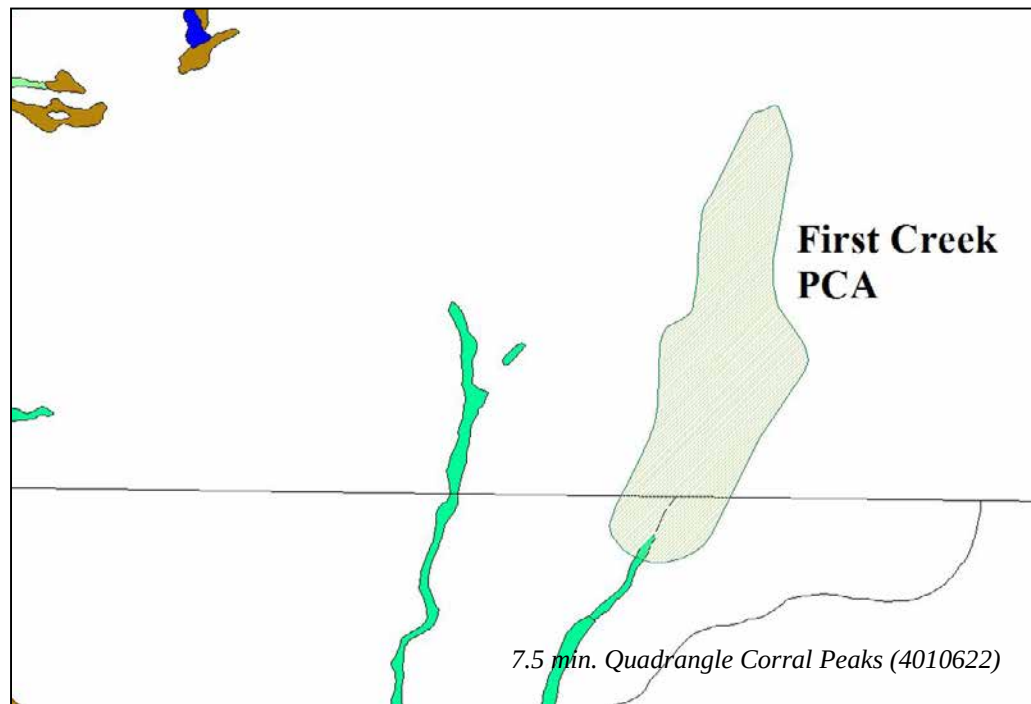


Figure 21. DOW Riparian Map of First Creek PCA (B3).

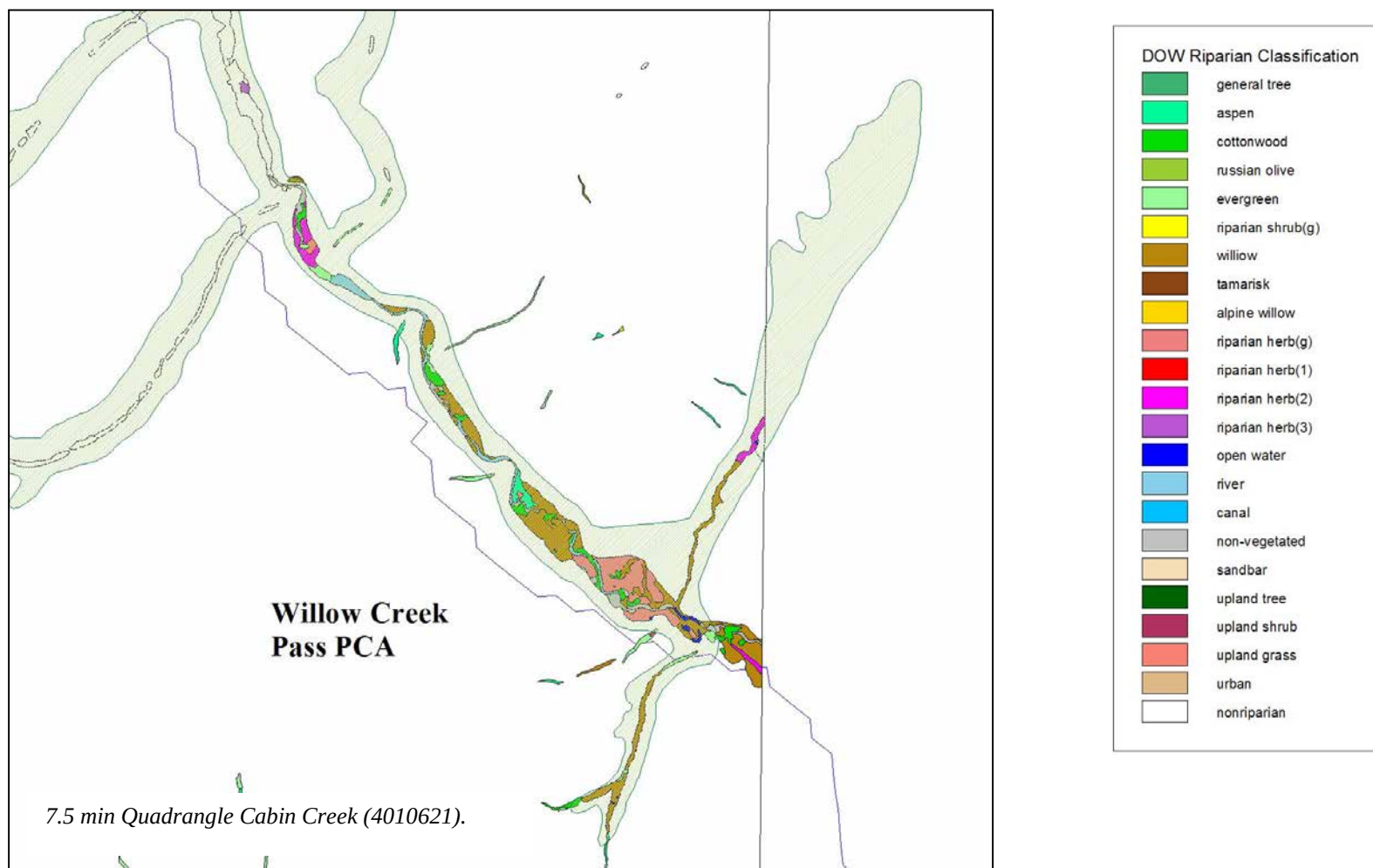


Figure 22. DOW Riparian Map of Willow Creek Pass PCA (B3).

SITES OF BIODIVERSITY SIGNIFICANCE

The 53 most important wetland sites in Grand County are profiled in this section as Potential Conservation Areas (PCAs) with biodiversity ranks (Table 13, Map 2). These PCAs include the wetlands with the highest biodiversity significance, as well as the best examples of common wetland types present in the study area. **Seven are identified as being irreplaceable biodiversity significance (B1), two are identified as being nearly irreplaceable biodiversity significance (B2), twenty-nine of high biodiversity significance (B3), and fifteen of moderate biodiversity significance (B4). The highest ranking PCAs are the highest priorities for conservation action.**

Following the PCAs are three Sites of Local Significance (SLS).

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

PCA Profile Explanation Biodiversity Rank: B#

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

Protection Urgency Rank: P#

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

Management Urgency Rank: M#

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

USGS 7.5-minute Quadrangle name(s): A list of USGS 7.5 minute quadrangles which contain the boundary of the PCA; all quadrangles are from Colorado unless otherwise noted.

Size: Expressed in acres.

***Elevation:** Expressed in feet.

General Description: A brief narrative of the topography, hydrology, vegetation, and current use of the potential conservation area.

***Key Environmental Factors:** A description of key environmental factors that are known to have an influence on the PCA, such as seasonal flooding, wind, geology, soil type, etc.

***Climate Description:** Where climate has a significant influence on the elements within a PCA, a brief description of climate, weather patterns, seasonal and annual variations, temperature and precipitation patterns is included.

***Land Use History:** General comments concerning past land uses within the PCA which may affect the elements occurring within the boundary.

***Cultural Features:** Where pertinent, a brief description is given of any historic, cultural, or archeological features found within the PCA.

Biodiversity Significance Rank Comments: 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 PCA, 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.

Boundary Justification: Justification for the location of the proposed PCA 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 Urgency Rank Comments:** Brief comments to justify the rating assigned to the PCA.

***Management Urgency Rank Comments:** Brief comments to justify the rating assigned to the PCA.

***Land Use Comments:** Brief comments describing the current and/or past land use as it affects those elements contained in the PCA.

***Natural Hazard Comments:** If any potential natural hazards such as cliffs, caves, poisonous plants, etc. are prominent within the PCA and relevant to a land manager or steward, comments are included along with any precautions that may need to be taken.

***Exotic Species Comments:** A description of potentially damaging exotic (i.e., alien) flora and/or fauna within the PCA, including information on location, abundance, and their potential effect on the viability of the targeted elements within the PCA.

***Offsite Considerations:** Where offsite land uses or other activities (e.g., farming, logging, grazing, dumping, watershed diversion, etc.) may have a significant influence on the elements within a PCA, a brief description of these is included.

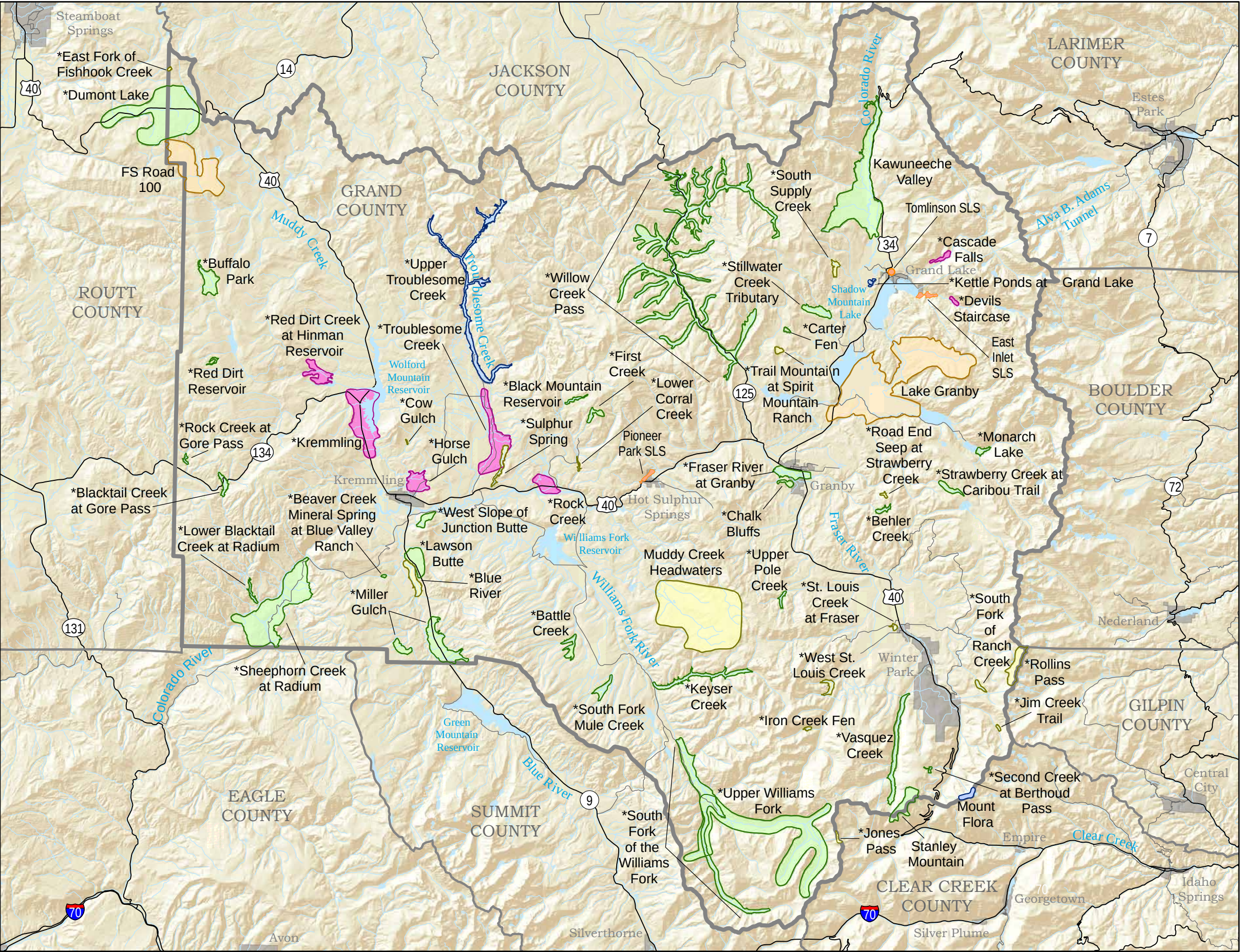
***Information Needs:** A brief summary of any information that may still be needed in order to effectively manage the PCA and the elements within it.

* Optional fields, may or may not be included in Potential Conservation Area descriptions.

Table 13. Potential Conservation Areas in Grand County.

Potential Conservation Area	Biodiversity Significance
Cascade Falls	B1
Devils Staircase	B1
Horse Gulch	B1
Kremmling	B1
Red Dirt Creek at Hinman Reservoir	B1
Rock Creek	B1
Troublesome Creek	B1
Kettle Ponds at Grand Lake	B2
Upper Troublesome Creek	B2
Battle Creek	B3
Beaver Creek Mineral Spring at Blue Valley Ranch	B3
Behler Creek	B3
Black Mountain Reservoir	B3
Blacktail Creek at Gore Pass	B3
Buffalo Park	B3
Carter Fen	B3
Chalk Bluffs	B3
Dumont Lake	B3
First Creek	B3
Fraser River at Granby	B3
Keyser Creek	B3
Lawson Butte	B3
Lower Blacktail Creek at Radium	B3
Miller Gulch	B3
Monarch Lake	B3
Red Dirt Reservoir	B3
Rock Creek at Gore Pass	B3
Second Creek at Berthoud Pass	B3
Sheephorn Creek at Radium	B3
South Fork Mule Creek	B3
South Fork of the Williams Fork	B3
Stillwater Creek Tributary	B3
Strawberry Creek at Caribou Trail	B3
Upper Pole Creek	B3

Potential Conservation Area	Biodiversity Significance
Upper Williams Fork	B3
Vasquez Creek	B3
West Slope of Junction Butte	B3
Willow Creek Pass	B3
Blue River	B4
Cow Gulch	B4
East Fork of Fishhook Creek	B4
Iron Creek Fen	B4
Jim Creek Trail	B4
Jones Pass	B4
Lower Corral Creek	B4
Road End Seep at Strawberry Creek	B4
Rollins Pass	B4
South Fork of Ranch Creek	B4
South Supply Creek	B4
St. Louis Creek at Fraser	B4
Sulphur Spring	B4
Trail Mountain at Spirit Mountain Ranch	B4
West St. Louis Creek	B4



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Map Date: 5/10/2006

Legend

CNHP Potential Conservation Areas (PCAs) by Biodiversity Significance Rank

- B1: Outstanding Biodiversity Significance
- B2: Very High Biodiversity Significance
- B3: High Biodiversity Significance
- B4: Moderate Biodiversity Significance
- B5: General Biodiversity Interest

PCAs with an asterisk before the site name are fully described in the 2006 report

Sites of Local Significance

Colorado Base Data

- Counties
- Municipalities
- Lakes, Reservoirs
- Rivers, Streams, Creeks
- Highways
- Major Roads

Digital Elevation Model Produced by the U.S.G.S.

Location in Colorado

PCAs represent CNHP's best estimate of the primary area supporting long-term survival of targeted species, subspecies and natural communities.

N

0 2.5 5 10 Miles

Map 3. Potential Conservation Areas and Sites of Local Significance in Grand County

Cascade Falls

Biodiversity Rank - B1: Outstanding Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Grand Lake

Size: 174 acres (70 ha)

Elevation: 8,700 - 9,000 ft. (2,652 - 2,743 m)

General Description: The Cascade Falls site is located above the North Inlet Trail in Rocky Mountain National Park, within an Engelmann spruce (*Picea engelmannii*) / subalpine fir (*Abies lasiocarpa*) forest with lodgepole pine (*Pinus contorta*). Cascade Falls is a popular destination for day and overnight hikes. The Weber's monkey-flower (*Mimulus gemmiparus*) is found under gneiss ledges (Tweto 1979), where surface seepage from springs and/or snowmelt provides seasonal moisture. The overhangs create a unique micro-environment that is 5 feet long and 2 feet wide. Associated plants within the seep area include bracted alumroot (*Heuchera bracteata*), oceanspray (*Holodiscus discolor*), stiff club-moss (*Lycopodium annotinum*), and rockbrake (*Cryptogramma acrostichoides*).

Key Environmental Factors: Presence of seeps along gneiss.

Climate Description: The climate is mostly continental characterized by dry air, sunny days, clear nights, variable precipitation, and large diurnal temperature changes.

Biodiversity Significance Rank Comments (B1): The Cascade Falls site supports an excellent (A-ranked) occurrence of the globally critically imperiled (G1/S1) Weber's monkey-flower (*Mimulus gemmiparus*). This narrowly restricted Colorado endemic is known only from higher elevations in and around Rocky Mountain National Park in Colorado and surrounding counties (NatureServe 2005). Weber's monkey-flower has evolved a unique reproduction strategy. Its leaf petiole bases are modified to form pockets containing dormant embryonic shoots (Spackman et al. 1997). This site is identified as irreplaceable due to its outstanding biodiversity.

Natural Heritage element occurrences at the Cascade Falls PCA.

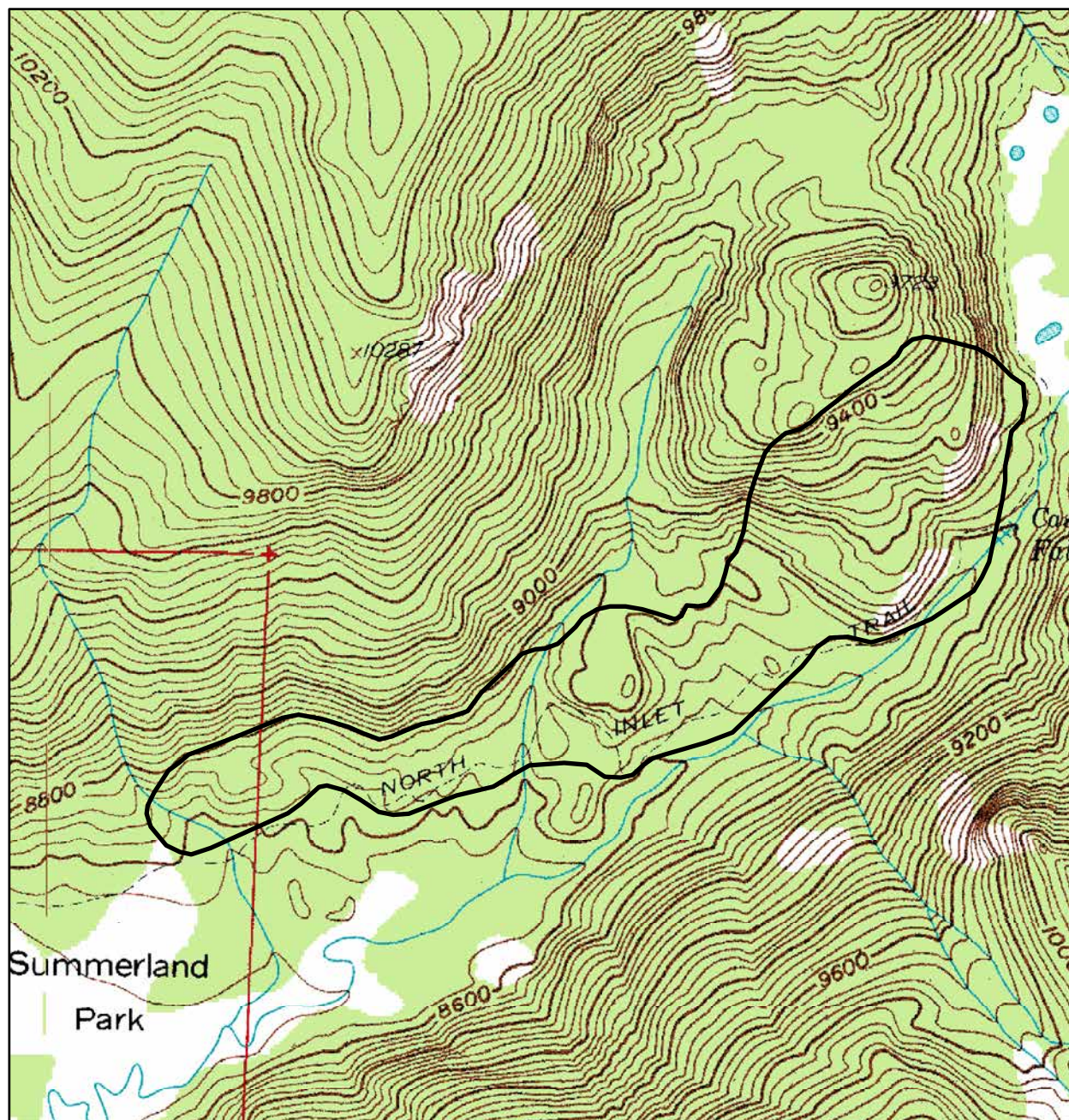
Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Mimulus gemmiparus</i>	Weber's monkey - flower	G1	S1			USFS	A	2005-09-07

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundaries are drawn to capture the immediate watershed that provides consistent moisture throughout the growing season. It encompasses portions of the North Inlet Trail and North Inlet.

Protection Urgency Rank Comments (P4): The site is located in Rocky Mountain National Park. No protection actions are needed in the foreseeable future.

Management Urgency Rank Comments (M4): Current management seems to favor the persistence of the plant. The first observation date is 1950. It is recommend to monitor disturbances from hikers, i.e., gemmule or miniature plant collecting.



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Map Date: 02/09/2006

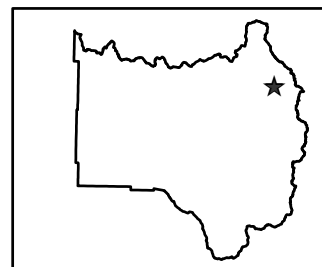
Legend

 PCA Boundary

Grand Lake, 40105-C7

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 4. Cascade Falls Potential Conservation Area, B1: Outstanding Biodiversity Significance

Devils Staircase

Biodiversity Rank - B1: Outstanding Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Shadow Mountain

Size: 80 acres (32 ha)

Elevation: 9,000 - 9,300 ft. (2,743 - 2,835 m)

General Description: The Devils Staircase site is located in Rocky Mountain National Park. The Devils Staircase is aptly named due to the steepness of the trail as it climbs up from East Inlet Creek. Weber's monkey-flower (*Mimulus gemmiparus*), a globally rare plant, has established its niche under the cliff overhangs. The gneiss cliffs are formed from sedimentary rocks of the Precambrian Age (Tweto 1979). Subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*), with lodgepole pine (*Pinus contorta*) is the dominant plant community surrounding the cliffs. The Weber's monkey-flower flourishes within the micro-habitat, dominated by bracted alumroot (*Heuchera bracteata*) and stiff club-moss (*Lycopodium annotinum*).

Key Environmental Factors: Presence of seep water along gneiss ledges.

Biodiversity Significance Rank Comments (B1): This site supports a good (B-ranked) occurrence of Weber's monkey-flower (*Mimulus gemmiparus*) a globally critically imperiled (G1/S1) plant. Weber's monkey-flower has evolved a unique reproduction strategy. Its leaf petiole bases are modified to form pockets containing dormant embryonic shoots (Spackman et al. 1997). With additional survey on the cliffs above the known EO, more individuals are expected, potentially elevating this to an A-ranked occurrence. Thus, this site is identified as irreplaceable due to its outstanding biodiversity.

Natural Heritage element occurrences at the Devils Staircase PCA.

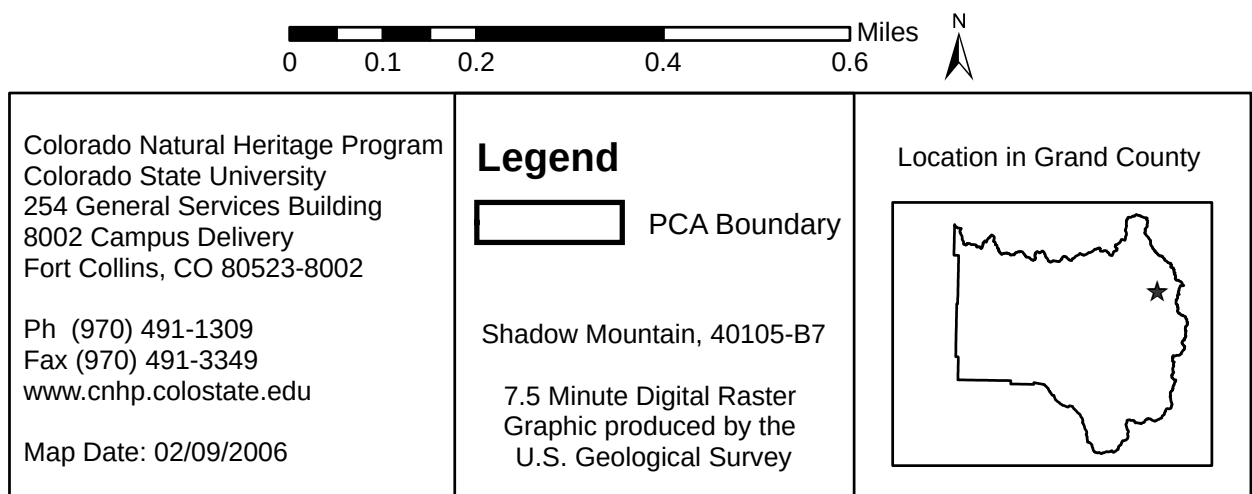
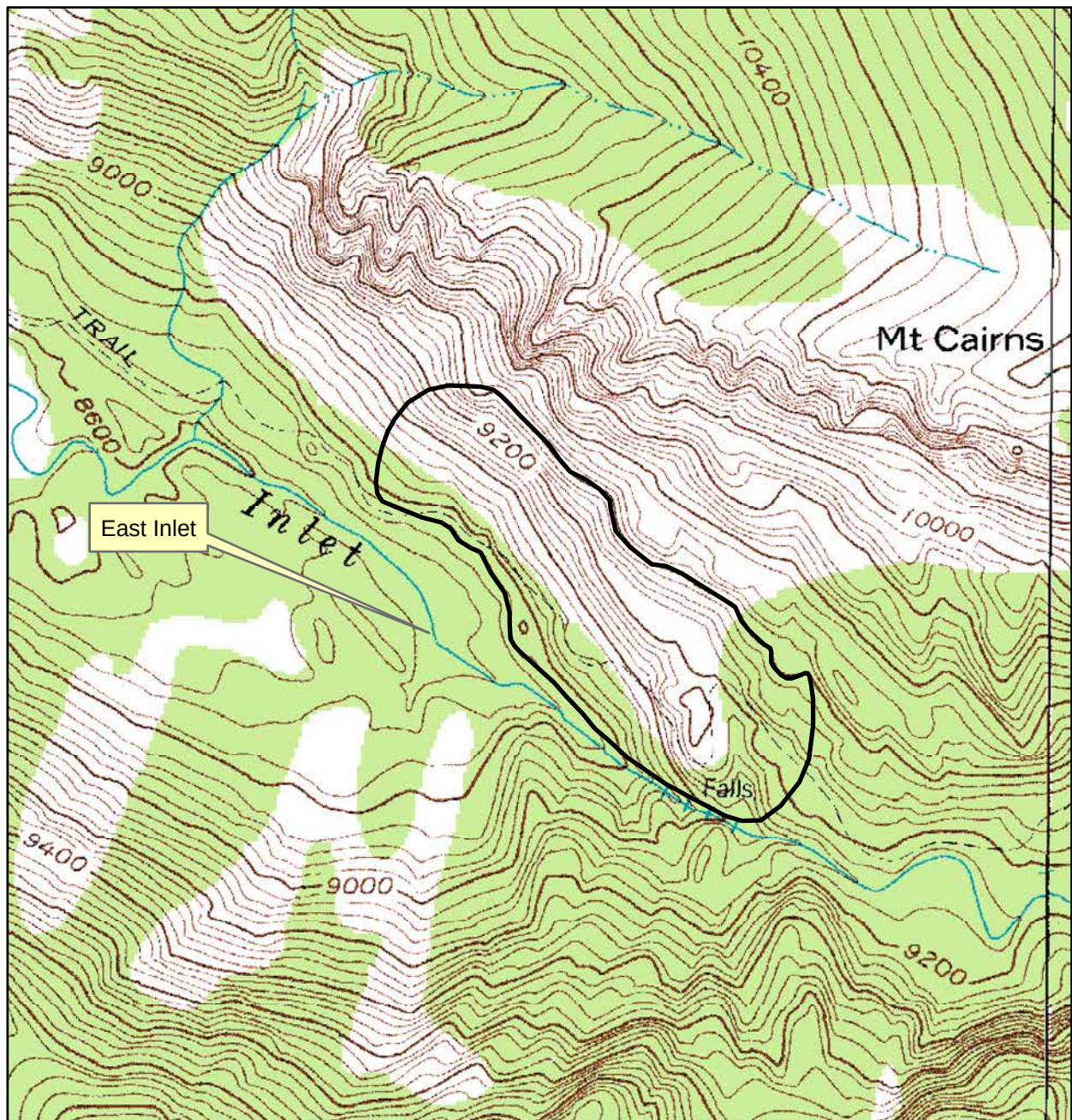
Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Mimulus gemmiparus</i>	Weber's monkey - flower	G1	S1			USFS	B	2005-08-25

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary is drawn to capture the rare plant occurrence as well as the immediate watershed from the west slope of Mt. Cairns to East Inlet Creek.

Protection Urgency Rank Comments (P4): The site is located in Rocky Mountain National Park. No protection actions are needed in the foreseeable future.

Management Urgency Rank Comments (M4): Management seems to favor the persistence of the plant. The first observation date is 1969. It is recommended to monitor disturbances from hikers, i.e., gemmule or miniature plant collecting.



Map 5. Devils Staircase Potential Conservation Area, B1: Outstanding Biodiversity Significance

Horse Gulch

Biodiversity Rank - B1: Outstanding Biodiversity Significance

Protection Urgency Rank - P1: Immediately Threatened/Outstanding Opportunity

Management Urgency Rank - M1: Essential within 1 Year to Prevent Loss

U.S.G.S. 7.5-minute quadrangles: Junction Butte, Kremmling

Size: 762 acres (308 ha)

Elevation: 7,550 - 7,800 ft. (2,301 - 2,377 m)

General Description: The Horse Gulch site is located in Middle Park, 1 mile north of Kremmling. Middle Park is located within a series of high mountain parks formed by north/south trending faults traveling the length of Colorado (Chronic 1980). The predominant grayish-brown soils (USDA, NRCS 1994) are derived from Cretaceous Niobrara and Pierre shale of the Troublesome Formation (Tweto 1979). The sparsely vegetated slopes are due to the presence of fine textured, clayey soils that contain mineralogic properties that effectively excludes almost all vegetation (Colorado Native Plant Society 1989). Osterhout milkvetch (*Astragalus osterhoutii*) is a Federally Listed Plant, found only in Middle Park on seleniferous soils (Dawson 1999). This unique plant is able to thrive in the seleniferous, clayey soils where few other plants can. Other associated plants, at low (<5%) cover include: Patterson's milkvetch (*Astragalus pattersonii*), shortstem buckwheat (*Eriogonum brevicaulis*), spiny phlox (*Phlox hoodii*), Fendler's bluegrass (*Poa fendleriana*), bluebunch wheatgrass (*Pseudoroegneria spicata*), sulphur-flowered buckwheat (*Eriogonum umbellatum*), mat penstemon (*Penstemon caespitosus*), and Indian ricegrass (*Achnatherum hymenoides*). Upland vegetation, where soils have a lower concentration of minerals, include: yellow rabbitbrush (*Chrysothamnus viscidiflorus*), broom snakeweed (*Gutierrezia sarothrae*), Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), long-leaf phlox (*Phlox longifolia*), spiny phlox (*Phlox hoodii*), lobeleaf groundsel (*Packera multilobata*), needle-and-thread grass (*Hesperostipa comata*), western wheatgrass (*Pascopyrum smithii*), prairie sagewort (*Artemisia frigida*), wooly groundsel (*Packera cana*), prairie Junegrass (*Koeleria macrantha*), and scarlet globemallow (*Sphaeralcea coccinea*).

Key Environmental Factors: Edaphic indicators are clayey, seleniferous soils derived from Niobrara and Pierre shale, soil series Harsha loams (USDA, NRCS 1994).

Climate Description: The climate follows typical weather patterns of high mountain valleys, low precipitation/snowfall (<12-15 inches/year) and late summer "monsoons".

Land Use History: The town of Kremmling operates an active gravel operation.

Biodiversity Significance Rank Comments (B1): The Horse Gulch site supports an excellent (A-ranked) occurrence of a globally critically imperiled (G1/S1) plant that is a Federally Listed Endangered species: Osterhout milkvetch (*Astragalus osterhoutii*). Osterhout milkvetch is known only from Middle Park/Grand County within the Troublesome and Muddy Creek drainages. Due to its narrow global distribution, this site is irreplaceable. If destroyed, a significant amount of the genetic diversity for Osterhout milkvetch would be lost.

Natural Heritage element occurrences at the Horse Gulch PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Astragalus osterhoutii</i>	Osterhout milkvetch	G1	S1	LE			A	2005-07-01

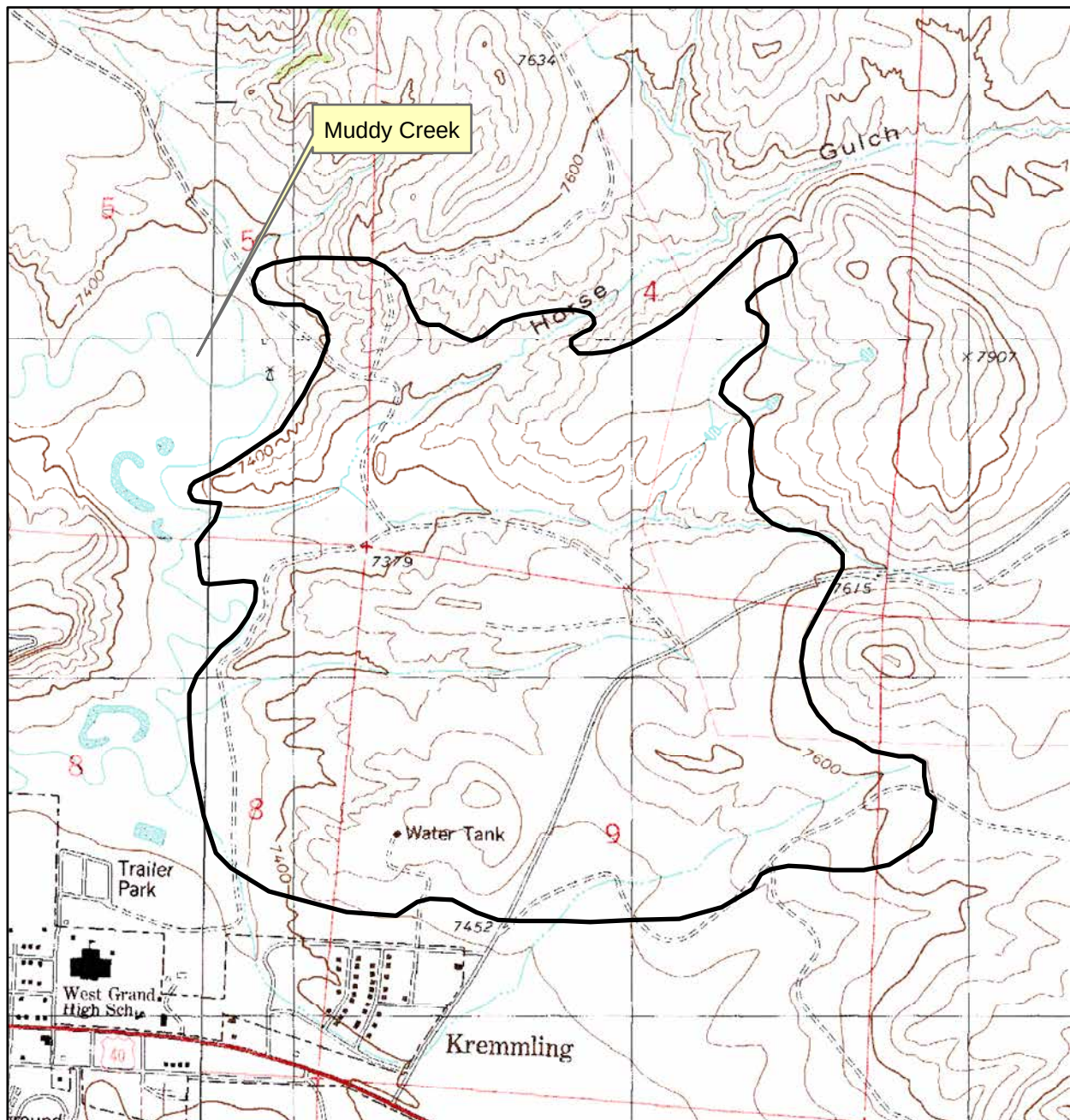
** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundaries are drawn, using soil maps (USDA STATSGO 1994), to capture the immediate outcrops of the Troublesome Formation within the Horse Gulch watershed to buffer the known plant occurrence and identified potential habitat .

Protection Urgency Rank Comments (P1): Protection actions are needed immediately. Current stressors, such as gravel extraction/storage and off-road travel, are destroying habitat, killing plants, and likely transporting exotic plant seed. The boundaries include BLM, State Land Board, and private property. It is recommended that the BLM portion of the site be nominated for a BLM Area of Critical Environmental Concern, and that the state land be designated as a Colorado Natural Area.

Management Urgency Rank Comments (M1): Management of off-road vehicle travel is essential within 1 year to prevent permanent loss of the element occurrence. All terrain vehicle use and/or road maintenance activities that reduce sagebrush cover, weed spraying or invasion of exotic species, i.e., crested wheatgrass (*Agropyron cristatum*) directly jeopardize the viability of occurrence (Hobbs and Huenneke 1992, as cited in Dawson 1999). Special designation, e.g., Area of Critical Environmental Concern, would ensure the protection of the site.

Natural Hazard Comments: Clayey soils, once wet, are difficult to drive and walk on.



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Map Date: 02/06/2006

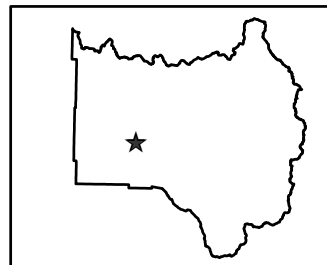
Legend

 PCA Boundary

Junction Butte, 40106-A3
Kremmling, 40106-A4

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 6. Horse Gulch Potential Conservation Area, B1: Outstanding Biodiversity Significance

Kremmling

Biodiversity Rank - B1: Outstanding Biodiversity Significance

Protection Urgency Rank - P1: Immediately Threatened/Outstanding Opportunity

Management Urgency Rank - M1: Essential within 1 Year to Prevent Loss

U.S.G.S. 7.5-minute quadrangles: Hinman Reservoir, Kremmling

Size: 3,156 acres (1,277 ha)

Elevation: 7,400 - 7,580 ft. (2,256 - 2,310 m)

General Description: The Kremmling site is located in Middle Park, north of Kremmling. Middle Park is within a series of high mountain parks formed by north/south trending faults traveling the length of Colorado (Chronic 1980). The predominant grayish-brown soils (USDA, NRCS 1994) are derived from Cretaceous Niobrara and Pierre Shale of the Troublesome Formation (Tweto 1979). The sparsely vegetated slopes are due to the presence of fine textured, clayey soils that contain mineralogic properties that effectively exclude almost all vegetation (Colorado Native Plant Society 1989). Muddy Creek and the Wolford Reservoir form the eastern boundary and Pass Creek forms the northern boundary. Highway 40 bisects the site. Osterhout milkvetch (*Astragalus osterhoutii*) is an endemic plant found only in Middle Park on clayey soils (Colorado Native Plant Society 1989, Dawson 1999). This unique plant is able to thrive in the seleniferous soils where few other plants can. Other associated plants, at low (<5%) cover include: Patterson's milkvetch (*Astragalus pattersonii*), shortstem buckwheat (*Eriogonum brevicaulis*), spiny phlox (*Phlox hoodii*), Fendler's bluegrass (*Poa fendleriana*), bluebunch wheatgrass (*Pseudoroegneria spicata*), sulphur-flowered buckwheat (*Eriogonum umbellatum*), mat penstemon (*Penstemon caespitosus*), and Indian ricegrass (*Achnatherum hymenoides*). Upland vegetation, where soils have lower concentration of minerals, include: yellow rabbitbrush (*Chrysothamnus viscidiflorus*), broom snakeweed (*Gutierrezia sarothrae*), Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), long-leaf phlox (*Phlox longifolia*), spiny phlox (*Phlox hoodii*), lobeleaf groundsel (*Packera multilobata*), needle-and-thread grass (*Hesperostipa comata*), Western wheatgrass (*Pascopyrum smithii*), prairie sagewort (*Artemisia frigida*), wooly groundsel (*Packera cana*), prairie Junegrass (*Koeleria macrantha*), and scarlet globemallow (*Sphaeralcea coccinea*).

Key Environmental Factors: Edaphic indicators are clayey, seleniferous soils derived from Niobrara and Pierre shale, soil series Harsha loams (USDA, NRCS 1994).

Climate Description: The climate follows typical weather patterns of high mountain valleys, low precipitation/snowfall (<12-15 inches/year) and late summer "monsoons".

Land Use History: The Muddy Creek Reservoir was completed in 1994 destroying unknown numbers of Osterhout milkvetch.

Biodiversity Significance Rank Comments (B1): The Kremmling site supports an excellent to good (AB-ranked) occurrence of the Federally Listed Endangered, globally critically imperiled (G1/S1) Osterhout milkvetch (*Astragalus osterhoutii*), including several good (B-ranked) sub-populations. This plant is known only from Grand County within the Troublesome and Muddy Creek drainages. This site is irreplaceable. If destroyed, a significant amount of the genetic diversity for Osterhout milkvetch will be lost.

Natural Heritage element occurrences at the Kremmling PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Astragalus osterhoutii</i>	Osterhout milkvetch	G1	S1	LE			AB	2005-07-22
Vascular Plants	<i>Astragalus osterhoutii</i>	Osterhout milkvetch	G1	S1	LE			B	2005-06-27
Vascular Plants	<i>Astragalus osterhoutii</i>	Osterhout milkvetch	G1	S1	LE			BC	2004-08-04
Vascular Plants	<i>Astragalus osterhoutii</i>	Osterhout milkvetch	G1	S1	LE			C	2004-07-29
Vascular Plants	<i>Astragalus osterhoutii</i>	Osterhout milkvetch	G1	S1	LE			H	1982-09-01
Vascular Plants	<i>Astragalus osterhoutii</i>	Osterhout milkvetch	G1	S1	LE			H	1985-07-99
Vascular Plants	<i>Astragalus osterhoutii</i>	Osterhout milkvetch	G1	S1	LE			X?	1981-02-15

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

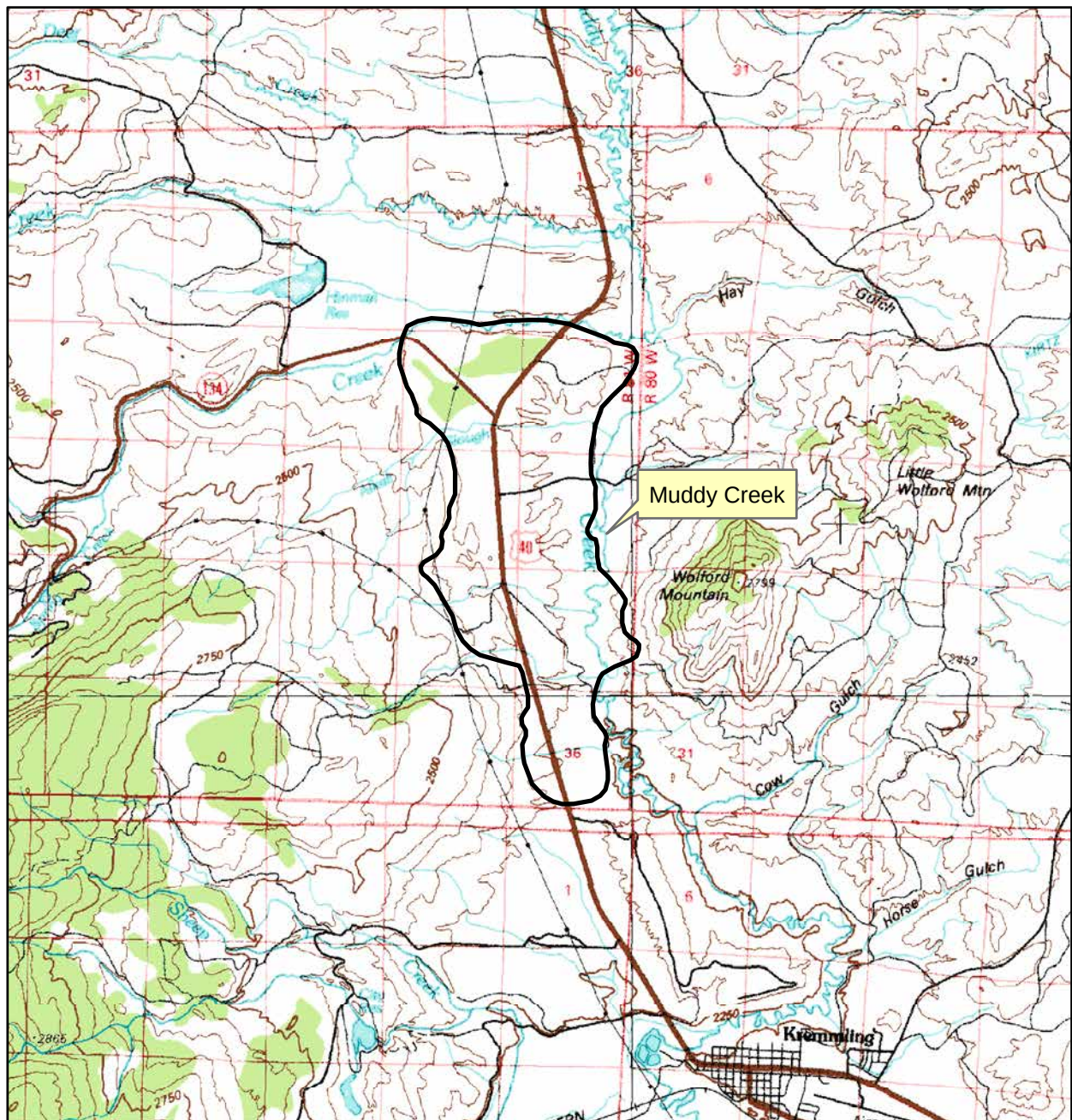
Boundary Justification: The boundaries are drawn to capture the outcrops of the Troublesome Formation and Harsha soil series. Specifically, Pass Creek is the north boundary and Muddy Creek and Wolford Reservoir define the eastern edge.

Protection Urgency Rank Comments (P1): Protection actions are needed immediately. Current stressors, such as off-road travel, are destroying habitat, killing plants, and likely transporting exotic plant seed. In 1994, the Wolford Reservoir was completed, destroying several sub-populations of Osterhout milkvetch. Further development and/or expansion around the reservoir will directly impact the extant population. Expansion and maintenance of Highway 40 will impact several occurrences that occur within the right-of-way. It is recommended that this site be nominated as a BLM Area of Critical Environmental

Concern.

Management Urgency Rank Comments (M1): Management of off-road vehicle travel is essential within one year to prevent permanent loss of the element occurrence. All terrain vehicle use and/or road maintenance activities that reduce sagebrush cover, weed spraying or invasion of exotic species, i.e., crested wheatgrass (*Agropyron cristatum*) directly jeopardize the viability of occurrence (Hobbs and Huenneke 1992, as cited in Dawson 1999). Special designation, e.g., Area of Critical Environmental Concern, would ensure the protection of the site.

Natural Hazard Comments: Clayey soils, once wet, are difficult to drive and walk on.



0 0.5 1 2 3 Miles



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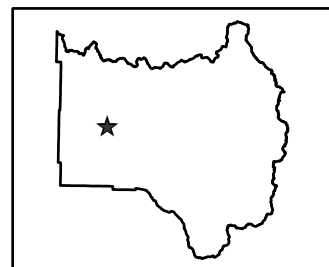
Legend

 PCA Boundary

Steamboat Springs, 40106-A1

30 x 60 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 7. Kremmling Potential Conservation Area, B1: Outstanding Biodiversity Significance

Red Dirt Creek at Hinman Reservoir

Biodiversity Rank - B1: Outstanding Biodiversity Significance

Protection Urgency Rank - P1: Immediately Threatened/Outstanding Opportunity

Management Urgency Rank - M1: Essential within 1 Year to Prevent Loss

U.S.G.S. 7.5-minute quadrangles: Hinman Reservoir

Size: 715 acres (290 ha)

Elevation: 7,700 - 7,800 ft. (2,347 - 2,377 m)

General Description: The Red Dirt Creek at Hinman Reservoir site is located within the western portion of Middle Park. Middle Park is located within a series of high mountain parks formed by north/south trending faults traveling the length of Colorado (Chronic 1980). The predominant grayish-brown soils (USDA, NRCS 1994) are derived from Cretaceous Niobrara and Pierre Shale of the Troublesome Formation (Tweto 1979). The sparsely vegetated slopes are due to the presence of fine textured, clayey soils that contain mineralogic properties that effectively excludes almost all vegetation (Colorado Native Plant Society 1989). Red Dirt Creek and several ephemeral gullies dissect the site. The endemic Osterhout milkvetch (*Astragalus osterhoutii*) is found within the site. Osterhout milkvetch is a clay-loving specialist that has adapted to the moisture-holding soils (Dawson 1999). This unique plants is able to thrive in the seleniferous soils where few other plants can. Other associated plants, at low (<5%) cover include: Patterson's milkvetch (*Astragalus pattersonii*), shortstem buckwheat (*Eriogonum brevicaulis*), spiny phlox (*Phlox hoodii*), Fendler's bluegrass (*Poa fendleriana*), bluebunch wheatgrass (*Pseudoroegneria spicata*), sulphur-flowered buckwheat (*Eriogonum umbellatum*), mat penstemon (*Penstemon caespitosus*), and Indian ricegrass (*Achnatherum hymenoides*). Upland vegetation, where soils have lower concentration of minerals, include: Utah juniper (*Juniperus osteosperma*), yellow rabbitbrush (*Chrysothamnus viscidiflorus*), broom snakeweed (*Gutierrezia sarothrae*), Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), long-leaf phlox (*Phlox longifolia*), spiny phlox (*Phlox hoodii*), lobeleaf groundsel (*Packera multilobata*), needle and thread grass (*Hesperostipa comata*), Western wheatgrass (*Pascopyrum smithii*), prairie sagewort (*Artemisia frigida*), wooly groundsel (*Packera cana*), prairie Junegrass (*Koeleria macrantha*), and scarlet globemallow (*Sphaeralcea coccinea*).

Key Environmental Factors: Edaphic indicators are clayey, seleniferous soils derived from Niobrara and Pierre shale, soil series Harsha loams (USDA, NRCS 1994).

Climate Description: The climate follows typical weather patterns of high mountain valleys, low precipitation/snowfall (<12-15 inches/year) and late summer

"monsoons".

Biodiversity Significance Rank Comments (B1): The site supports a good (B-ranked) occurrence of a globally critically imperiled (G1/S1) plant that is a Federally Listed Endangered species: Osterhout milkvetch (*Astragalus osterhoutii*). This species is endemic to the Middle Park region of Colorado. This site is irreplaceable, if destroyed, a significant amount of the genetic diversity for Osterhout milkvetch would be lost.

Natural Heritage element occurrences at the Red Dirt Creek at Hinman Reservoir PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Astragalus osterhoutii</i>	Osterhout milkvetch	G1	S1	LE			B	2005-07-14

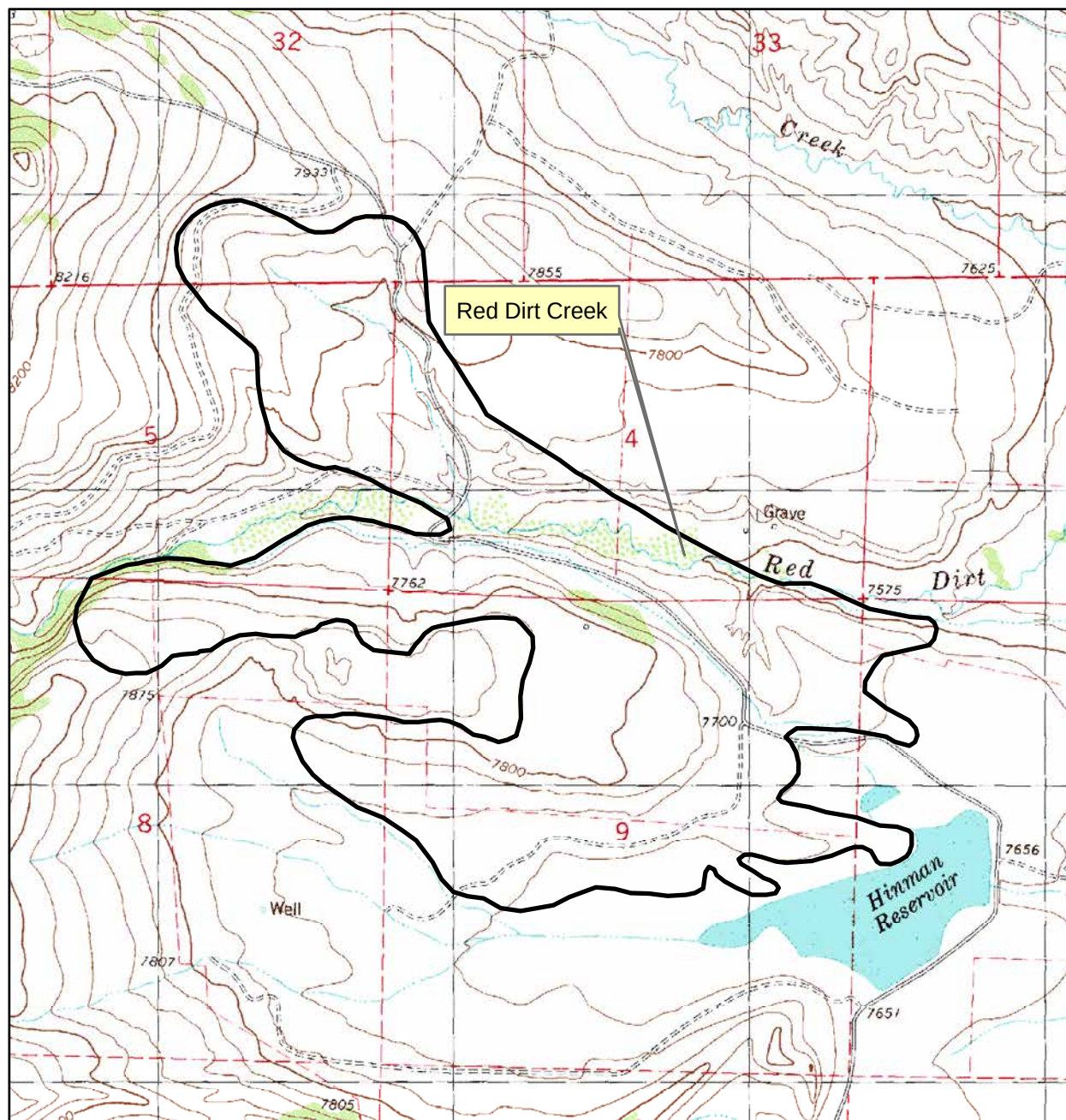
** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

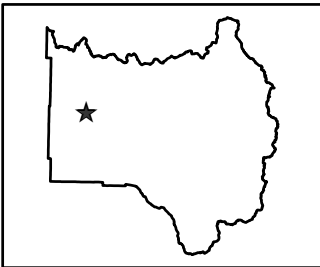
Boundary Justification: The boundaries are drawn to capture the outcrops of the Troublesome Formation. The south boundary begins at Hinman Reservoir and goes north towards Deer Creek, and then south to the reservoir to capture the known rare plant occurrence and potential habitat.

Protection Urgency Rank Comments (P1): Protection actions are needed immediately. Current stressors, such as off-road travel, are destroying habitat, killing plants, and likely transporting exotic plant seed. It is recommended to work with the BLM and private landowners to consider a conservation easement or the BLM's status of Area of Critical Environmental Concern.

Management Urgency Rank Comments (M1): Management of off-road vehicle travel is essential within 1 year to prevent permanent loss of the element occurrence. All terrain vehicle use and/or road maintenance activities that reduce sagebrush cover, weed spraying or invasion of exotic species, i.e., crested wheatgrass (*Agropyron cristatum*) directly jeopardize the viability of occurrence (Hobbs and Huenneke 1992, as cited in Dawson 1999).

Natural Hazard Comments: Clayey soils, once wet, are difficult to drive and walk on.



Colorado Natural Heritage Program Colorado State University 254 General Services Building 8002 Campus Delivery Fort Collins, CO 80523-8002 Ph (970) 491-1309 Fax (970) 491-3349 www.cnhp.colostate.edu Map Date: 02/06/2006	Legend  PCA Boundary Hinman Reservoir, 40106-B4 7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey	Location in Grand County 
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Map 8. Red Dirt Creek at Hinman Reservoir Potential Conservation Area, B1:
Outstanding Biodiversity Significance

Rock Creek

Biodiversity Rank - B1: Outstanding Biodiversity Significance

Protection Urgency Rank - P2: Threat/Opportunity within 5 Years

Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss

U.S.G.S. 7.5-minute quadrangles: Parshall

Size: 720 acres (291 ha)

Elevation: 7,500 - 7,500 ft. (2,286 - 2,286 m)

General Description: The Rock Creek site is located in Middle Park, between Kremmling and Parshall. In general, Middle Park is located within a series of high mountain parks formed by north/south trending faults traveling the length of Colorado (Chronic 1980). The predominant grayish-brown soils (USDA, NRCS 1994) are derived from Cretaceous Niobrara and Pierre shale of the Troublesome Formation (Tweto 1979). The sparsely vegetated slopes are due to the presence of fine textured, clayey soils that contain mineralogic properties that effectively excludes almost all vegetation (Colorado Native Plant Society 1989). Rock Creek is an ephemeral stream that drains into the Colorado River. The Middle Park endemic Osterhout milkvetch (*Astragalus osterhoutii*) and dog parsley (*Aletes nuttallii*), a regional endemic, are found on the clayey soils (Dawson 1999). These unique plants are able to thrive in the seleniferous soils where few other plants can. Other associated plants, at low (<5%) cover include Patterson's milkvetch (*Astragalus pattersonii*), shortstem buckwheat (*Eriogonum brevicaulis*), spiny phlox (*Phlox hoodii*), Fendler's bluegrass (*Poa fendleriana*), bluebunch wheatgrass (*Pseudoroegneria spicata*), sulphur-flowered buckwheat (*Eriogonum umbellatum*), mat penstemon (*Penstemon caespitosus*), and Indian ricegrass (*Achnatherum hymenoides*). Upland vegetation, where soils have lower concentration of minerals, includes yellow rabbitbrush (*Chrysothamnus viscidiflorus*), broom snakeweed (*Gutierrezia sarothrae*), Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), greasewood (*Sarcobatus vermiculatus*), and scarlet globemallow (*Sphaeralcea coccinea*).

Key Environmental Factors: Edaphic indicators are clayey, seleniferous soils derived from Niobrara and Pierre shale, soil series Harsha loams (USDA, NRCS 1994).

Climate Description: The climate follows typical weather patterns of high mountain valleys, low precipitation/snowfall (<12-15 inches/year) and late summer "monsoons".

Biodiversity Significance Rank Comments (B1): The Rock Creek site supports an excellent (A-ranked) occurrence of a globally critically imperiled (G1/S1) plant that is a Federally Listed Endangered species: Osterhout milkvetch (*Astragalus*

osterhoutii). Additionally, an excellent (A-ranked) occurrence of the globally vulnerable (G3/S1) dog parsley (*Aletes nuttallii*), was discovered here. This site is irreplaceable. If destroyed, a significant amount of the genetic diversity for Osterhout milkvetch will be lost.

Natural Heritage element occurrences at the Rock Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Astragalus osterhoutii</i>	Osterhout milkvetch	G1	S1	LE			A	2005-07-07
Vascular Plants	<i>Aletes nuttallii</i>	dog parsley	G3	S1				A	2005-06-26

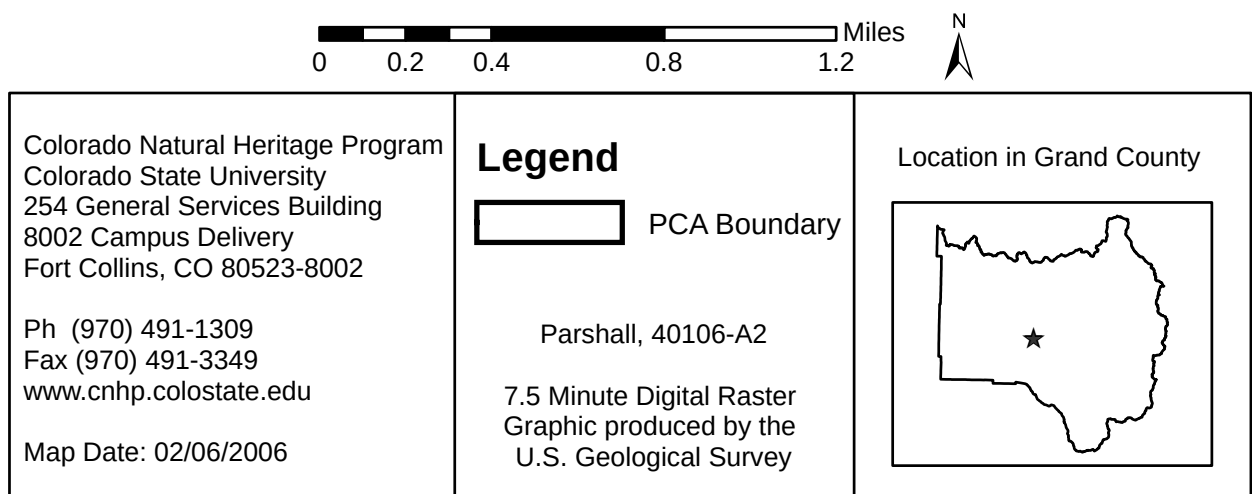
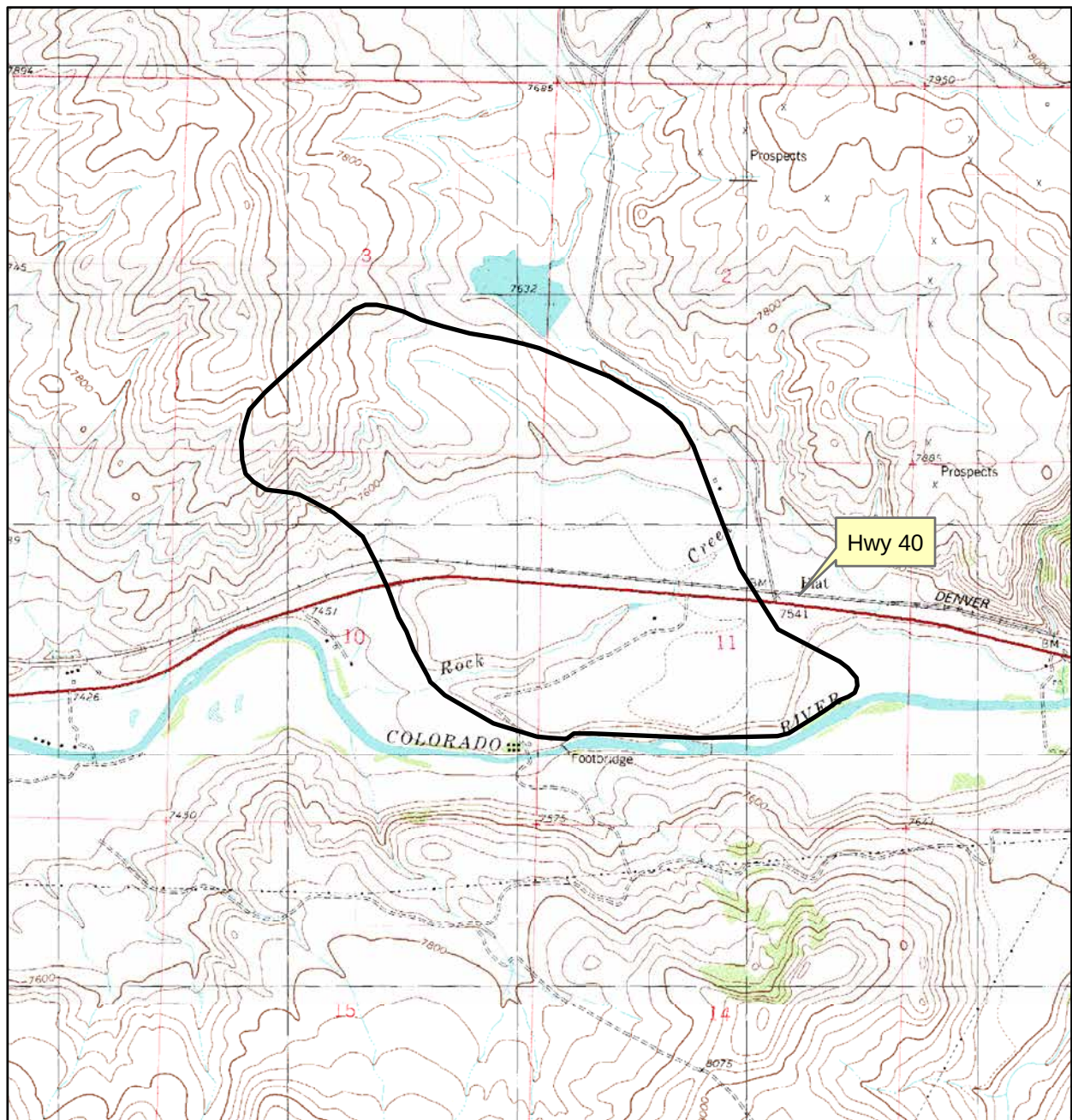
** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundaries are drawn to capture the outcrops of the Troublesome Formation which support the known rare plant occurrences and potential habitat.

Protection Urgency Rank Comments (P2): Protection actions are needed within the next 5 years. Current stressors, such as off-road travel, are destroying habitat, killing plants, and likely transporting exotic plant seed.

Management Urgency Rank Comments (M2): Management of pedestrian traffic is suggested within the next 5 years to prevent permanent loss of the element occurrences.

Natural Hazard Comments: Clayey soils, once wet, are difficult to drive and walk on.



Map 9. Rock Creek Potential Conservation Area, B1: Outstanding Biodiversity Significance

Troublesome Creek

Biodiversity Rank - B1: Outstanding Biodiversity Significance

Protection Urgency Rank - P1: Immediately Threatened/Outstanding Opportunity

Management Urgency Rank - M1: Essential within 1 Year to Prevent Loss

U.S.G.S. 7.5-minute quadrangles: Gunsight Pass, Junction Butte

Size: 2,341 acres (948 ha)

Elevation: 7,400 - 7,700 ft. (2,256 - 2,347 m)

General Description: The Troublesome Creek site is located in Middle Park, northeast of Kremmling. Middle Park is located within a series of high mountain parks formed by north/south trending faults traveling the length of Colorado (Chronic 1980). The predominant grayish-brown soils (USDA, NRCS 1994) are derived from Cretaceous Niobrara and Pierre Shale of the Troublesome Formation (Tweto 1979). The sparsely vegetated slopes are due to the presence of fine textured, clayey soils that contain mineralogic properties that effectively excludes almost all vegetation (Colorado Native Plant Society 1989). Troublesome Creek and its major tributaries, Waste Creek and Sulphur Gulch dissect the site. Two endemic plants are found within Middle Park on the clayey soils, Penland beardtongue (*Penstemon penlandii*) and Osterhout milkvetch (*Astragalus osterhoutii*), due in part to the moisture-holding soils (Dawson 1999). These unique plants are able to thrive in the seleniferous soils where few other plants can. Other associated plants, at low (<5%) cover include: dog parsley (*Aletes nuttallii*, a regional endemic), Patterson's milkvetch (*Astragalus pattersonii*), shortstem buckwheat (*Eriogonum brevicaulis*), spiny phlox (*Phlox hoodii*), Fendler's bluegrass (*Poa fendleriana*), bluebunch wheatgrass (*Pseudoroegneria spicata*), sulphur-flowered buckwheat (*Eriogonum umbellatum*), mat penstemon (*Penstemon caespitosus*), and Indian ricegrass (*Achnatherum hymenoides*). Upland vegetation, where soils have a lower concentration of minerals, include: yellow rabbitbrush (*Chrysothamnus viscidiflorus*), broom snakeweed (*Gutierrezia sarothrae*), Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), long-leaf phlox (*Phlox longifolia*), spiny phlox (*Phlox hoodii*), lobeleaf groundsel (*Packera multilobata*), needle and thread grass (*Hesperostipa comata*), Western wheatgrass (*Pascopyrum smithii*), prairie sagewort (*Artemisia frigida*), wooly groundsel (*Packera cana*), prairie Junegrass (*Koeleria macrantha*), and scarlet globemallow (*Sphaeralcea coccinea*).

Key Environmental Factors: Edaphic indicators are clayey, seleniferous soils derived from Niobrara and Pierre shale, soil series Harsha loams (USDA, NRCS 1994).

Climate Description: The climate follows typical weather patterns of high mountain valleys, low precipitation/snowfall (<12-15 inches/year) and late summer

"monsoons".

Biodiversity Significance Rank Comments (B1): The Troublesome Creek site supports excellent and good (A and B-ranked) occurrences of two globally critically imperiled (G1/S1) plants that are Federally Listed Endangered species: Penland beardtongue (*Penstemon penlandii*) and Osterhout milkvetch (*Astragalus osterhoutii*). One of the world's largest populations of Osterhout milkvetch is found here. A larger population lies northwest of Kremmling on BLM land, however it was partially destroyed by the creation of the Wolford Mountain Reservoir. This site also includes all known occurrences for Penland beardtongue. Penland beardtongue and Osterhout milkvetch are known only from Grand County within the Troublesome and Muddy Creek drainages. Additionally, an excellent (A-ranked) occurrence of dog parsley (*Aletes nuttallii*), a globally vulnerable (G3/S1) plant species is found within the site. The dog parsley is a regional endemic, and the Middle Park populations are at the southern extension of its range (NatureServe 2005). This site is of outstanding biodiversity value, in essence irreplaceable.

Natural Heritage element occurrences at the Troublesome Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Astragalus osterhoutii</i>	Osterhout milkvetch	G1	S1	LE			A	2005-06-21
Vascular Plants	<i>Penstemon penlandii</i>	Penland beardtongue	G1	S1	LE			A	2005-06-21
Vascular Plants	<i>Penstemon penlandii</i>	Penland beardtongue	G1	S1	LE			B	2005-06-22
Vascular Plants	<i>Aletes nuttallii</i>	dog parsley	G3	S1				A	2005-06-22

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

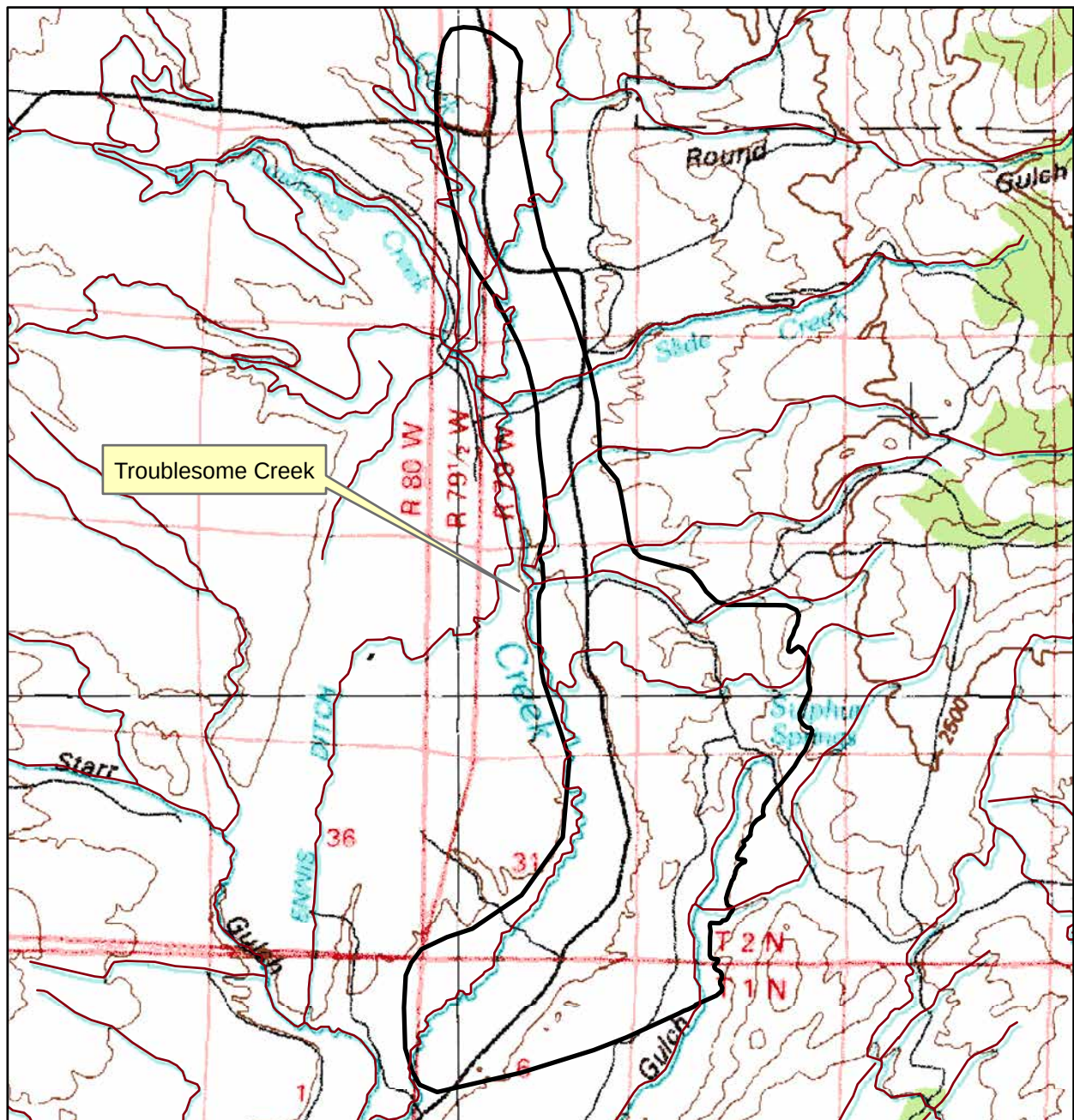
Boundary Justification: The boundaries are drawn to capture the outcrops of the Troublesome Formation. The north boundary begins at the intersection of CR 22 and CR 2 and expands south between Troublesome Creek and Sulphur Gulch to capture known plant occurrences and potential habitat.

Protection Urgency Rank Comments (P1): Protection actions are needed immediately. Current stressors, such as off-road vehicle travel, are destroying habitat, killing plants, and likely transporting exotic plant seed. Special designation, e.g., Area of Critical Environmental Concern, would ensure the protection of the site.

Management Urgency Rank Comments (M1): Management of off-road vehicle travel is essential within 1 year to prevent permanent loss of the element occurrences. All terrain vehicle use and/or road maintenance activities that reduce sagebrush cover, weed spraying or invasion of exotic species, i.e., crested

wheatgrass (*Agropyron cristatum*), directly jeopardize the viability of occurrences (Hobbs and Huenneke 1992, as cited in Dawson 1999).

Natural Hazard Comments: Clayey soils, once wet, are difficult to drive and walk on.



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Map Date: 02/09/2006

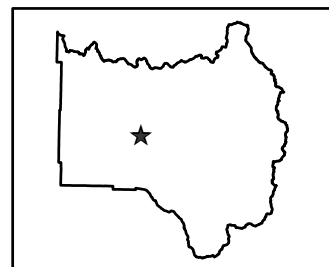
Legend

 PCA Boundary

Steamboat Springs, 40106-A1

30 x 60 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 10. Troublesome Creek Potential Conservation Area, B1: Outstanding Biodiversity Significance

Kettle Ponds at Grand Lake

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Grand Lake, Shadow Mountain

Size: 70 acres (28 ha)

Elevation: 8,635 - 8,680 ft. (2,632 - 2,646 m)

General Description: Community occurs along second kettle pond in a series of five ponds. Ponds are glacial relics which grade from open water aquatic at their centers to inundated, to saturated, to mesic soils. There is a distinct transition from wetlands dominated by mesic graminoids to upland of xeric woodland. Surrounding uplands are dominated by lodgepole pine (*Pinus contorta*) overstory with a whortleberry (*Vaccinium* sp.) / kinnikinnik (*Arctostaphylos uva-ursi*) understory. Ponds are separated by this xeric woodland community. Ponds are seral and have residual areas of open water surrounded by inundated to seasonally saturated soils. Many aquatic species are present throughout, with beaked sedge (*Carex utriculata*) being the dominant species in all areas except for the area dominated by American mannagrass (*Glyceria grandis*). Soils are composed of silty clay loams with consistent mottling throughout indicating seasonal drying likely in the fall and winter. General geology consists of unconsolidated surficial deposits and rocks of the Quaternary Age, specifically glacial drift of the Pinedale and Bull lake glaciations. Disturbances include adjacent golf course parking lot, golf course, and gardens and recreational use of the area by a system of trails. The wetlands do not seem impacted by recreational use due to little use and inundated soils.

Key Environmental Factors: Key environmental factors influencing the biota of the site are slope shape due to glacial formation, soil type, and precipitation.

Climate Description: Climate likely follows typical patterns of this region of Colorado being generally xeric throughout the year with a wet spring season and later summer "monsoons".

Biodiversity Significance Rank Comments (B2): This site is drawn for a good (B-ranked) occurrence of a globally imperiled (G2?/S2) plant community of American mannagrass (*Glyceria grandis*) herbaceous vegetation and a good (B-ranked) occurrence of a globally demonstrably secure (G5/S3) amphibian, wood frog (*Rana sylvatica*).

Natural Heritage element occurrences at the Kettle Ponds at Grand Lake PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Amphibians	<i>Rana sylvatica</i>	Wood Frog	G5	S3		SC	USFS	B	2005-07-15
Natural Communities	<i>Glyceria grandis</i> Herbaceous Vegetation	American Mannagrass	G2?	S2				B	2005-07-15

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundary is drawn to encompass five kettle ponds along the northwestern edge of Shadow Mountain Reservoir. Ponds are self-contained and depend mostly on precipitation as their main source of water. Water levels may be influenced by fluctuations in water table. Not all ecological processes important to the site are included in the boundaries and activities such as development in the area may be deleterious to the hydrology and health of the ponds by adding sediment and toxins.

Protection Urgency Rank Comments (P3): The site is protected as part of the Grand Lake Recreation Area. This protection is likely focused more towards recreational use including hiking, nature walks, cross-country skiing and snow shoeing and less towards proper functioning of ecological systems.

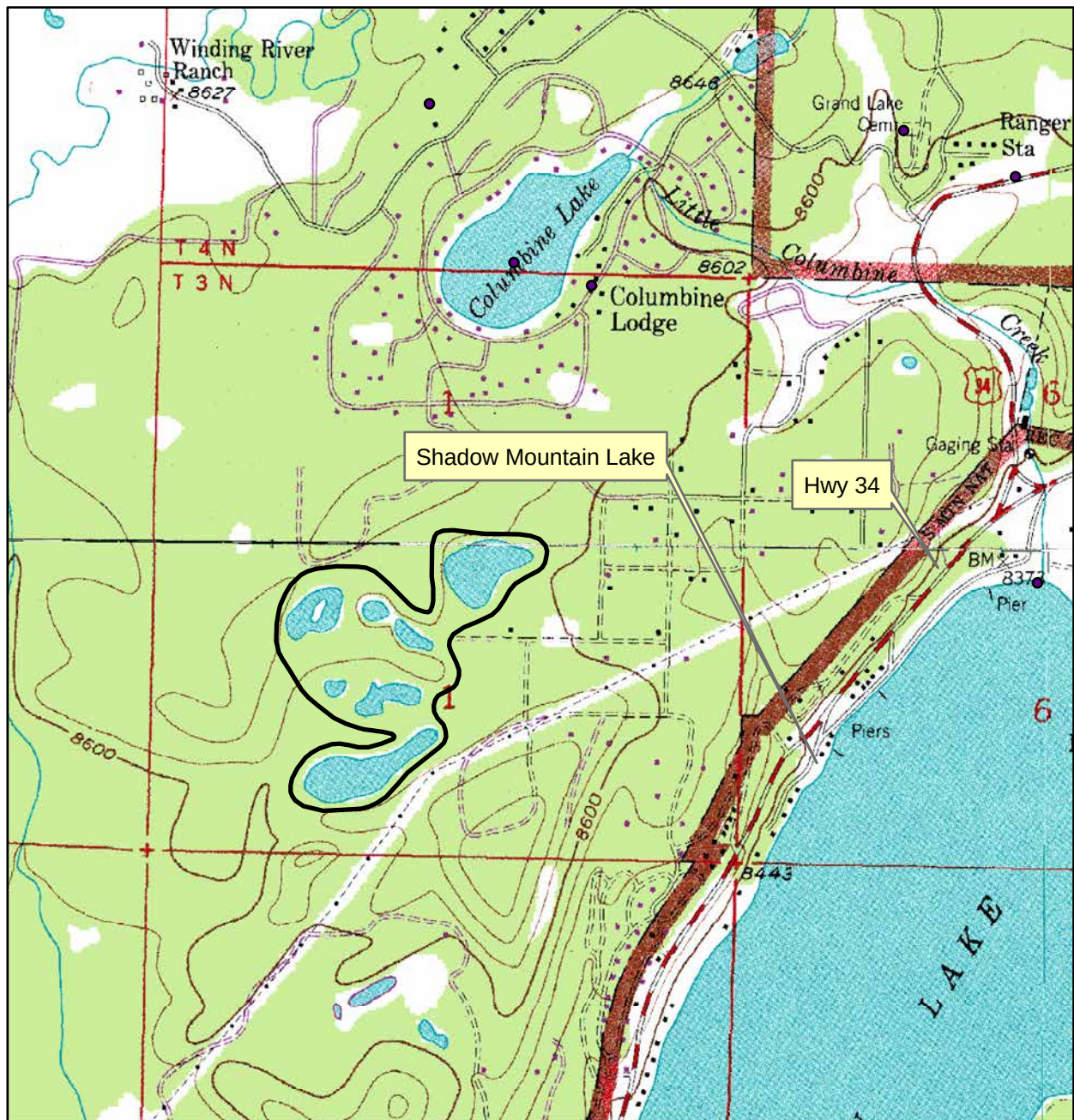
Management Urgency Rank Comments (M4): The area does not currently need any specific management, but may need management if adjacent developed areas are altered or usage of the area is altered or increased.

Land Use Comments: Land is currently utilized for recreational purposes including hiking, biking, skiing, and snowshoeing. Immediately adjacent to the site is a golf course and parking lot.

Natural Hazard Comments: Inundated soils are difficult to walk in and centers of ponds have areas of deep water.

Exotic Species Comments: Site harbors very few exotic species. Dock (*Rumex* sp.) was found in one of the ponds, but it was not positively identified as the non-native species.

Off-Site Considerations: Off-site considerations include golf course and parking lots just north of ponds, which may add sediment and toxins to the system. As well, property to the west of the site is developed with a complex of housing, septic, water, electric, and road systems.



0 0.125 0.25 0.5 0.75 Miles



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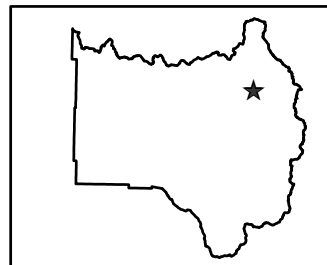
Legend

 PCA Boundary

Shadow Mountain, 40105-B7
Grand Lake, 40105-C7

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 11. Kettle Ponds at Grand Lake Potential Conservation Area, B2: Very High Biodiversity Significance

Upper Troublesome Creek

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Gunsight Pass, Hyannis Peak

Size: 2,087 acres (845 ha)

Elevation: 7,880 - 9,200 ft. (2,402 - 2,804 m)

General Description: Site encompasses the upper reaches of Troublesome Creek, a second order tributary of the Colorado River. Geology along the majority of the drainage is composed of igneous rocks of the Tertiary Age, with lower reaches of the stream being part of the Troublesome Formation. Soils are xeric and clayey along the Troublesome Formation and uplands are dominated by big sagebrush (*Artemisia tridentata*) shrubland communities. Higher elevation and upper reaches of the drainage are dominated by lodgepole pine (*Pinus contorta*) forest communities with mixed subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*) at the highest reaches. Riparian areas are variable throughout and include quaking aspen (*Populus tremuloides*) and narrowleaf cottonwood (*Populus angustifolia*) woodlands, willow (*Salix*) and thinleaf alder (*Alnus incana*) dominated tall shrublands, and meadows of mesic graminoids.

Key Environmental Factors: Key environmental factors include snow melt, gentle slopes and solar exposure, seasonal flooding, groundwater discharge, and clay soils. Snow pack is likely not important at lower reaches of drainage due to gentle topography where snow is melted by solar exposure throughout the winter, but is more important at upper reaches where snow pack is retained until later in the season.

Climate Description: Area likely follows typical Colorado weather patterns being generally xeric throughout the year with wetter spring seasons and later summer "monsoons".

Land Use History: Ownership varies from public to private with large areas of the upper reaches being part of a BLM Wilderness Study Area. BLM property is located within a grazing allotment. A majority of the private property has been irrigated and either cultivated for hay production or used for livestock grazing.

Biodiversity Significance Rank Comments (B2): This site is drawn for a good (B-ranked) occurrence of a globally imperiled to globally vulnerable (G2G3/S2) community, Drummond's willow (*Salix drummondiana*) / water sedge (*Carex aquatilis*), and a good (B-ranked) occurrence of a globally imperiled (G2?/S2)

community, American mannagrass (*Glyceria grandis*). The site also supports four good (B-ranked) occurrences of globally vulnerable (G3/S3) communities: Drummond's willow / bluejoint reedgrass (*Calamagrostis canadensis*), thinleaf alder (*Alnus incana*) - Drummond's willow (*Salix drummondiana*), thinleaf alder / mesic forbs, and narrowleaf cottonwood (*Populus angustifolia*) / thinleaf alder. In addition, it supports a fair (C-ranked) occurrence of the globally vulnerable (G3/S3) community, thinleaf alder / mixed willow (*Salix monticola*, *lucida*, *ligulifolia*).

Natural Heritage element occurrences at the Upper Troublesome Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Glyceria grandis</i> Herbaceous Vegetation	American Mannagrass	G2?	S2				B	2005-07-19
Natural Communities	<i>Salix drummondiana</i> / <i>Carex aquatilis</i> Shrubland	Drummond Willow / Aquatic Sedge	G2G3	S2				B	2005-07-03
Natural Communities	<i>Alnus incana</i> - <i>Salix (monticola, lucida, ligulifolia)</i> Shrubland	Thinleaf Alder - Mixed Willow Species	G3	S3				C	2005-09-28
Natural Communities	<i>Alnus incana</i> - <i>Salix drummondiana</i> Shrubland	Montane Riparian Shrubland	G3	S3				B	2005-07-18
Natural Communities	<i>Alnus incana</i> / Mesic Forbs Shrubland	Thinleaf Alder / Mesic Forb Riparian Shrubland	G3	S3				B	2005-07-19
Natural Communities	<i>Populus angustifolia</i> / <i>Alnus incana</i> Woodland	Montane Riparian Forest	G3	S3				B	2005-08-31
Natural Communities	<i>Salix drummondiana</i> / <i>Calamagrostis canadensis</i> Shrubland	Lower Montane Willow Carrs	G3	S3				B	2005-07-18

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries incorporate a large area of the upper reaches of Troublesome Creek and some of its tributaries that contain a number of high quality communities. Boundaries were drawn to encompass those hydrologic functions necessary to the maintenance of these elements including spring flooding, groundwater recharge, sediment movement, and surface water levels. The

boundaries do not encompass all hydrologic and ecologic processes that maintain site elements. Upstream activities, such as improper livestock grazing, water diversion, and development may be deleterious to the elements.

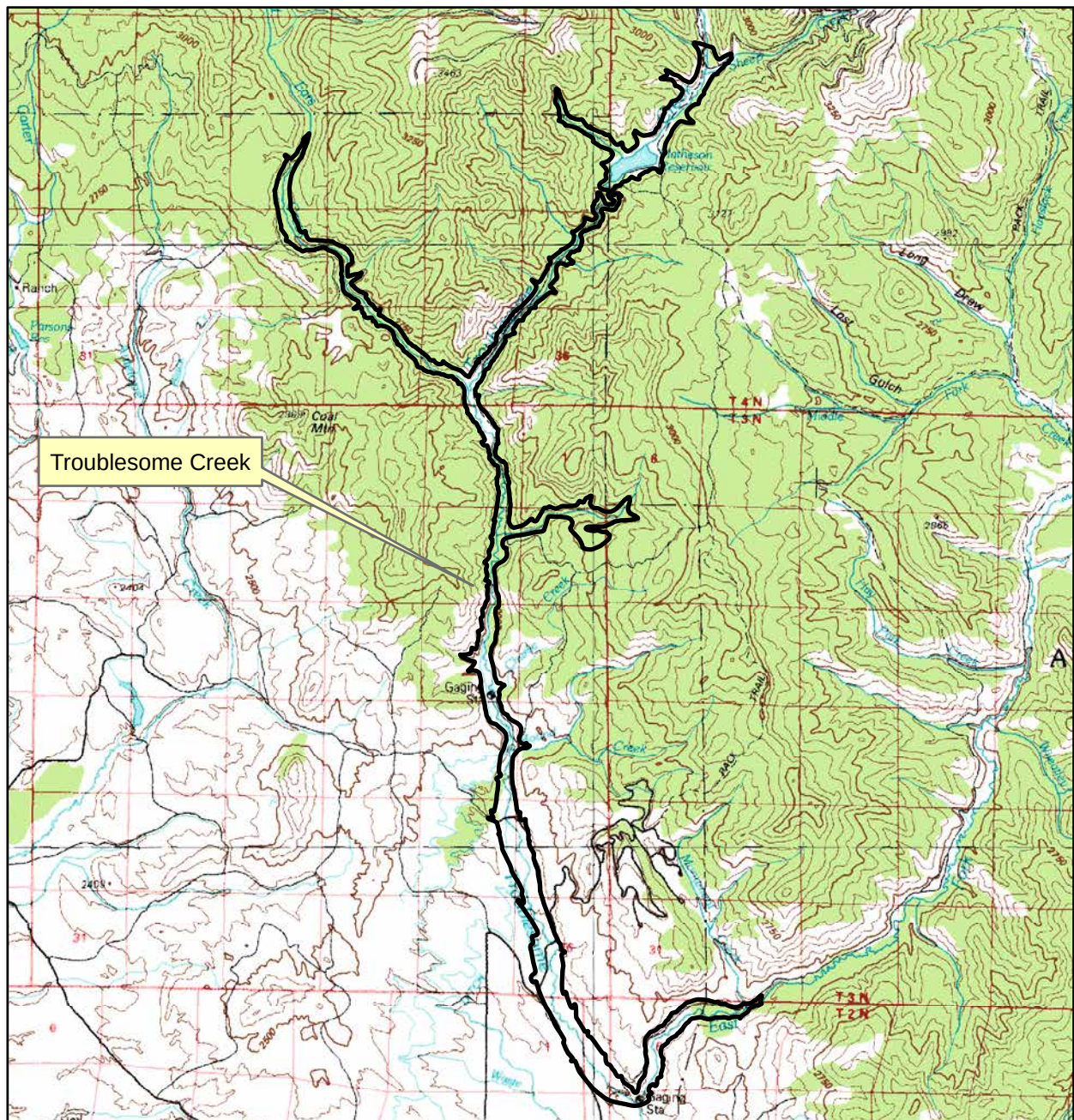
Protection Urgency Rank Comments (P3): Portions of the PCA are owned by BLM and designated as a Wilderness Study Area.

Management Urgency Rank Comments (M3): There are no urgent threats, although lower reaches of Troublesome Creek have been impacted by agriculture and livestock grazing. If current management is altered and livestock, agriculture, or dewatering of the drainage is increased, management practices may need to be modified to account for the changes including livestock movement and timed water release.

Land Use Comments: Upper reaches are designated specifically for research. Non-motorized use is allowed. Downstream areas are used for livestock grazing and agriculture.

Exotic Species Comments: Exotic species are prevalent in some areas where livestock grazing is intense or was in the past. Impacted riparian areas tend to support common exotics such as Kentucky bluegrass (*Poa pratensis*), smooth brome (*Bromus inermis*), and Canada thistle (*Cirsium arvense*), which all indicate disturbance from grazing. Other species such as meadow foxtail (*Alopecurus pratensis*) and meadow barley (*Hordeum brachyantherum*) are found within some wetland areas.

Off-Site Considerations: Off-site disturbances to Upper Troublesome Creek include water diversion, agriculture, and livestock grazing.



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Map Date: 02/09/2006

Legend

 PCA Boundary

Steamboat Springs, 40106-A1

30 x 60 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 12. Upper Troublesome Creek Potential Conservation Area, B2: Very High Biodiversity Significance

Battle Creek

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Battle Mountain

Size: 344 acres (139 ha)

Elevation: 8,455 - 8,645 ft. (2,577 - 2,635 m)

General Description: Battle Creek and South Battle Creek are second order tributaries of the Williams Fork River. General geology consists of sedimentary rocks of the Tertiary Age, specifically sandstones and siltstones of the Troublesome Formation. Uplands immediately adjacent to drainages are dominated by xeric big sagebrush (*Artemisia tridentata*) shrublands. Forested uplands are dominated by lodgepole pine (*Pinus contorta*) forest ecosystems that exhibit extensive losses from current beetle infestation. Both drainages occur on private property which is utilized for grazing livestock. Some disturbances include development, trails from livestock and wildlife, and a few exotic species occurring along edges of the riparian areas. Old beaver dams and ponds are present along South Battle Creek. Element occurrences are sustained by surface flows, seasonal flooding, and groundwater discharge. Riparian areas are saturated to inundated throughout with a layer of hemic soils over mineral soil. Riparian areas are dominated by willow (*Salix* sp.) tall shrub communities. The tall shrub strata along South Battle Creek is dominated by mountain willow (*Salix monticola*) with some Geyer's willow (*Salix geyeriana*) occurring along drying edges with a mixture of thinleaf alder (*Alnus incana*), strapleaf willow (*Salix eriocephala* var. *ligulifolia*), and diamondleaf willow (*Salix planifolia*). The herbaceous strata is dominated by mesic graminoids including beaked sedge (*Carex utriculata*), bluejoint reedgrass (*Calamagrostis canadensis*), and water sedge (*Carex aquatilis*). Mesic forbs and other species present include field horsetail (*Equisetum arvense*), large-leaved avens (*Geum macrophyllum*), northern bedstraw (*Galium septentrionale*), and nettle (*Urtica gracilis*). Battle Creek is similarly stratified with much more sparse tall shrub cover. The small, quaking fen adjacent to Battle Creek is dominated by beaked sedge.

Key Environmental Factors: Key environmental factors driving the hydrology and species composition include beaver activity, groundwater recharge/discharge, surface water flows, and seasonal flooding.

Climate Description: Area tends to follow typical climate patterns of Colorado being generally xeric throughout the year with wetter spring seasons and a late summer "monsoon" season.

Land Use History: Land has been mainly used for grazing in the past along with tree harvest in upper reaches of the drainage.

Cultural Features: Historic Pony Express wagon road crosses the upper end of South Battle Creek Basin, but is no longer heavily used. Pony Express station is still present uphill to the west of South Battle Creek drainage and has been designated as a historic landmark.

Biodiversity Significance Rank Comments (B3): This site is drawn for a good (B-ranked) occurrence of the globally vulnerable (G3/S3) wetland community, mountain willow / beaked sedge shrubland (*Salix monticola* / *Carex utriculata*) and a fair (C-ranked) occurrence of the globally common (G5/S4) wetland community, beaked sedge perched wetland (*Carex utriculata*).

Natural Heritage element occurrences at the Battle Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Salix monticola</i> / <i>Carex utriculata</i> Shrubland	Montane Riparian Willow Carr	G3	S3				B	2005-07-13
Natural Communities	<i>Carex utriculata</i> Herbaceous Vegetation	Beaked Sedge Montane Wet Meadows	G5	S4				C	2005-07-13

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary includes portions of South Battle Creek and Battle Creek. Boundaries were drawn to include portions of surrounding areas important to the maintenance of site hydrology and buffering uplands. This accounts for natural hydrologic processes important to the maintenance of the elements such as seasonal flooding, groundwater recharge, surface flows, and sediment deposition. The boundary does not include all hydrological processes necessary to the maintenance of site hydrology and upstream activities such as deforestation, improper livestock grazing, development, or water diversion could be detrimental to the site.

Protection Urgency Rank Comments (P3): Current threats to South Battle Creek include livestock grazing in surrounding uplands, non-native species invasion, and dewatering. A ditch is present uphill of the drainage, but does not appear to be currently in use. Current threats to Battle Creek include livestock grazing, roads, and development by property owner. There is an easement on large portions of the 5,000 acre ranch. Although the property's main income is from cattle production, the property owner appears to be interested in maintenance of the land's health and natural heritage.

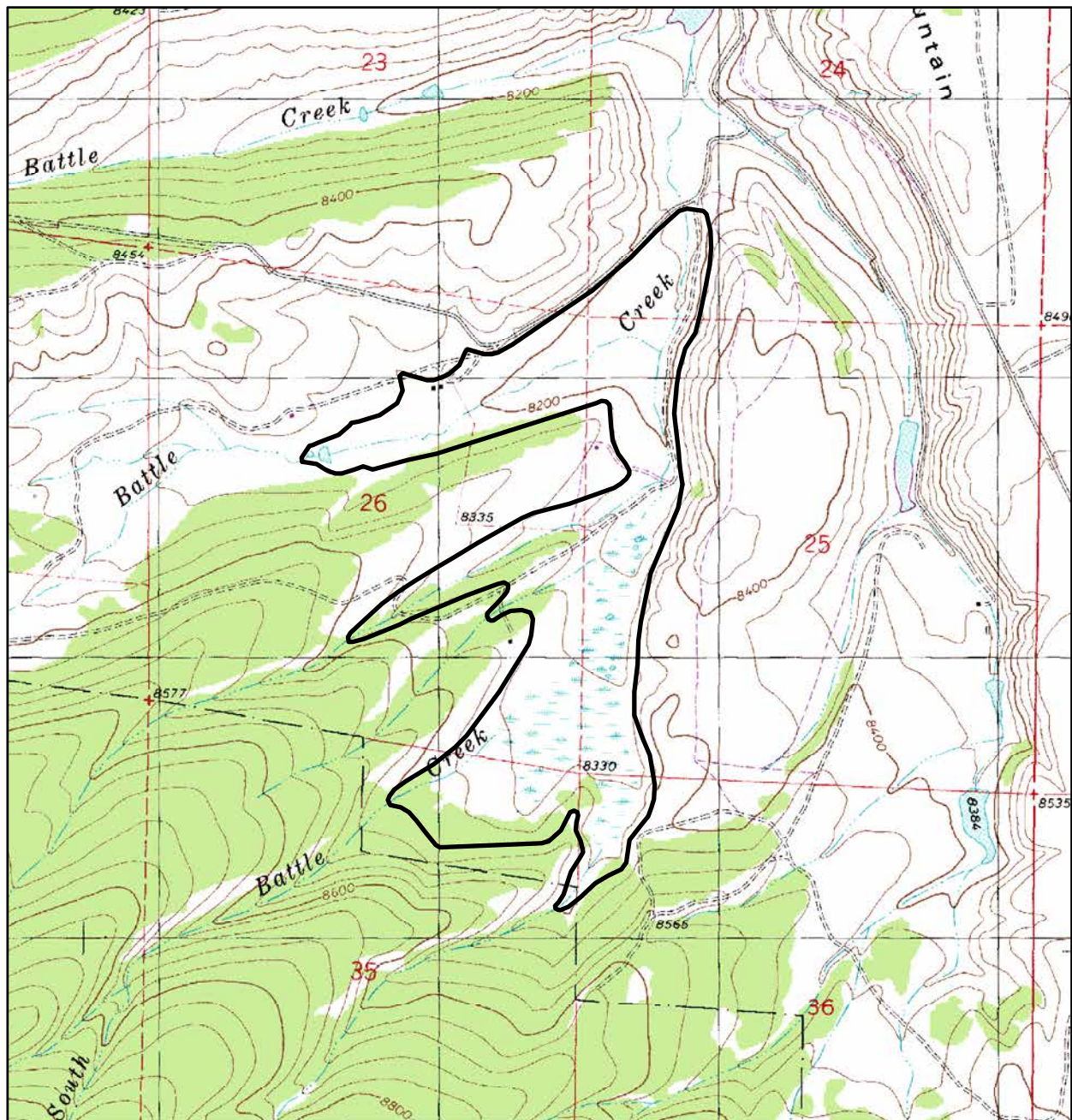
Management Urgency Rank Comments (M3): If dewatering practices are implemented or livestock use increased, the area would need to be more intensely managed to maintain current ranking.

Land Use Comments: Historically, the land was part of the Pony Express route and restored buildings from this era are still standing on the property although the old road sees vehicular use. Currently, the land is predominantly used for cattle production. There has been very little development on the property. An old homestead has been restored along Battle Creek. Due to beetle infestation, land owner has removed many dead and diseased trees from the property.

Natural Hazard Comments: Soils are very soft in fen area and property owner has had multiple animals caught in the peat.

Exotic Species Comments: Non-native species include Kentucky bluegrass (*Poa pratensis*), pennycress (*Thlaspi arvense*), dock (*Rumex* sp.), common dandelion (*Taraxacum officinale*), and increasers such as Virginia strawberry (*Fragaria virginiana*). These species are found along edges of wetlands and disturbed areas. They do not currently have major impacts on species composition and do not dominate in any broad areas. If disturbances along drainage areas are increased or not managed, non-native encroachment could become a problem.

Off-Site Considerations: Site is surrounded by and included in a very large, singly owned tract of land on which usage is similar throughout. There is a possibility of logging of *Pinus contorta* forests in upper reaches of the watershed. Further down, the watershed is dammed to create the South Fork of the Williams Fork Reservoir. Removal of dead and diseased trees on property may impact the site by adding sediment to the system and adding to the dispersal of non-native species.



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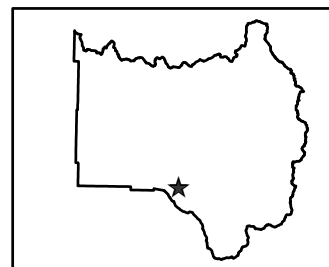
Legend

 PCA Boundary

Battle Mountain, 39106-H2

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 13. Battle Creek Potential Conservation Area, B3: High Biodiversity Significance

Beaver Creek Mineral Spring at Blue Valley Ranch

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Sheephorn Mountain

Size: 25 acres (10 ha)

Elevation: 7,670 - 7,680 ft. (2,338 - 2,341 m)

General Description: Community inhabits two warm mineral springs just south of Beaver Creek along the Colorado River Road, Rd 1. General geology consists of sedimentary rocks of the Cretaceous Age, specifically of the Colorado Group. Soils are very peaty and hummocky immediately surrounding the spring. Soils just outside of the fens are very dense clays and the lower spring has an area of deep, open water. Analogue sedge (*Carex simulata*) occurs throughout as a dense ground cover. In very hummocky, quaking soils, it occurs as the sole cover. On more solid, peaty soils it occurs in association with hardstem bulrush (*Schoenoplectus lacustris* ssp. *acutus*). There is a small area of threesquare bulrush (*Schoenoplectus pungens*) downhill of the upper spring which is likely fed by lateral seepage. The springs are heavily used by wildlife during the winter season, specifically antelope and mule deer, and seem to be an important mineral source for the area. Surrounding uplands are dominated by xeric subalpine big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) shrublands with a few small patches of aspen (*Populus tremuloides*) further uphill. The property supports little livestock, less than 200 head for 25,000 acres, and is heavily managed for its wildlife resources.

Key Environmental Factors: Key environmental factors for the area include hydrology dependent upon perennial, warm, mineral, groundwater discharge, making this site very unique for the area.

Climate Description: Climate likely follows typical Colorado weather patterns being xeric throughout most of the year with a wet spring season and late summer "monsoon" season.

Land Use History: Historically the area was split into multiple homesteads which were farmed by early settlers.

Cultural Features: Uplands surrounding the river still have many old homesteads from early settlers.

Biodiversity Significance Rank Comments (B3): This site is drawn for an excellent (A-ranked) occurrence of the globally apparently secure (G4/S3) plant community,

analogue sedge (*Carex simulata*) herbaceous vegetation. The site is ranked as a having high biodiversity significance due to its unique peat soils and mineral rich, groundwater fed, hydrology.

Natural Heritage element occurrences at the Beaver Creek Mineral Spring at Blue Valley Ranch PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Carex simulata</i> Herbaceous Vegetation	Wet Meadow	G4	S3				A	2005-09-14

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundary is drawn to include saturated and mesic soils around the Beaver Creek mineral hot spring on the Blue Valley Ranch. Boundary is drawn to encompass the hydrologic functions important to the area such as groundwater levels and groundwater discharge, as well as a portion of road just uphill of the site and some buffered uplands. However, boundaries do not include all uplands and surroundings important to the hydrology and maintenance of the site. Changes in management and use of surrounding uplands including development, road maintenance, and improper livestock grazing could be detrimental to soil stability and hydrology.

Protection Urgency Rank Comments (P3): Site is protected generally by the property owner within a 25,000 acre ranch.

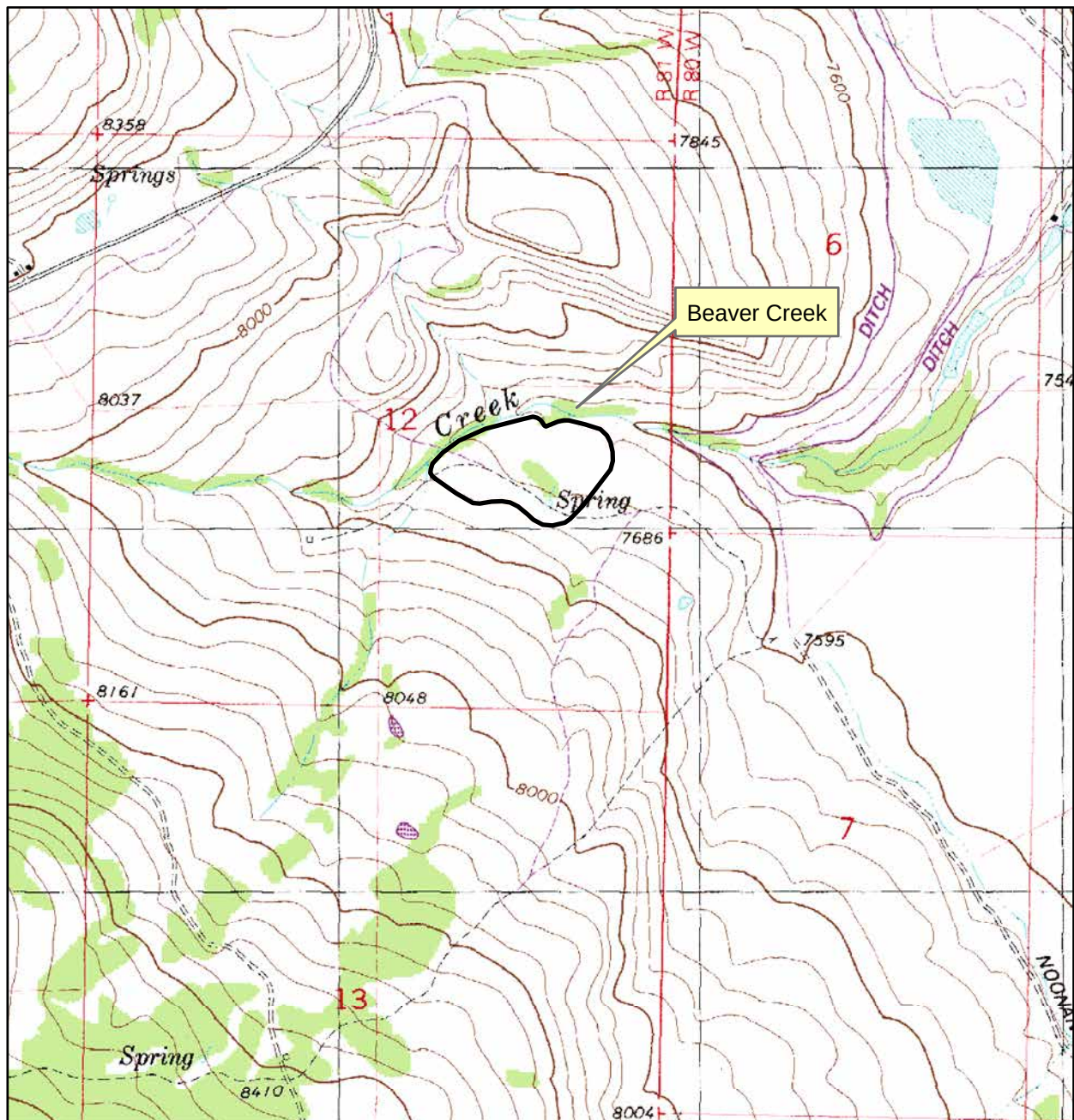
Management Urgency Rank Comments (M4): The main threats are from livestock, deer, and elk use. If livestock are increased, management may need to be altered to address more intensive use of the site.

Land Use Comments: Land is currently used as a summer retreat for the owner's family and friends. There are some 200 head of cattle that are grazed on the 25,000 acre ranch that do not impose much impact to the riparian areas due to intense management. Bison raised on the ranch use the area as a mineral source.

Natural Hazard Comments: The lower spring supplies an area of deep, open water. Water is not hot enough to inflict harm.

Exotic Species Comments: There are some exotic species present along the road that transects the slope just above the springs. There are very few non-natives present within the spring area.

Off-Site Considerations: Approximately 25,000 acres surrounding the site supports 200 head of cattle and about 50 bison. There is a private road used by the property owner that transects the slope just uphill from the springs.



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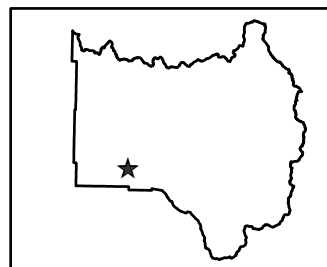
Legend

 PCA Boundary

Sheephorn Mountain, 39106-H4

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 14. Beaver Creek Mineral Spring at Blue Valley Ranch Potential Conservation Area, B3: High Biodiversity Significance

Behler Creek

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Strawberry Lake

Size: 125 acres (51 ha)

Elevation: 9,145 - 9,200 ft. (2,787 - 2,804 m)

General Description: Community inhabits a series of drying, successional beaver ponds along Behler Creek, a second order tributary of the Fraser River. Hydrology above the stand is free-flowing and appears to be dependent on a small perennial creek, snow melt, and some groundwater. Community consists of variable willow (*Salix* sp.) cover of multiple species along a varied hydrologic gradient of ponds and drier dams with a consistent graminoid layer also varied along hydrologic gradients. *Salix* species are mixed throughout, with strapleaf willow (*Salix ligulifolia*), Booth's willow (*Salix boothii*), and mountain willow (*Salix monticola*) being dominant. Diamondleaf willow (*Salix planifolia*) is also present in high cover. The herbaceous layer is dominated by graminoid species with bluejoint reedgrass (*Calamagrostis canadensis*) occurring along drier areas and beaked sedge (*Carex utriculata*) dominating areas that are saturated year round. Disturbances include browsing, past beaver activity, and adjacent road. Surrounding uplands are dominated by lodgepole pine (*Pinus contorta*) forest ecosystems. General geology consists of igneous rocks of the Cambrian Age, specifically granite of 1,400 MYA. Soils consist of rich loams of silty clays.

Key Environmental Factors: Key environmental factors include soils, beaver activity, perennial hydrology, and spring flooding.

Climate Description: Climate likely follows patterns typical of this region of Colorado being generally xeric throughout the year with wet spring seasons and late summer "monsoons".

Land Use History: There is an old homestead in the Behler Creek drainage above the site. Area may have been farmed historically.

Biodiversity Significance Rank Comments (B3): This site is drawn for a good (B-ranked) occurrence of the globally vulnerable (G3/S3) mountain willow (*Salix monticola*) / bluejoint reedgrass (*Calamagrostis canadensis*) plant community.

Natural Heritage element occurrences at the Behler Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Salix monticola / Calamagrostis canadensis Shrubland	Montane Willow Carr	G3	S3				B	2005-08-19

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries include portions of upper Behler Creek along a series of old beaver dams. Boundaries are drawn to encompass those ecological processes necessary to maintain site hydrology including perennial surface flow, groundwater discharge, and seasonal flooding as well as beaver dams which slow water and provide longer periods of soils saturation. Boundaries do not include all ecological processes influencing the site. Potential threats include activities upstream and along adjacent slopes such as improper grazing, water diversion, and development may negatively impact site hydrology and biota.

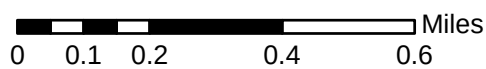
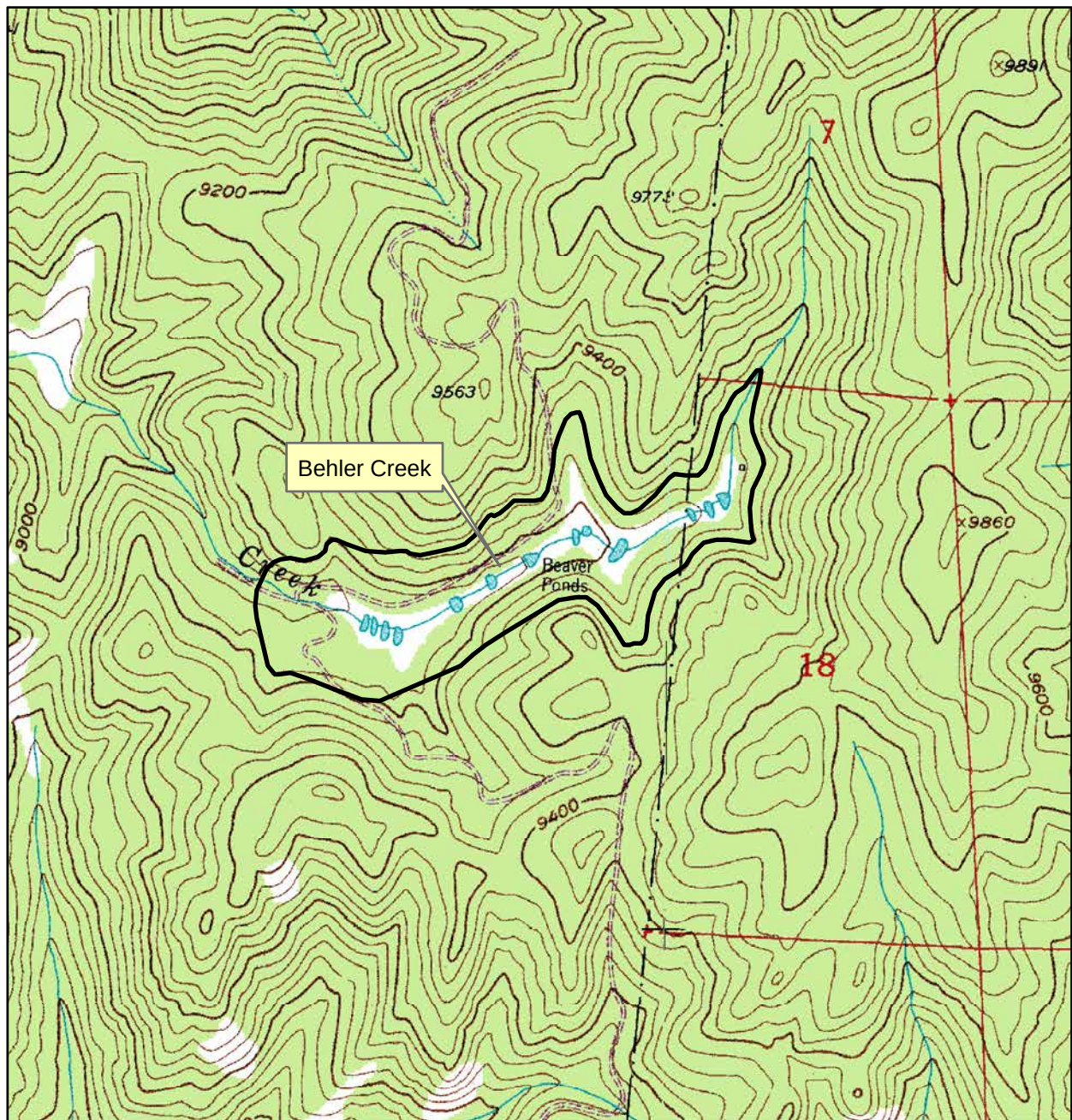
Protection Urgency Rank Comments (P4): PCA is located on BLM lands. Currently, there is no definable threat.

Management Urgency Rank Comments (M4): Management may be needed in the future if usage is increased or if exotics from adjacent road encroach on the wetland.

Land Use Comments: Main use of the site and surrounding lands is general public land use including recreation such as camping, hiking, hunting, and OHV use. There is evidence of past logging.

Exotic Species Comments: There are no exotics present in the drainage or along beaver ponds. Exotics such as smooth brome (*Bromus inermis*) and Kentucky bluegrass (*Poa pratensis*) are likely present along the adjacent road.

Off-Site Considerations: There is evidence of past logging of lodgepole pine forests within the drainage and in adjacent drainages.



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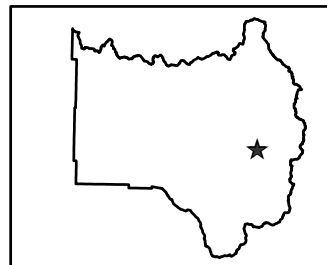
Legend

 PCA Boundary

Strawberry Lake, 40105-A7

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 15. Behler Creek Potential Conservation Area, B3: High Biodiversity Significance

Black Mountain Reservoir

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Corral Peaks

Size: 103 acres (42 ha)

Elevation: 8,800 - 9,550 ft. (2,682 - 2,911 m)

General Description: Community inhabits small, ephemeral tributary of Black Mountain Reservoir. Drainage is a type G stream along this section and is also fed by three small springs observed along its northern slopes and origin above road. Stand is variable in some sections, but is predominantly dominated by a tall shrub layer of thinleaf alder (*Alnus incana*) and Drummond's willow (*Salix drummondiana*). Other willow species present include mountain willow (*Salix monticola*) and greenleaf willow (*Salix lucida* ssp. *caudata*). Tall shrubs and associated mesic species are confined to the small drainage and its springs. The understory is dominated by mesic forb species including tall fringed bluebells (*Mertensia ciliata*), arrowleaf ragwort (*Senecio triangularis*), common cowparsnip (*Heracleum maximum*), and subalpine larkspur (*Delphinium barbeyi*). Uplands are dominated by lodgepole pine (*Pinus contorta*) and subalpine fir (*Abies lasiocarpa*) forests with some quaking aspen (*Populus tremuloides*) and a few small meadow openings. Some adjacent upslopes support invasive species such as smooth brome (*Bromus inermis*) from grazing activities. Soils along the drainage are very sandy throughout with cobbles along the main stream. General geology consists of sedimentary rocks of the Tertiary Age, specifically of the Coalmont Formation. Stream is stable, well-vegetated, sinuous, and supports lots of coarse material for stream dissipation.

Key Environmental Factors: Key environmental factors include perennial surface flows, seasonal flooding, elevated groundwater levels along side slopes, narrow, moderately steep slopes, and rocky soils.

Climate Description: Climate likely follows the typical weather patterns of Colorado being generally xeric year round, with wet spring seasons and late summer "monsoons".

Land Use History: The area has been logged and burned within the past fifty years.

Cultural Features: There is evidence of past homesteading.

Biodiversity Significance Rank Comments (B3): This site is drawn for a good

(B-ranked) occurrence of a globally vulnerable (G3/S3) plant community of thinleaf alder - Drummond's willow (*Alnus incana* - *Salix drummondiana*) montane riparian shrubland.

Natural Heritage element occurrences at the Black Mountain Reservoir PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Alnus incana</i> - <i>Salix drummondiana</i> Shrubland	Montane Riparian Shrubland	G3	S3				B	2005-06-28

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries are drawn to encompass approximately 1 mile of this unnamed eastern tributary of upper Corral Creek and include all ecological processes supporting the riparian system such as surface flows, groundwater discharges, and seasonal flooding, as well as areas of adjacent uplands contributing sediment and nutrients to the stream. However, boundaries do not include all ecological processes important to the hydrology of the site and activities such as improper grazing, development, and water diversions along adjacent slopes and upstream of the site could be detrimental to the hydrology and species composition of the drainage.

Protection Urgency Rank Comments (P3): Site is protected generally by the BLM as public land and has no specific protection strategies in place. Protection may be needed within five years to protect the site from recreational uses, weedy species invasion, impacts from grazing, and upstream road maintenance. As well, strategies may need to be implemented if logging is renewed or if other usage is changed in surrounding uplands.

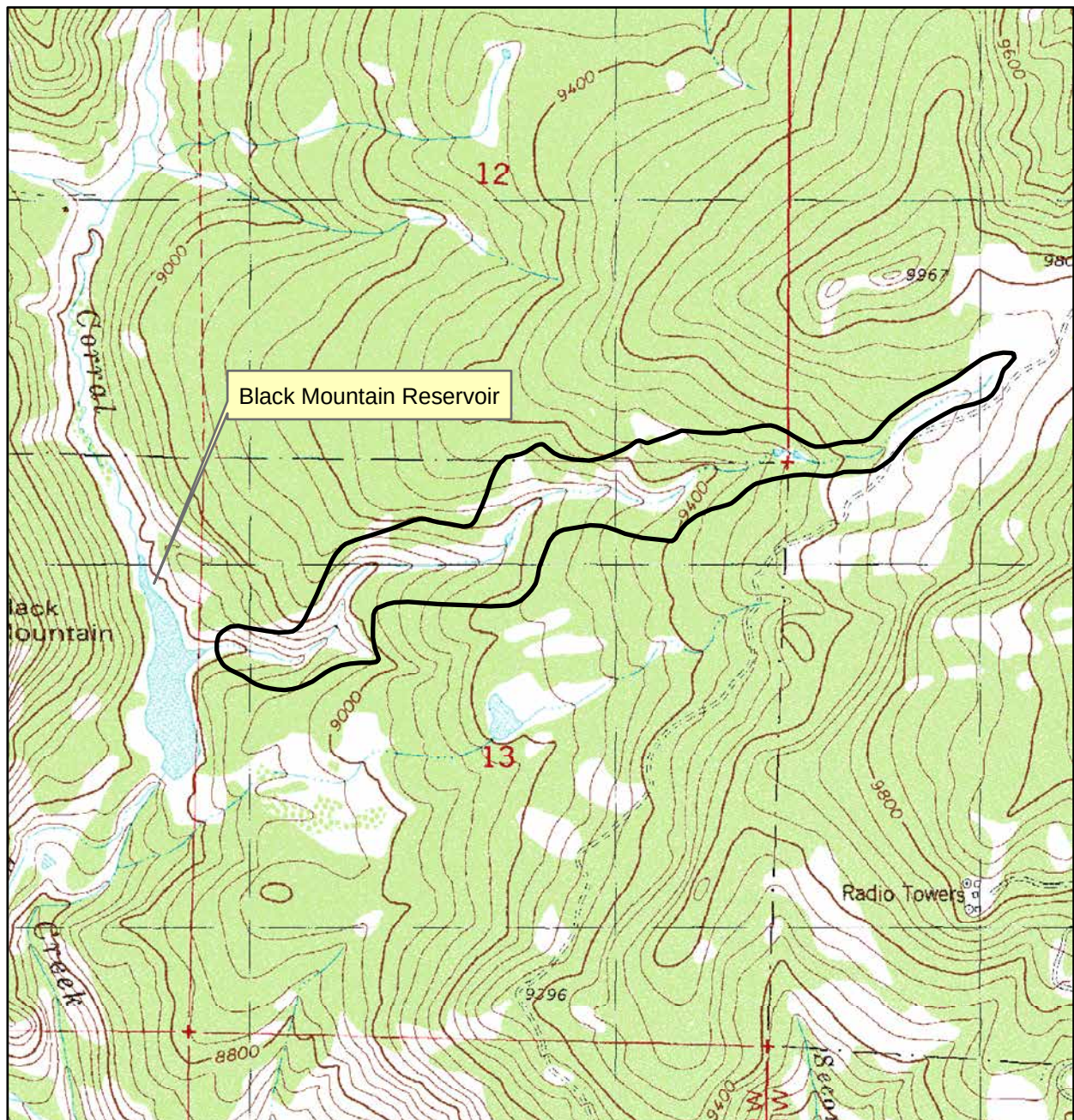
Management Urgency Rank Comments (M4): There are no urgent management needs at present. Management may need to be increased or altered if disturbances such as logging, livestock grazing, development, or water diversions are introduced or increased.

Land Use Comments: Land has been used in the past for logging and grazing. The only uses at present are recreation and hunting.

Natural Hazard Comments: Flooding may cause a potential hazard during spring and ephemeral high flows.

Exotic Species Comments: Smooth brome is present along adjacent upslopes and may be a result of past grazing practices or other disturbances. Kentucky bluegrass (*Poa pratensis*) occurs in low cover along mesic areas.

Off-Site Considerations: Off-site considerations include logging of adjacent forests, grazing, and water diversion.



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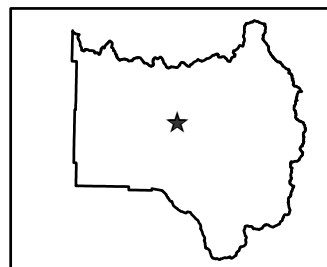
Legend

 PCA Boundary

Corral Peaks, 40106-B2

7.5 Minute Digital Raster
 Graphic produced by the
 U.S. Geological Survey

Location in Grand County



Map 16. Black Mountain Reservoir Potential Conservation Area, B3: High Biodiversity Significance

Blacktail Creek at Gore Pass

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Gore Pass

Size: 229 acres (93 ha)

Elevation: 8,020 - 9,065 ft. (2,445 - 2,763 m)

General Description: Community inhabits Blacktail Creek, a second order tributary of the Colorado River. A road transects the stand where there is some disturbance from increased use and fragmentation. About 25 acres of drainage along this section are dominated by the tall shrub Booth's willow (*Salix boothii*) and the short shrub Wolf's willow (*Salix wolfii*). Other shrub species present include Drummond's willow (*Salix drummondiana*), diamondleaf willow (*Salix planifolia*), and shrubby cinquefoil (*Dasiphora floribunda*). South of road, the drainage bottom is inundated throughout with many active beaver dams producing a series of ponds. Livestock grazing has been decreased since the previous CNHP visit and there is little evidence of grazing in the past few years. The understory is dominated by mesic graminoids with beaked sedge (*Carex utriculata*) dominating inundated areas around the creek and beaver ponds, and water sedge (*Carex aquatilis*) and bluejoint reedgrass (*Calamagrostis canadensis*) consistently dispersed throughout mesic to saturated areas. Forbs occur in moderate cover and are common along mesic and drying areas throughout. Stand provides good wildlife habitat for fish, beaver, and marmot. General geology consists of sedimentary rocks of the Jurassic Age, specifically the Morrison Formation and igneous rocks of the Precambrian Age. Soils are sandy loams to sands along the creek and ponds with some collection of organic matter along backwater sloughs.

Key Environmental Factors: Key environmental factors contributing to the hydrology and biota of the site include perennial surface flows, seasonal flooding, beaver activity, sediment deposition, and slope shape.

Climate Description: Climate likely follows patterns typical of this region of Colorado, being generally xeric throughout the year, with wet spring seasons and late summer "monsoons".

Biodiversity Significance Rank Comments (B3): This site is drawn for a good (B-ranked) occurrence of the globally vulnerable (G3/S3) plant community, Booth's willow (*Salix boothii*) / mesic forbs riparian willow carr.

Natural Heritage element occurrences at the Blacktail Creek at Gore Pass PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Salix boothii / Mesic Forbs Shrubland	Booth's Willow / Mesic Forb	G3	S3				B	1991-08-18

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries include approximately 30 acres of upper Blacktail Creek and some buffered upland areas and are drawn to encompass those ecological processes necessary to maintain site hydrology including perennial surface flows, spring flooding, sediment deposition, and beaver activity. However, boundaries do not include all ecological processes influencing the site. Activities upstream and along adjacent slopes such as improper grazing, water diversion, and development may impact site hydrology and biota.

Protection Urgency Rank Comments (P4): There are no current threats, but site may be threatened if usage increases or if grazing is reintroduced.

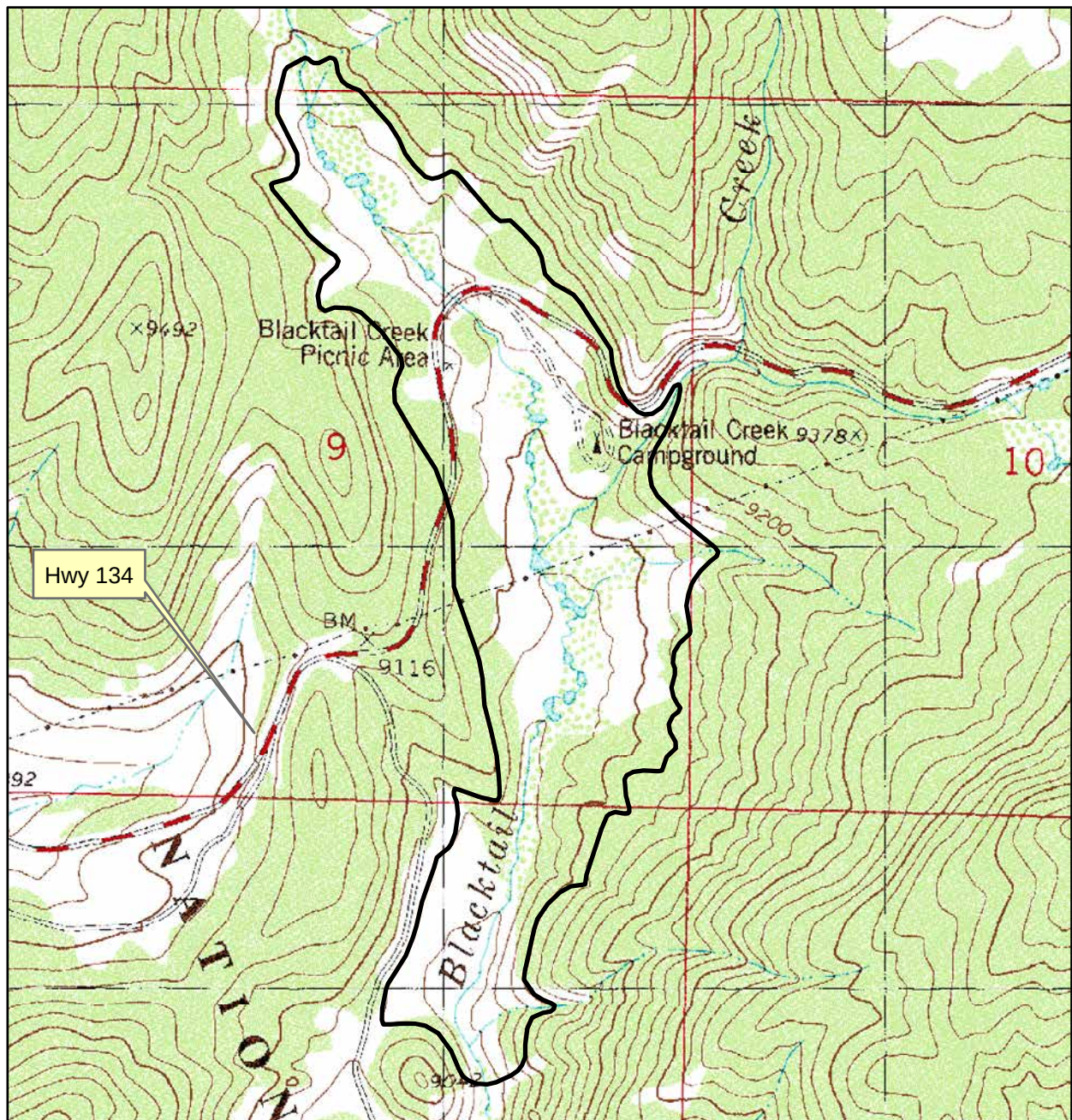
Management Urgency Rank Comments (M3): Site may need management within five years to maintain present quality due to adjacent road and increasing use of adjacent campground.

Land Use Comments: Predominant land uses at this time are recreational activities including camping, hiking, fishing, and hunting. As well, the area may be used for livestock grazing and as a source for timber.

Natural Hazard Comments: Spring flooding may produce high flows and dangerous conditions along the creek.

Exotic Species Comments: Exotic species are present along the drier edges, but are not common within the saturated and inundated areas within the community. Common dandelion (*Taraxacum officinale*) is the most common exotic present.

Off-Site Considerations: Off-site considerations include logging, water diversion, adjacent road, and campground.



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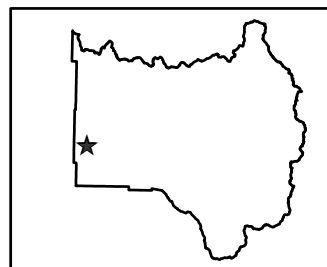
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 PCA Boundary

Gore Pass, 40106-A5

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 17. Blacktail Creek at Gore Pass Potential Conservation Area, B3: High Biodiversity Significance

Buffalo Park

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Lake Agnes, Tyler Mountain

Size: 777 acres (314 ha)

Elevation: 9,075 - 9,200 ft. (2,766 - 2,804 m)

General Description: Buffalo Park is a large, open meadow vegetated by a mosaic of herbaceous and shrub associations. The predominant herbaceous vegetation in the park is a tufted hairgrass (*Deschampsia cespitosa*) association. Patches of timber oatgrass (*Danthonia intermedia*) dominate multiple areas within the park. As well, Wolf's willow (*Salix wolfii*) forms dense thickets along more mesic areas. Other common graminoids include alpine timothy (*Phleum alpinum*) and fescue (*Festuca* sp.). Wet depressions are dominated by sedge (*Carex*) species, with water sedge (*Carex aquatilis*) being common amongst the Wolf's willow thickets. Forb species present in the herbaceous meadow openings include, longstalk clover (*Trifolium longipes*), Parry's gentian (*Gentiana parryi*), and American bistort (*Polygonum bistortoides*). Soils are generally dry throughout with patches of mesic to saturated areas. General geology of the site consists of unconsolidated surficial deposits and rocks of the Quaternary Age, specifically, modern alluvium. Surrounding uplands consist of lodgepole pine (*Pinus contorta*), subalpine fir (*Abies lasiocarpa*), and Engelmann spruce (*Picea engelmannii*) mixed forests. Disturbances in the area consist of adjacent forest service road, livestock grazing, and recreational uses such as camping and OHV use.

Key Environmental Factors: Key environmental factors contributing to the biota of the site include solar irradiation, spring flooding, soils and underlying geology, slope, and valley shape.

Climate Description: Climate likely follows patterns typical of this region of Colorado, being generally xeric throughout the year, with wet spring seasons and late summer "monsoons".

Biodiversity Significance Rank Comments (B3): This site is drawn for a good (B-ranked) occurrence of the globally imperiled (G2G3/S2S3) community, timber oatgrass (*Danthonia intermedia*) herbaceous vegetation. This community type is probably more common than the global rank implies (most likely a G3 instead of a G2G3).

Natural Heritage element occurrences at the Buffalo Park PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Danthonia intermedia Herbaceous Vegetation	Montane Grasslands	G2G3	S2S3				B	2005-09-28

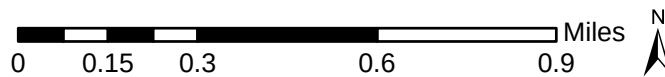
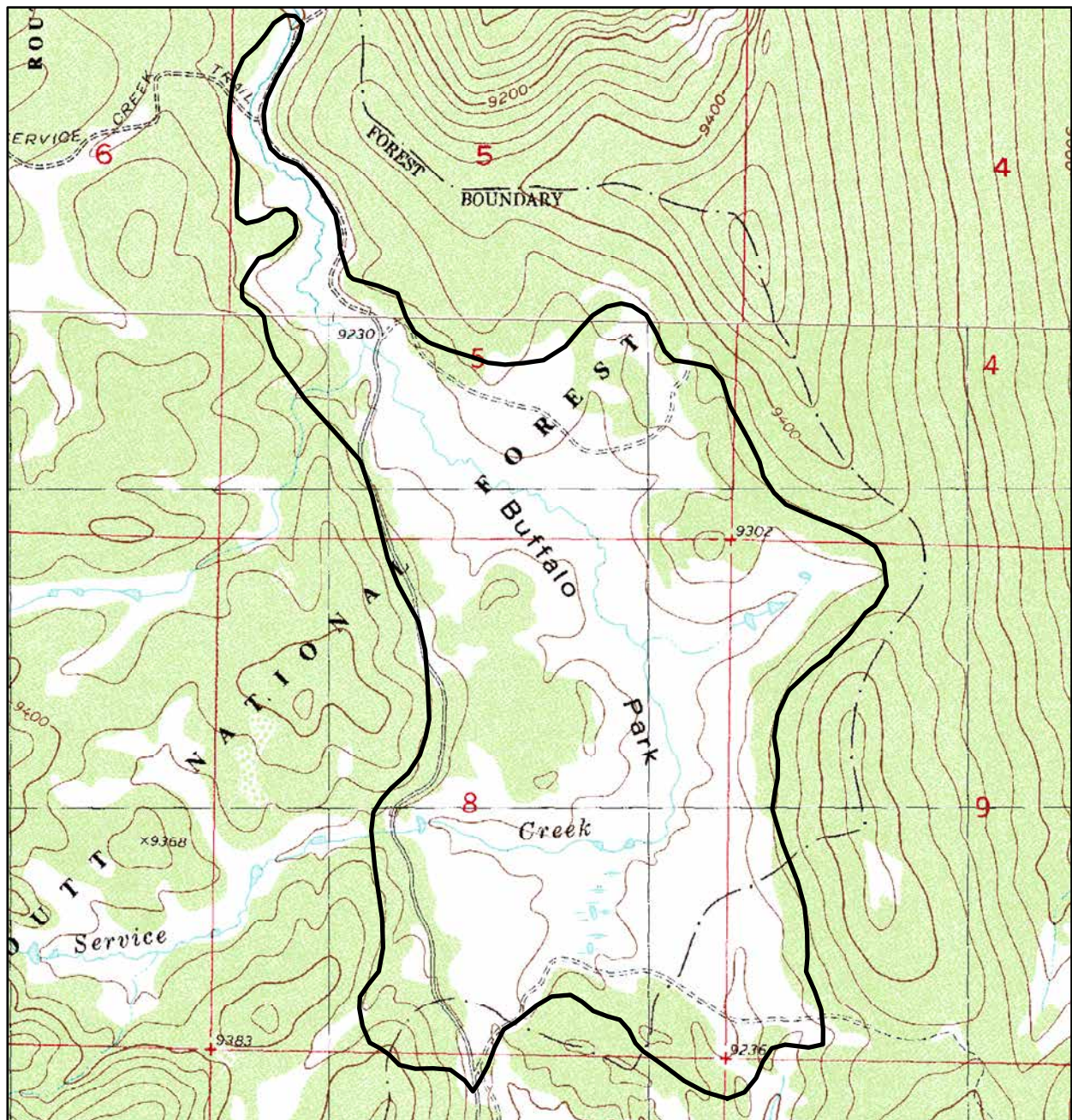
** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Site include portions of Buffalo Park and surrounding uplands. Boundaries are drawn to encompass those ecological processes necessary to maintain site integrity and biota including, gentle slope, solar irradiation, and seasonally moist soils. Boundaries do not include all ecological processes influencing the site, activities upstream and along adjacent slopes such as improper grazing, water diversion, road maintenance, and development may negatively impact site biota.

Protection Urgency Rank Comments (P4): Site is currently protected as public lands by the USFS.

Management Urgency Rank Comments (M3): Site needs management within the next five years or it may degrade due to livestock grazing, extensive recreational use, and adjacent road.

Off-Site Considerations: Offsite considerations include logging, road maintenance, and recreational activities. Improperly managed, these activities could add sediment to the system and introduce exotic species.



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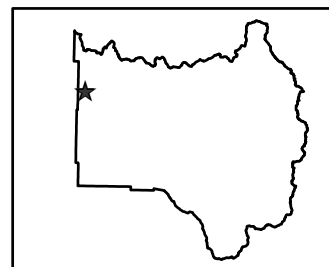
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 PCA Boundary

Tyler Mountain, 40106-B5
 Lake Agnes, 40106-C5

7.5 Minute Digital Raster
 Graphic produced by the
 U.S. Geological Survey

Location in Grand County



Map 18. Buffalo Park Potential Conservation Area, B3: High Biodiversity Significance

Carter Fen

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P1: Immediately Threatened/Outstanding Opportunity

Management Urgency Rank - M1: Essential within 1 Year to Prevent Loss

U.S.G.S. 7.5-minute quadrangles: Trail Mountain

Size: 51 acres (21 ha)

General Description: Community occurs in a small opening below the outlet of a mineral spring within a larger willow (*Salix*) dominated shrubland. Surrounding *Salix* shrubland is a mixture of diamondleaf willow (*Salix planifolia*), shortfruit willow (*Salix brachycarpa*), Wolf's willow (*Salix wolfii*), and mountain willow (*Salix monticola*) as well as dwarf birch (*Betula nana*). Surrounding uplands are dominated by quaking aspen (*Populus tremuloides*). Species composition within the fen is unique for the county being fed by warm, alkaline, mineral groundwater. Soils consist of a light colored mineral layer on top of rich, dark fibric peats with some mottling in the upper layers. Dominant species include seaside arrowgrass (*Triglochin maritimum*), alpine meadow-rue (*Thalictrum alpinum*), fewflower spikerush (*Eleocharis quinqueflora*), and false uncinia sedge (*Carex microglochin*). Common species include diamondleaf willow (*Salix planifolia*), northern bog sedge (*Carex gynocrates*), analogue sedge (*Carex simulata*), silvery primrose (*Primula incana*), smallflower grass of Parnassus (*Parnassia parviflora*), and shrubby cinquefoil (*Dasiphora floribunda*). Marsh arrowgrass (*Triglochin palustre*) is also present in sparse cover throughout. Disturbances in the area include housing development and roadways. An area just upstream of the site across the adjacent drainage has been filled and bridged for a homesite. Following the discovery of this unique fen, the area has been designated for protection as a mitigation bank and the previously filled areas are being restored. The site has been described as more saline (EC > 1500 uS/cm², pH > 8.0) than calcareous, being on shale, not limestone, (Cooper 2004). General geology consists of sedimentary, Mesozoic rocks, mainly lower Cretaceous, Jurassic, and Triassic formations.

Key Environmental Factors: Key environmental factors contributing to site hydrology and biota include a perennial groundwater source, mineral rich substrate and hydrology, peat soils, and slope. Site has been characterized as an extreme rich fen due to high pH and a high concentration of calcium.

Climate Description: Climate likely follows patterns typical of this region of Colorado, being generally xeric throughout the year, with wet spring seasons and late summer "monsoons".

Biodiversity Significance Rank Comments (B3): This site is drawn for a good (B-ranked) occurrence of a plant community, fewflower spikerush (*Eleocharis quinqueflora*) - arrowgrass (*Triglochin* sp.) herbaceous vegetation, whose global distribution is unknown at this time (GU/S2). Although the GU ranking is typically defaulted to globally apparently secure when assigning biodiversity significance ranks, this occurrence is very unique to the area due to its hydrology and soil type and merits a higher rank.

Natural Heritage element occurrences at the Carter Fen PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	ELEOCHARIS QUINQUEFLORA - TRIGLOCHIN SPP.	Alkaline Spring Wetland	GU	S2				B	2005-07-20

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The site contains approximately .06 acre of spring fed fen along Trail Creek. Boundaries include adjacent buffered wetlands and uplands and encompass those ecological processes necessary to maintain site hydrology including perennial groundwater and perennial surface flows along adjacent drainage. However, boundaries do not include all ecological processes influencing the site and activities upstream and along adjacent slopes such as improper grazing, water diversion, and development may impact site hydrology and biota.

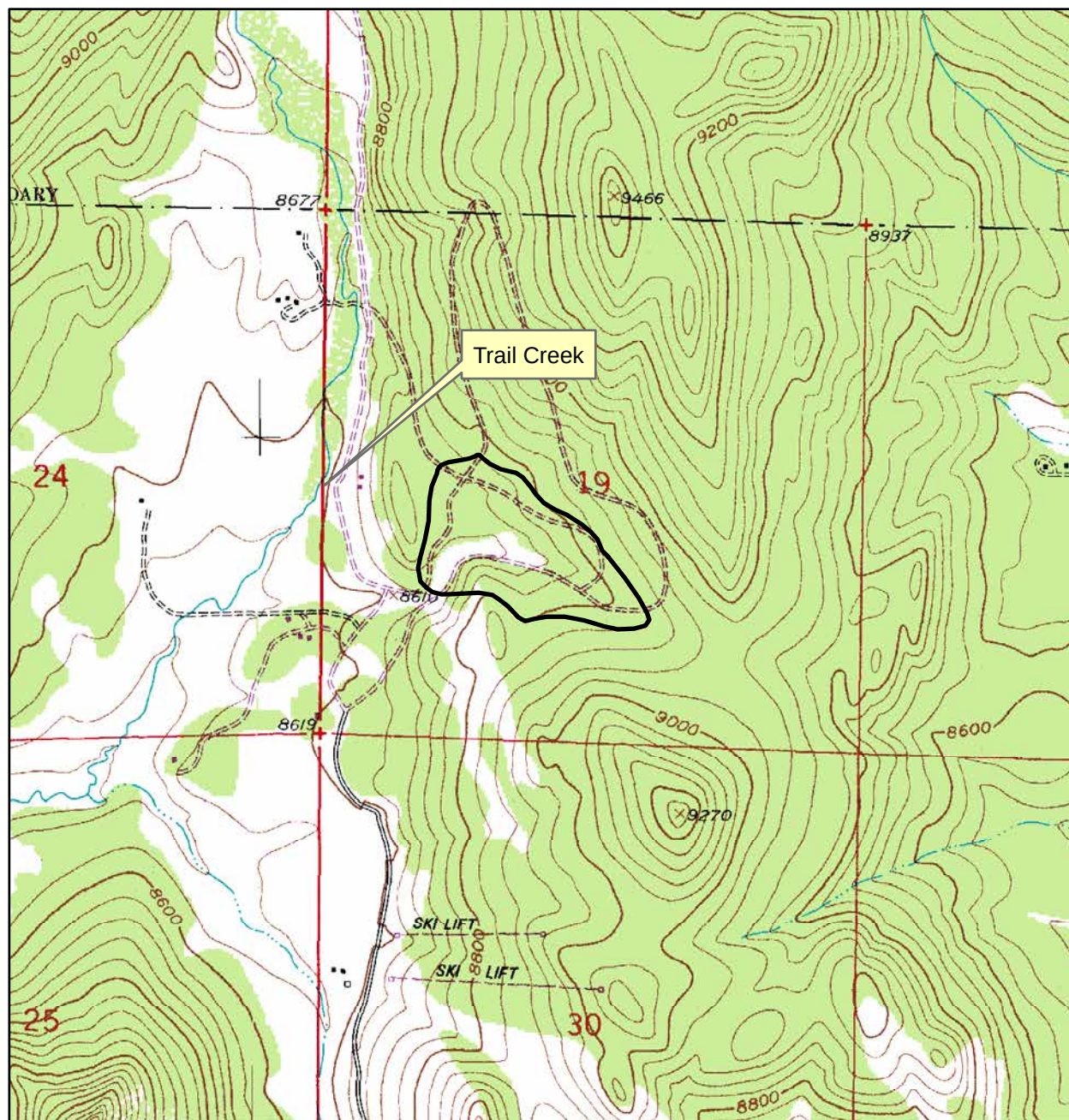
Protection Urgency Rank Comments (P1): Construction of home sites poses immediate threats. Upstream areas have been filled and bridged along with the placement of a septic tank system and leveling of soil for basement formation. Currently, construction has been put on hold and the process of restoration has begun. The future of ownership and further development in surrounding areas is pending.

Management Urgency Rank Comments (M1): The process of restoration has been implemented, but the site will need consistent maintenance in the coming years to ensure hydrology has not been altered and exotic species have not been introduced.

Land Use Comments: Surrounding properties are all privately owned and slated for development.

Exotic Species Comments: There were no exotic species observed. Adjacent road may support exotic species and may act as a conduit for exotics in the future.

Off-Site Considerations: Off-site considerations include road proximity and maintenance, development, dewatering, and water diversion.



0 0.1 0.2 0.4 0.6 Miles



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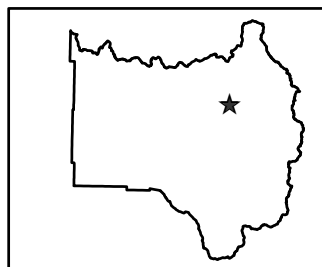
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 PCA Boundary

Trail Mountain, 40105-B8

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 19. Carter Fen Potential Conservation Area, B3: High Biodiversity Significance

Chalk Bluffs

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P2: Threat/Opportunity within 5 Years

Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss

U.S.G.S. 7.5-minute quadrangles: Granby

Size: 136 acres (55 ha)

Elevation: 7,900 - 8,200 ft. (2,408 - 2,499 m)

General Description: The Chalk Bluffs are a dominant landmark south of the town of Granby, bordered by Rockwell Creek to the west, Mueller Creek to the east, and Fraser River to the south. The Chalk Bluffs are steep and barren with highly erodable, silty soils, underlain by sedimentary deposits. The predominant grayish soils (USDA, NRCS 1994) are derived from Cretaceous Niobrara and Pierre Shale of the Troublesome Formation (Tweto 1979). The Chalk Bluffs appear to be mantled with old alluvium and a fine-textured deposit of uncertain geologic age is exposed on the northwest-facing slope (USDA, NRCS 1994). Dropleaf buckwheat (*Eriogonum exilifolium*), a globally vulnerable plant, dominates the vegetation throughout the Chalk Bluffs. The Bluff's lower slopes are dominated by a low stature three-part sagewort (*Artemisia tripartita* ssp. *tripartita*) with fringed sage (*Artemisia frigida*), yellow rabbitbrush, (*Chrysothamnus viscidiflorus*), spearleaf stonecrop (*Sedum lanceolatum*), Fendlers bluegrass (*Poa fendleriana*) and Indian ricegrass (*Achnatherum hymenoides*). Bitterroot (*Lewisia rediviva*) occurs throughout the sagebrush flats. Globally, the bitterroot is common. The Colorado occurrences are representative of its southern range. The ravines west of the Chalk Bluffs are dominated by aspen (*Populus tremuloides*), Douglas-fir (*Pseudotsuga menziesii*) and buffalo berry (*Sherperdia canadensis*). Lodgepole pine (*Pinus contorta* var. *latifolia*) and limber pine (*Pinus flexilis*) border the Chalk Bluffs. North of the Chalk Bluffs, the Fraser River flows west supporting a narrowleaf cottonwood (*Populus angustifolia*) riparian forest with mountain willow (*Salix monticola*).

Key Environmental Factors: Edaphic indicators are silty-clayey soils derived from Niobrara and Pierre shale, soil series Crespin (USDA, NRCS 1994).

Climate Description: The climate follows typical weather patterns of high mountain valleys, low precipitation/snowfall (<12-15 inches/year) and late summer "monsoons".

Land Use History: Past grazing evident.

Biodiversity Significance Rank Comments (B3): The Chalk Bluffs site supports an excellent (A-ranked) occurrence of the globally vulnerable (G3/S2) dropleaf buckwheat (*Eriogonum exilifolium*) and a good (B-ranked) occurrence of the

globally secure but state imperiled (G5/S2) bitterroot (*Lewisia rediviva*). Additionally, documentation of the three-part sagewort (*Artemisia tripartite*) in 2005 is a new record for Grand County and the West Slope flora.

Natural Heritage element occurrences at the Chalk Bluffs PCA.

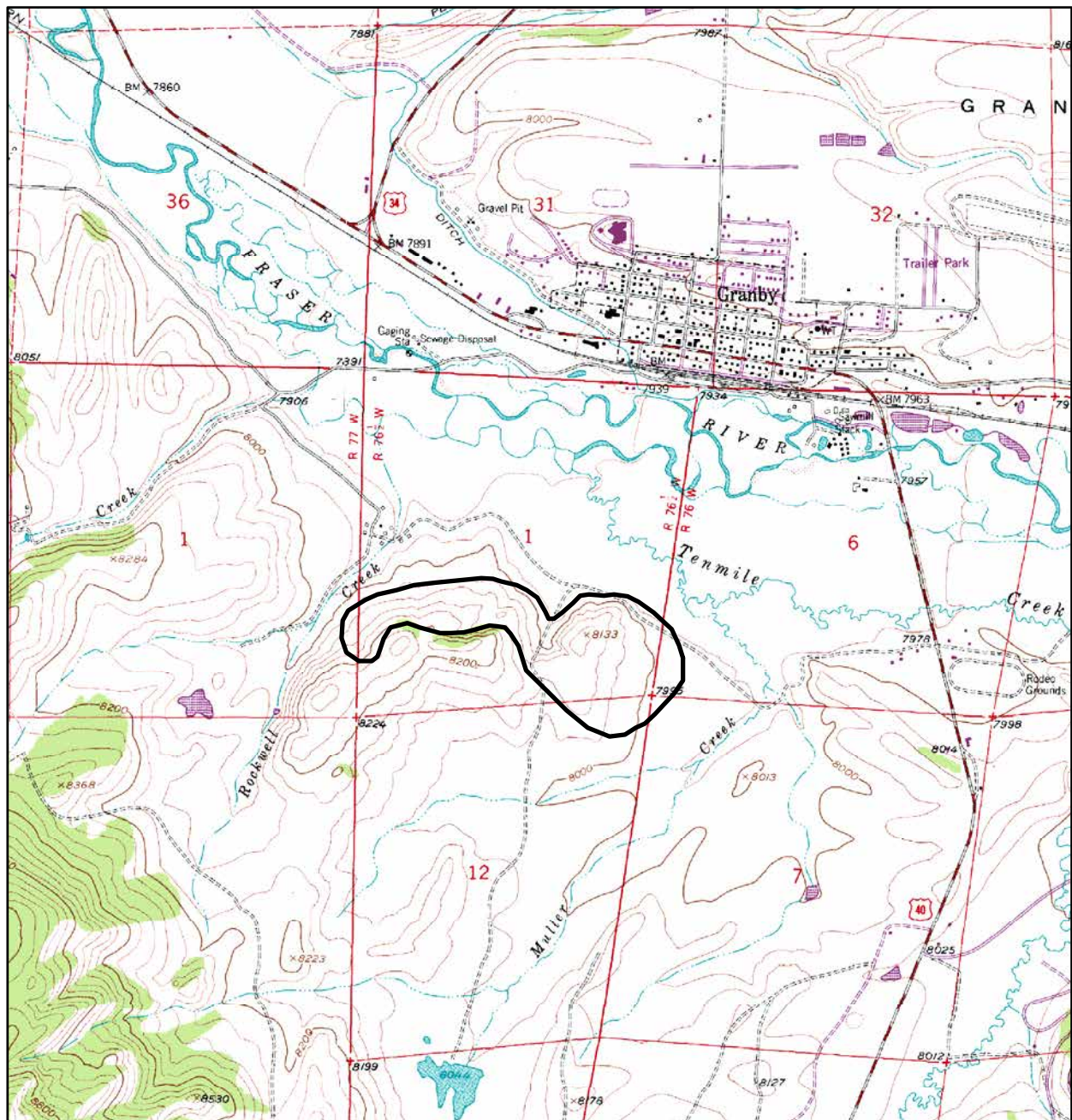
Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Eriogonum exilifolium</i>	dropleaf buckwheat	G3	S2			USFS	A	2005-06-24
Vascular Plants	<i>Lewisia rediviva</i>	bitterroot	G5	S2				B	2005-06-24

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundaries are delineated according to soil series to capture the Chalk Bluffs, sagebrush knoll and adjacent ravines. Boundaries include known occurrences as well as potential habitat.

Protection Urgency Rank Comments (P2): As of 2005, the private property portion of this site is under a conservation easement (345 acres), held by the Cattlemen's Association. The rest is owned by the BLM. The site is adjacent to a rapidly growing subdivision and golf course that could expand into potential rare plant habitat.

Management Urgency Rank Comments (M2): Managers are encouraged to monitor potential threats that include ORV travel and residential/commercial development.



0 0.15 0.3 0.6 0.9 Miles



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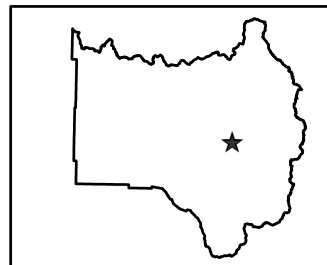
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 PCA Boundary

Granby, 40105-A8

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 20. Chalk Bluffs Potential Conservation Area, B3: High Biodiversity Significance

Dumont Lake

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Lake Agnes, Mount Werner, Rabbit Ears Peak, Walton Peak

Size: 6,833 acres (2,765 ha)

General Description: Site occurs west of Rabbit Ears Pass in the Gore Range mountains along the headwaters of Walton and Muddy creeks. General geology consists of multiple components, the predominant being metamorphic rocks of the Precambrian Age and igneous rocks of the Tertiary Age. Uplands are dominated by mixed coniferous forests of lodgepole pine (*Pinus contorta*), subalpine fir (*Abies lasiocarpa*), and Engelmann spruce (*Picea engelmannii*). Drainages are dominated by mosaics of mesic meadows and dense shrub thickets. Herbaceous meadow openings are dominated by tufted hairgrass (*Deschampsia caespitosa*) communities. Shrublands are dominated by Wolf's willow (*Salix wolfii*) and diamondleaf willow (*Salix planifolia*). More mesic areas near the creek are dominated by mesic graminoids in the understory including water sedge (*Carex aquatilis*) and beaked sedge (*Carex utriculata*) with bluejoint reedgrass (*Calamagrostis canadensis*). Forb species are common and consistent throughout meadows and wetlands with white-marsh marigold (*Caltha leptosepala*), cinquefoil (*Potentilla* sp.), arrowleaf ragwort (*Senecio triangularis*), and tall fringed bluebells (*Mertensia ciliata*) being common. Disturbances include a forest service road that transects and runs adjacent to the Muddy Creek, Highway 40 that runs north of the site, beaver activity, and possibly natural resource extraction.

Key Environmental Factors: Key environmental factors contributing to the biota of the site include substrate, soils, moisture, shading, slope, and aspect.

Climate Description: Climate likely follows patterns typical of this region of Colorado, being generally xeric throughout the year, with wet spring seasons and late summer "monsoons".

Biodiversity Significance Rank Comments (B3): This site is drawn for an excellent (A-ranked) occurrence of the globally imperiled (G5T2/S2) plant subspecies, rabbit ears gilia (*Ipomopsis aggregata* ssp. *weberi*) and a good (B-ranked) occurrence of the globally vulnerable (G3/S3) plant community, Wolf's willow (*Salix wolfii*)/mesic forb.

Natural Heritage element occurrences at the Dumont Lake PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Salix wolfii / Mesic Forbs Shrubland	Subalpine Riparian Willow Carr	G3	S3				B	2005-08-28
Vascular Plants	Ipomopsis aggregata ssp. weberi	rabbit ears gilia	G5T2	S2			USFS	A	1998-09-10
Vascular Plants	Ipomopsis aggregata ssp. weberi	rabbit ears gilia	G5T2	S2			USFS	B	1998-09-08
Vascular Plants	Ipomopsis aggregata ssp. weberi	rabbit ears gilia	G5T2	S2			USFS	E	1998-08-20
Vascular Plants	Ipomopsis aggregata ssp. weberi	rabbit ears gilia	G5T2	S2			USFS		1995-08-10
Vascular Plants	Ipomopsis aggregata ssp. weberi	rabbit ears gilia	G5T2	S2			USFS		1998-07-21
Vascular Plants	Ipomopsis aggregata ssp. weberi	rabbit ears gilia	G5T2	S2			USFS		1998-08-20
Vascular Plants	Ipomopsis aggregata ssp. weberi	rabbit ears gilia	G5T2	S2			USFS		1998-09-08
Vascular Plants	Ipomopsis aggregata ssp. weberi	rabbit ears gilia	G5T2	S2			USFS		1998-09-09
Vascular Plants	Ipomopsis aggregata ssp. weberi	rabbit ears gilia	G5T2	S2			USFS		1998-09-10

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries encompass approximately 4,320 acres west of Rabbit Ears Pass along Walton and Muddy Creek drainages. Boundaries are drawn to encompass those ecological processes necessary to maintain site hydrology and biota including spring flooding, perennial surface flows, and disturbances producing forest openings. Boundaries do not include all ecological processes influencing the site. Activities upstream and along adjacent slopes such as improper grazing, water diversion, road maintenance, and development may impact site hydrology and biota.

Protection Urgency Rank Comments (P3): There are definable threats, but not

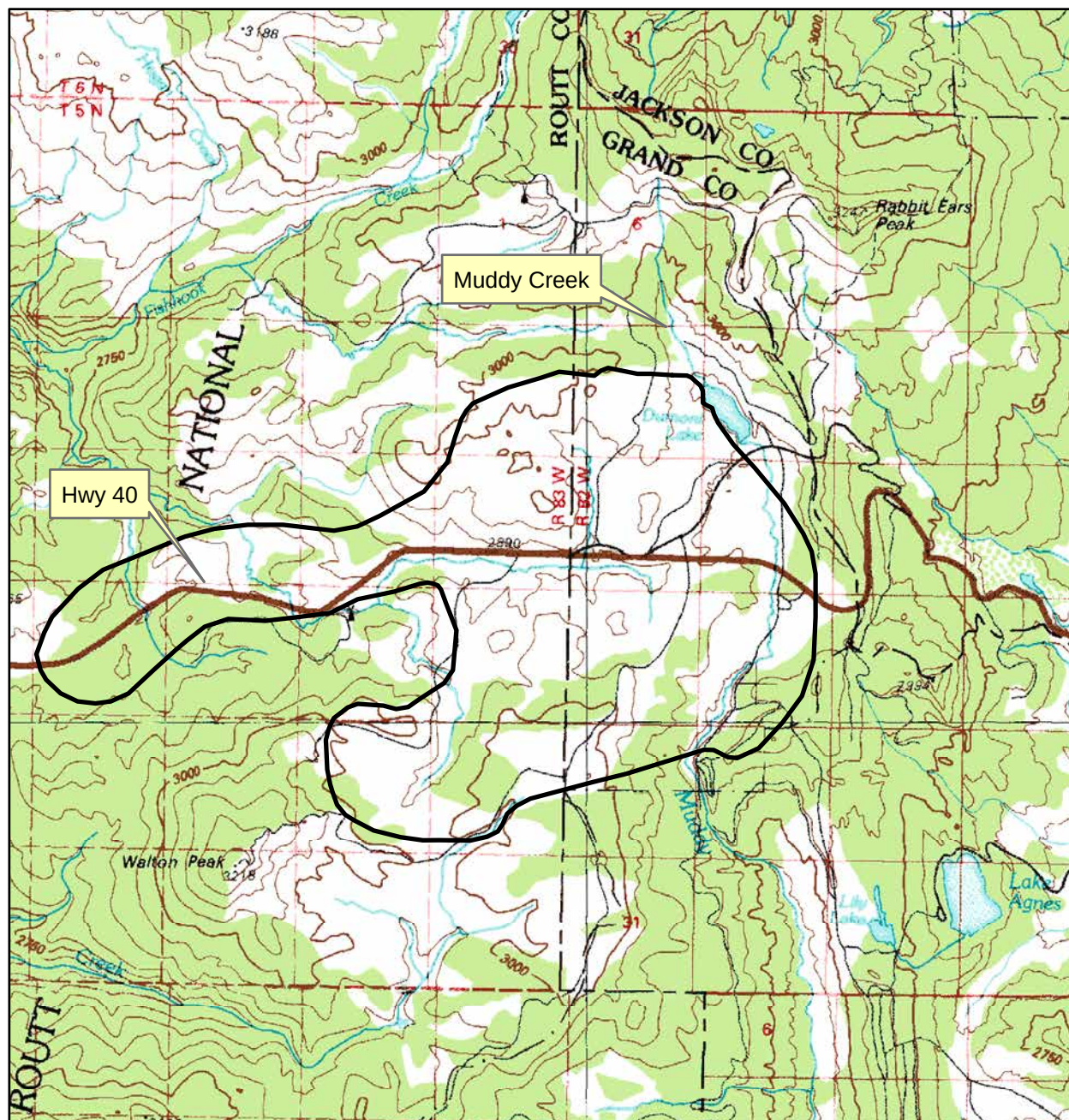
within five years.

Management Urgency Rank Comments (M3): Site may need to be managed for exotic species invasion and impacts from recreational uses and nearby roads.

Land Use Comments: Predominant land uses are recreational uses including hunting, fishing, camping, hiking, biking, and OHV use.

Exotic Species Comments: Timothy (*Phleum pratense*), meadow foxtail (*Alopecurus pratensis*), and common dandelion (*Taraxacum officinale*) are all found within drainages and along roadways. Virginia strawberry (*Fragaria virginiana*) is common in meadows and may be an indicator of past land uses such as livestock grazing.

Off-Site Considerations: Off-site considerations include logging of adjacent forests, road maintenance and proximity, and recreational uses which may all be conduits for exotic species and may impact wetlands by adding sediment, denuding banks, and altering hydrology.



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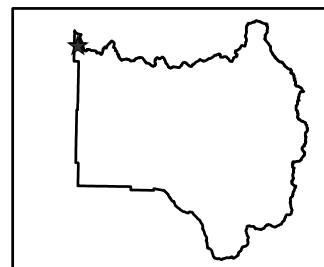
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 PCA Boundary

Steamboat Springs, 40106-A1

30 x 60 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 21. Dumont Lake Potential Conservation Area, B3: High Biodiversity Significance

First Creek

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Corral Peaks, Parshall

Size: 214 acres (87 ha)

Elevation: 9,200 - 9,725 ft. (2,804 - 2,964 m)

General Description: Communities inhabit about 0.85 mile of First Creek and two small, perennial seeps along an eastern drainage. First Creek is a small, first order tributary of Corral Creek and seeps feed into the Smith Creek drainage. Hydrology originates along the southern slopes of Grouse Mountain. The First Creek area is dominated by a tall shrub layer of thinleaf alder (*Alnus incana*) and Drummond's willow (*Salix drummondiana*). Willow and alder are large, healthy, and consistent throughout. There are some encroaching canopy species including subalpine fir (*Abies lasiocarpa*), Engelmann spruce (*Picea engelmannii*), and quaking aspen (*Populus tremuloides*). The understory layer is dominated by mesic forbs including brook saxifrage (*Saxifraga odontoloma*), common cowparsnip (*Heracleum maximum*), Columbian monkshood (*Aconitum columbianum*), and tall fringed bluebells (*Mertensia ciliata*). Stream banks are well-vegetated and stable throughout with good amounts of coarse materials. Soils are composed of sandy clays. Smith Creek seeps are dominated by a tall shrub layer of thinleaf alder (*Alnus incana*). Alder are very robust and mature with many large diameter stems and new lateral stems indicating the water source has been consistent for many years. Species composition throughout suggests a perennial water source with the majority of the species being facultative wetland species. The understory is dominated by mesic forbs including Columbian monkshood (*Aconitum columbianum*), common cowparsnip (*Heracleum maximum*), threepetal bedstraw (*Galium trifidum*), and brook saxifrage (*Saxifraga odontoloma*), and heartleaf bittercress (*Cardamine cordifolia*). Graminoids present include bluejoint reedgrass (*Calamagrostis canadensis*) and smallflowered woodrush (*Luzula parviflora*). Saturated soils in seep areas are silty clays up to 40+ cm. The lodgepole pine in surrounding uplands show signs of beetle infestation and may need to be removed or thinned in the future. Disturbances include game use for bathing and watering, road proximity, and signs of past logging. The areas likely see heavy use during the fall hunting season. Geology consists of sedimentary rocks of the Tertiary Age, specifically Arkosic sandstone, conglomerate, and shale of the Coalmont Formation.

Key Environmental Factors: Key environmental factors driving the species composition include moderate slope, spring flooding, and perennial surface hydrology.

Climate Description: Climate likely follows typical weather patterns of this region of Colorado being generally xeric throughout the year, with wet spring seasons and late summer "monsoons".

Land Use History: The area was homesteaded in the past and cabins are still present. Evidence of past logging exists in adjacent lodgepole pine (*Pinus contorta*) forests.

Biodiversity Significance Rank Comments (B3): This site is drawn for a good (B-ranked) occurrence of the globally vulnerable (G3/S3) community, thinleaf alder - Drummond's willow (*Alnus incana* - *Salix drummondiana*) montane riparian shrubland, and a fair (C-ranked) occurrence of the globally vulnerable (G3/S3) community, thinleaf alder (*Alnus incana*) / mesic forb shrubland.

Natural Heritage element occurrences at the First Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Alnus incana</i> - <i>Salix drummondiana</i> Shrubland	Montane Riparian Shrubland	G3	S3				B	2005-06-19
Natural Communities	<i>Alnus incana</i> / Mesic Forbs Shrubland	Thinleaf Alder / Mesic Forb Riparian Shrubland	G3	S3				C	2005-06-19

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries are drawn to encompass approximately one mile of the First Creek tributary of Corral Creek and springs in adjacent Smith Creek drainage. Boundaries include all ecological processes important to the maintenance of site hydrology and biota including surface flows, spring flooding, and groundwater discharge. However, boundaries do not include all ecological processes influencing the site and activities such as improper grazing, road maintenance, development, and water diversion may have a negative impact.

Protection Urgency Rank Comments (P4): Site is owned by BLM. Potential threats include; road encroachment, recreational use, and logging.

Management Urgency Rank Comments (M4): Management needs are not immediate, but may be needed in the future if non-native species become more prevalent, recreational use is increased, or if logging is reinstated.

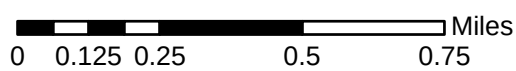
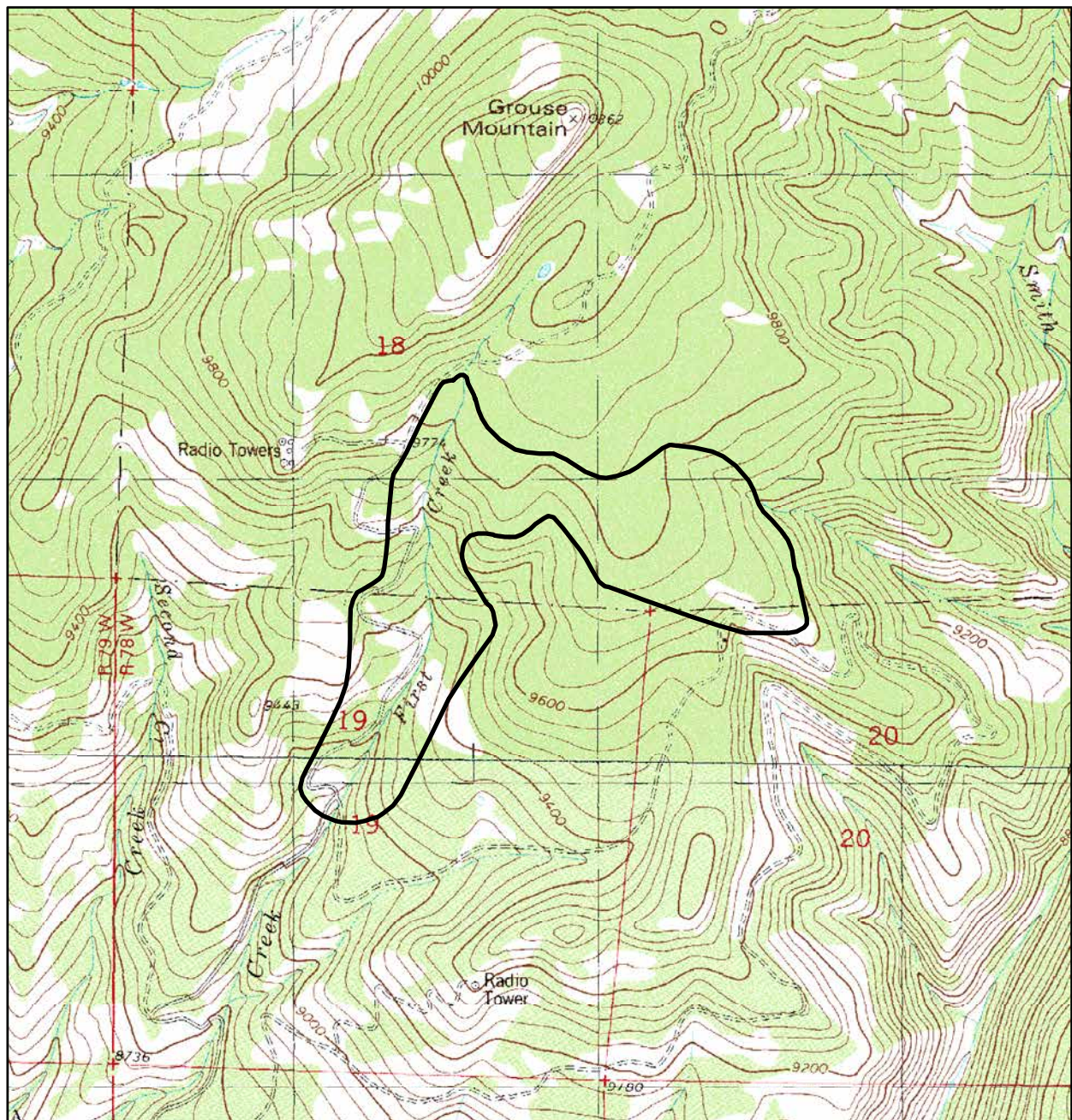
Land Use Comments: Predominant land uses include recreational activities such as limited hiking, camping, biking, hunting, grazing, and OHV use. As well, the area

has been used for logging in the past.

Natural Hazard Comments: Portions of the lower road are clay soils and may be dangerous when wet. There is the possibility of a flooding hazard during spring run-off.

Exotic Species Comments: There were no exotic species observed, but there is potential for the adjacent road to act as a conduit for exotics along the drainage.

Off-Site Considerations: Off-site considerations include logging, OHV use, and road maintenance.



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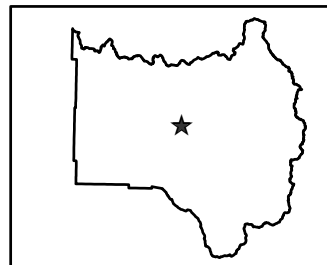
Legend

 PCA Boundary

Parshall, 40106-A2
Corral Peaks, 40106-B2

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 22. First Creek Potential Conservation Area, B3: High Biodiversity Significance

Fraser River at Granby

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P5: No Action to be Taken on this Site

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Granby

Size: 653 acres (264 ha)

Elevation: 7,935 - 7,975 ft. (2,419 - 2,431 m)

General Description: The Fraser River is a major tributary in the upper Colorado River watershed. It originates at Berthoud Pass and joins the Colorado River just south of Granby. Near the occurrence, the Fraser River is a type C stream. General geology consists of unconsolidated surficial deposits and rocks of the Quaternary Age, specifically modern alluvium. Alluvial soils consist of large cobble along the stream corridor and silt loams of moderate organic content in backwater sloughs. Soils are saturated to inundated throughout with perennial surface flows along the main drainage and high groundwater levels along sloughs. Canopy layer is dominated by narrowleaf cottonwood (*Populus angustifolia*). The tall shrub layer is dominated by willow species including mountain willow (*Salix monticola*), Geyer's willow (*Salix geyeriana*), greenleaf willow (*Salix lucida*), and narrowleaf willow (*Salix exigua*) with mountain willow being the most common. Herbaceous understory is dominated by mesic graminoids including bluejoint reedgrass (*Calamagrostis canadensis*), beaked sedge (*Carex utriculata*), and clustered field sedge (*Carex praegracilis*). Exotic species are common throughout. Irrigation and residential water supplies remove water from the system at the town of Granby.

Key Environmental Factors: Key environmental factors influencing the biota of this site include perennial surface flows, spring flooding, slope, and valley shape.

Climate Description: Climate likely follows patterns typical of this region of Colorado being generally xeric throughout the year with wet spring seasons and late summer "monsoons".

Land Use History: Surrounding uplands have been developed for many years and the site has been used for cattle grazing in the past.

Biodiversity Significance Rank Comments (B3): This site is drawn for a good (B-ranked) occurrence of the globally vulnerable (G3/S3) plant community, narrowleaf cottonwood (*Populus angustifolia*) / mixed willow (*Salix monticola*, *drummondiana*, *lucida*) shrubland.

Natural Heritage element occurrences at the Fraser River at Granby PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Populus angustifolia / Salix (monticola, drummondiana, lucida) Woodland	Narrowleaf Cottonwood / Mixed Willows Montane Riparian Forest	G3	S3				B	2005-06-22

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries include approximately 4 miles of the Fraser River near Granby. Boundaries are drawn to include some buffered uplands and to encompass those ecological processes necessary to maintain site hydrology including perennial surface flows, spring flooding, sediment deposition, and groundwater recharge. However, boundaries do not include all ecological processes influencing the site and activities upstream and along adjacent slopes such as improper grazing, water diversion, and development may negatively impact site hydrology and biota.

Protection Urgency Rank Comments (P5): Site protected by property owners who want to preserve it as a natural area.

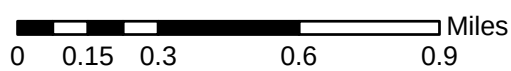
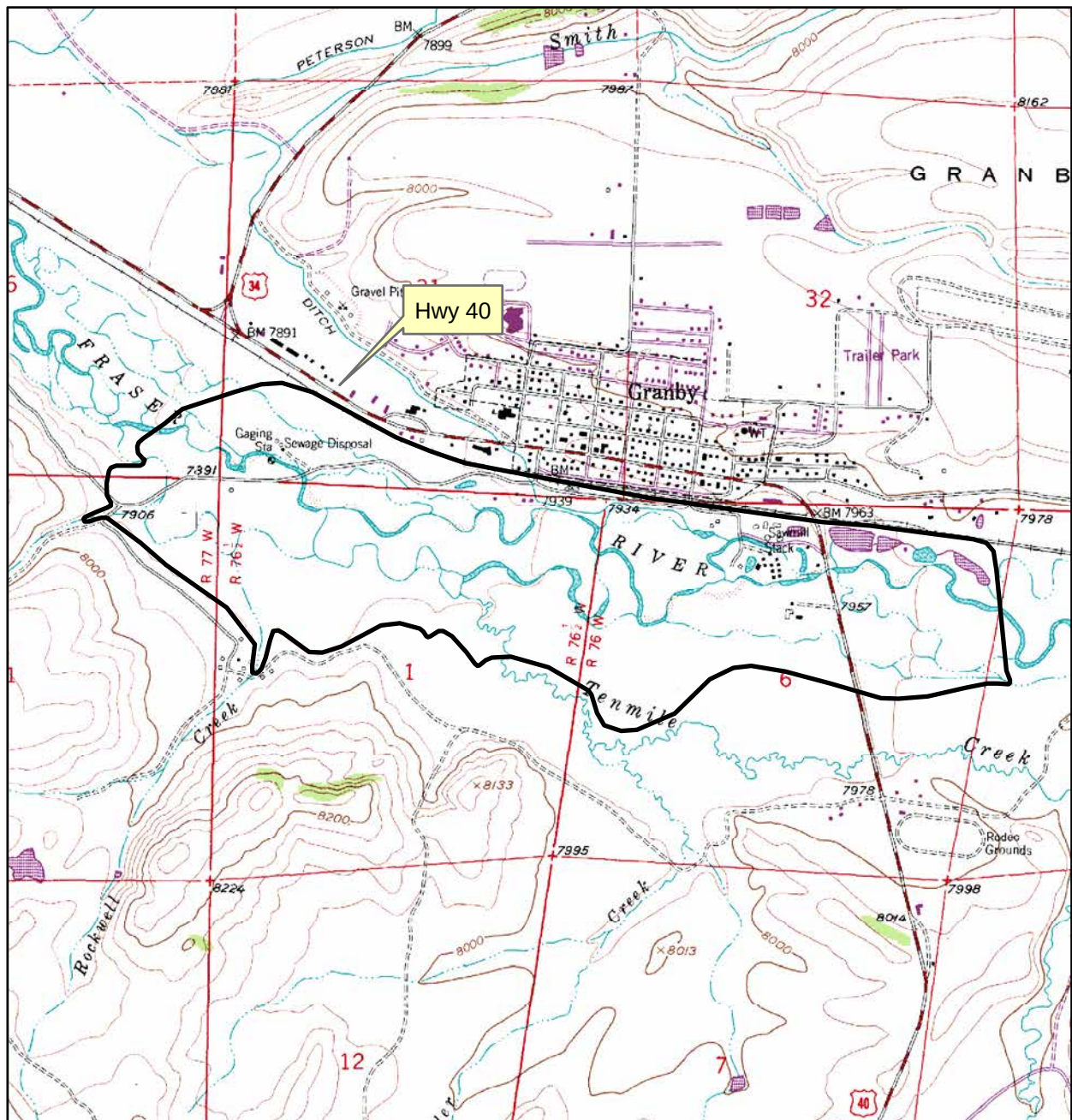
Management Urgency Rank Comments (M3): The site supports many exotic species which are dominant in some areas. Property owners have excluded cattle which may aid in recovery from past uses.

Land Use Comments: Land was used for cattle grazing in the past. Cattle have been excluded by fencing and less than 40 cattle are grazed on adjacent uplands.

Natural Hazard Comments: Flooding during spring snow melt may cause dangerous flows and deep pools along main drainage.

Exotic Species Comments: Exotics are common throughout the surveyed areas. Most common exotic species include Timothy (Phleum pratense), Canada thistle (Cirsium arvense), smooth brome (Bromus inermis), and Kentucky bluegrass (Poa pratensis). Other exotics present include common dandelion (Taraxacum officinale), whitetop (Cardaria sp.), and common mullein (Verbascum thapsus). Exotics may be so abundant due to past land uses.

Off-Site Considerations: There are multiple off-site considerations. Dewatering upstream for municipal use, water treatment facilities just above the site, a golf course within the adjacent floodplain, adjacent highway, and the city of Granby all have impacts on the hydrology and sediment and toxins inputs. As well, cattle are grazed on adjacent uplands within the floodplain.



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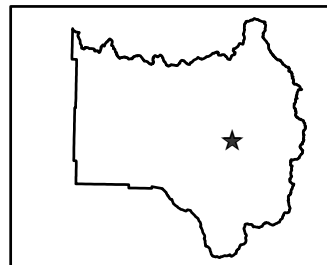
Legend

 PCA Boundary

Granby, 40105-A8

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 23. Fraser River at Granby Potential Conservation Area, B3: High Biodiversity Significance

Keyser Creek

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Bottle Pass, Sylvan Reservoir

Size: 796 acres (322 ha)

Elevation: 8,440 - 9,400 ft. (2,573 - 2,865 m)

General Description: Keyser Creek is a second order tributary of the Williams Fork River. Drainage supports a type A stream along the majority of the site, being narrow and moderately sloped. General geology consists of metamorphic rocks of the Precambrian Age. Soils are mineral throughout with pockets of organic soils in upper meadow and alluvium along the main drainage. Soils are inundated to seasonally saturated along the drainage and upper meadow. Open meadow above the confluence with Simpson Creek is dominated by a short shrub community of Wolf's willow (*Salix wolfii*). The short shrub layer forms a mosaic with mesic graminoids. The graminoid layer is dominated by water sedge (*Carex aquatilis*) with consistent cover of mesic forb species. Keyser Creek supports a community of blue spruce (*Picea pungens*), Engelmann spruce (*Picea engelmannii*), and thinleaf alder (*Alnus incana*). Both subalpine fir (*Abies lasiocarpa*) and lodgepole pine (*Pinus contorta*) are common along the drainage. Surrounding uplands are dominated by xeric lodgepole pine forests. Surrounding uplands show very little sign of anthropogenic disturbance. Approximately 50% of lodgepole in surrounding uplands have been affected by the current beetle infestation which may impact wetlands in the next decade. Hydrology appears to be intact and adjacent road does not seem to impact hydrology.

Key Environmental Factors: Key environmental factors influencing the biota of the site include slope, perennial hydrology, spring flooding, elevation, and aspect.

Climate Description: Climate likely follows patterns typical of this region of Colorado, being generally xeric throughout the year, with wet spring seasons and late summer "monsoons".

Biodiversity Significance Rank Comments (B3): This site is drawn for a good (B-ranked) occurrence of the globally vulnerable (G3/S3) community blue spruce (*Picea pungens*) / thinleaf alder (*Alnus incana*) and a good (B-ranked) occurrence of the globally apparently secure (G4/S3) community, Wolf's willow (*Salix wolfii*) / water sedge (*Carex aquatilis*).

Natural Heritage element occurrences at the Keyser Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Picea pungens / Alnus incana Woodland	Montane Riparian Forests	G3	S3				B	1993-08-21
Natural Communities	Salix wolfii / Carex aquatilis Shrubland	Subalpine Riparian Willow Carr	G4	S3				B	2005-07-01

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries include approximately 5 miles of Keyser Creek near its confluence with the Williams Fork River. Boundaries include buffered upland areas and encompass those ecological processes necessary to maintain site hydrology and biota including seasonal flooding, and sediment deposition. However, boundaries do not include all ecological processes influencing the site and activities upstream and along adjacent slopes such as improper grazing, water diversion, and development may impact site hydrology and biota.

Protection Urgency Rank Comments (P4): The site is contained in USFS property and there are currently no threats.

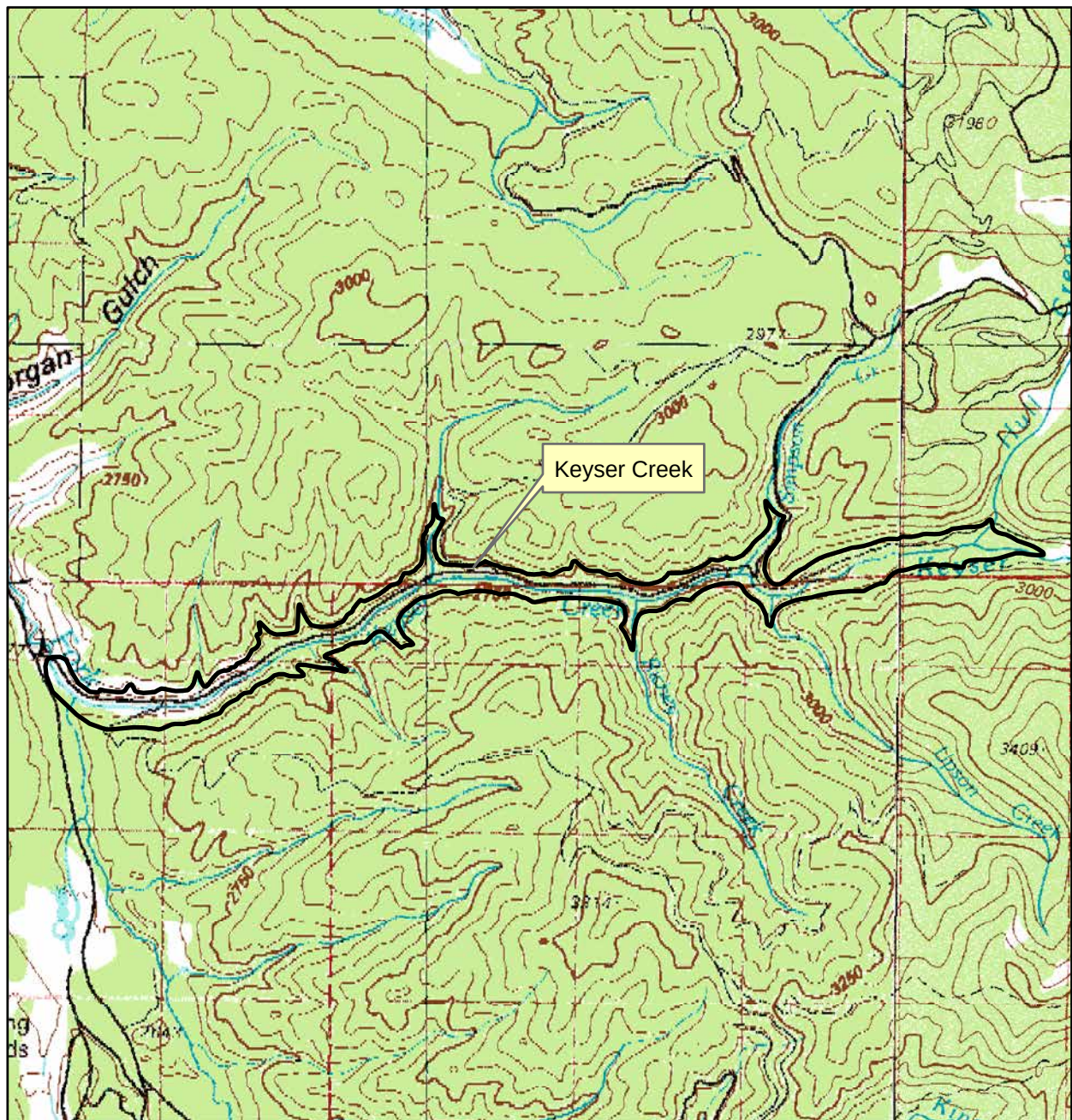
Management Urgency Rank Comments (M4): No management is needed now, but may be needed in the future for exotic species invasion from adjacent road, channeling and diversions due to road proximity and maintenance, and possible buffering if surrounding uplands are logged due to beetle infestation.

Land Use Comments: Predominant land uses include recreational uses such as hunting, fishing, camping, hiking, and biking. As well, surrounding forests may be used as a source for natural resource extraction by the USFS.

Natural Hazard Comments: Spring flooding may cause hazardous conditions along main drainage and adjacent roadways.

Exotic Species Comments: No exotic species were observed within the communities, but may be present along adjacent roadway.

Off-Site Considerations: Off-site considerations include beetle infestation of lodgepole pine in surrounding forests, logging, roads, and recreational uses.



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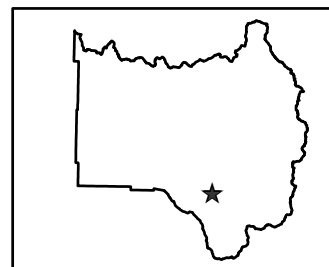
Legend

 PCA Boundary

Denver West, 39105-E1
Vail, 39106-E1

30 x 60 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 24. Keyser Creek Potential Conservation Area, B3: High Biodiversity Significance

Lawson Butte

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Junction Butte, King Creek, Kremmling

Size: 818 acres (331 ha)

Elevation: 7,460 - 8,200 ft. (2,274 - 2,499 m)

General Description: The Lawson Butte site is located in the southern portion of Middle Park. Middle Park is located within a series of high mountain parks formed by north/south trending faults traveling the length of Colorado (Chronic 1980). The predominant grayish-brown soils (USDA, NRCS 1994) are derived from Cretaceous Niobrara and Pierre Shale of the Troublesome Formation (Tweto 1979). Lawson Butte is one in a series of rolling hills on both sides of Highway 9. Elliott Creek runs along the northern border and the Blue River is west of the site. Vegetation is primarily composed of Wyoming big sagebrush (*Artemisia tridentata* var. *wyomingensis*) and rubber rabbitbrush (*Ericameria nauseosa*). Dog parsley (*Aletes nuttallii*) dominates the herbaceous layer with western wheatgrass (*Pascopyrum smithii*).

Key Environmental Factors: Edaphic indicators are clayey, seleniferous soils derived from Niobrara and Pierre shale, soil series Harsha and Tine series (USDA, NRCS 1994).

Climate Description: The climate follows typical weather patterns of high mountain valleys, low precipitation/snowfall (<12-15 inches/year) and late summer "monsoons".

Biodiversity Significance Rank Comments (B3): The Lawson Butte site supports a good (B-ranked) occurrence of the globally vulnerable (G3/S1) dog parsley (*Aletes nuttallii*). Dog parsley is a regional endemic that reaches its southern most range in Colorado. This site contains one of the largest occurrences observed during the summer of 2005 by CNHP staff.

Natural Heritage element occurrences at the Lawson Butte PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	Aletes nuttallii	dog parsley	G3	S1				B	2005-06-27

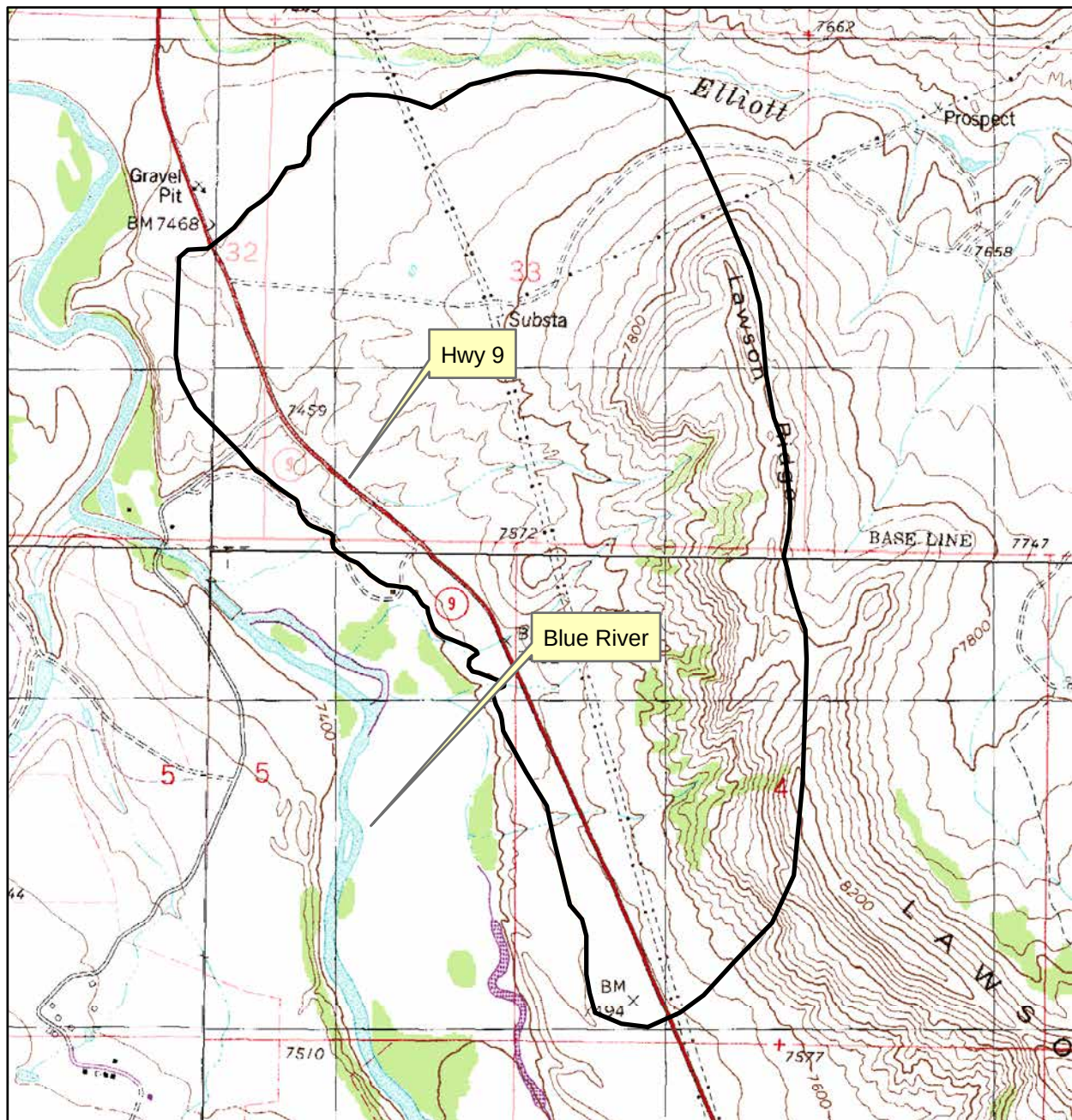
** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

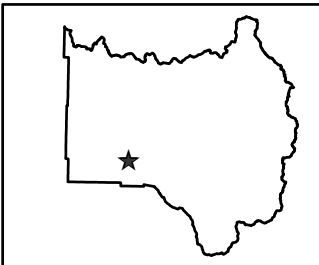
Boundary Justification: Dog parsley (*Aletes nuttallii*) is not known to be restricted by soil or geology, however, this occurrence appears to be populating barren areas that may be related to the Harsha and Tine soil types. Based on this hypothesis, boundaries delineate potential habitat based on soils (USDA, NRCS 1994), and also encompass potential habitat to allow the population to move over time and to protect the occurrence from direct disturbances. The north boundary is defined by Elliott Creek, Lawson Ridge is the eastern border, and Highway 9 defines the western border.

Protection Urgency Rank Comments (P3): Protection actions may be needed, but not within the next 5 years. This occurrence was first documented in 1985 and has persisted, if not flourished, for 10 years. Primary ownership is BLM. Private lands are mainly within the western edge of the site.

Management Urgency Rank Comments (M4): Past and current management seems to favor the persistence and viability of this species.

Information Needs: The pollinator for this species is unknown. Necessary habitat for the pollinator should be included in this site when determined.



Colorado Natural Heritage Program Colorado State University 254 General Services Building 8002 Campus Delivery Fort Collins, CO 80523-8002 Ph (970) 491-1309 Fax (970) 491-3349 www.cnhp.colostate.edu Map Date: 02/10/2006	Legend  PCA Boundary King Creek, 39106-H3 Junction Butte, 40106-A3 Kremmling, 40106-A4 7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey	Location in Grand County 
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Map 25. Lawson Butte Potential Conservation Area, B3: High Biodiversity Significance

Lower Blacktail Creek at Radium

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Radium

Size: 130 acres (53 ha)

Elevation: 6,930 - 7,480 ft. (2,112 - 2,280 m)

General Description: The plant community inhabits a narrow, A type stream along Lower Blacktail Creek. Slope is moderate and the drainage is oriented towards southern exposures in most places. General geology consists of metamorphic rocks of the Precambrian Age, specifically granitic rocks of 1,700 MYA. Blacktail Creek is a free-flowing second order tributary in the upper Colorado River basin. Canopy is dominated by narrowleaf cottonwood (*Populus angustifolia*) and Douglas-fir (*Pseudotsuga menziesii*) with some scattered Colorado blue spruce (*Picea pungens*). Subcanopy consists of regeneration of all canopy species and a tall shrub layer dominated by thinleaf alder (*Alnus incana*) and red-osier dogwood (*Cornus sericea*). The herbaceous layer is dominated by mesic forb species along the creek and mesic graminoids along drying zones. Uplands are dominated by a mosaic of open big sagebrush (*Artemisia tridentata*) shrublands and mixed Rocky Mountain juniper (*Juniperus scopulorum*) - pinon pine (*Pinus edulis*) - Douglas-fir (*Pseudotsuga menziesii*) woodlands. The creek bottom consists of large boulders with alluvial, sandy, cobble bottom and some silt deposits. Adjacent floodplain is comprised of sandy loam over cobble. There is a trail constructed along the creek for the first mile up from the road which crosses the creek by a series of bridges. Some weeds are present along the trail in uplands areas, but do not inhabit the creek bottom except for occasional patches of Kentucky bluegrass (*Poa pratensis*). The occurrence seems stable and probably in an upward trend due to lack of use in recent years.

Key Environmental Factors: Key environmental factors affecting the drainage include seasonal flooding, confined channel, and light exposure due to narrow canyon walls.

Climate Description: Area likely follows climate patterns typical for Colorado being generally xeric, with wet spring seasons and late summer "monsoons".

Biodiversity Significance Rank Comments (B3): This area is drawn for a good (B-ranked) occurrence of the globally vulnerable (G3/S2) riparian plant community, narrowleaf cottonwood / Douglas-fir (*Populus angustifolia* / *Pseudotsuga menziesii*) woodland.

Natural Heritage element occurrences at the Lower Blacktail Creek at Radium PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Populus angustifolia - Pseudotsuga menziesii Woodland	Montane Riparian Forest	G3	S2				B	2005-07-30

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries are drawn to encompass about 1.75 miles of lower Blacktail Creek. Surrounding uplands and tributaries are included and are important to hydrologic functions of the area such as sediment deposition, and seasonal flooding. Boundary does not include all areas that may negatively impact hydrologic processes if activities such as improper grazing, development, or water diversions are introduced.

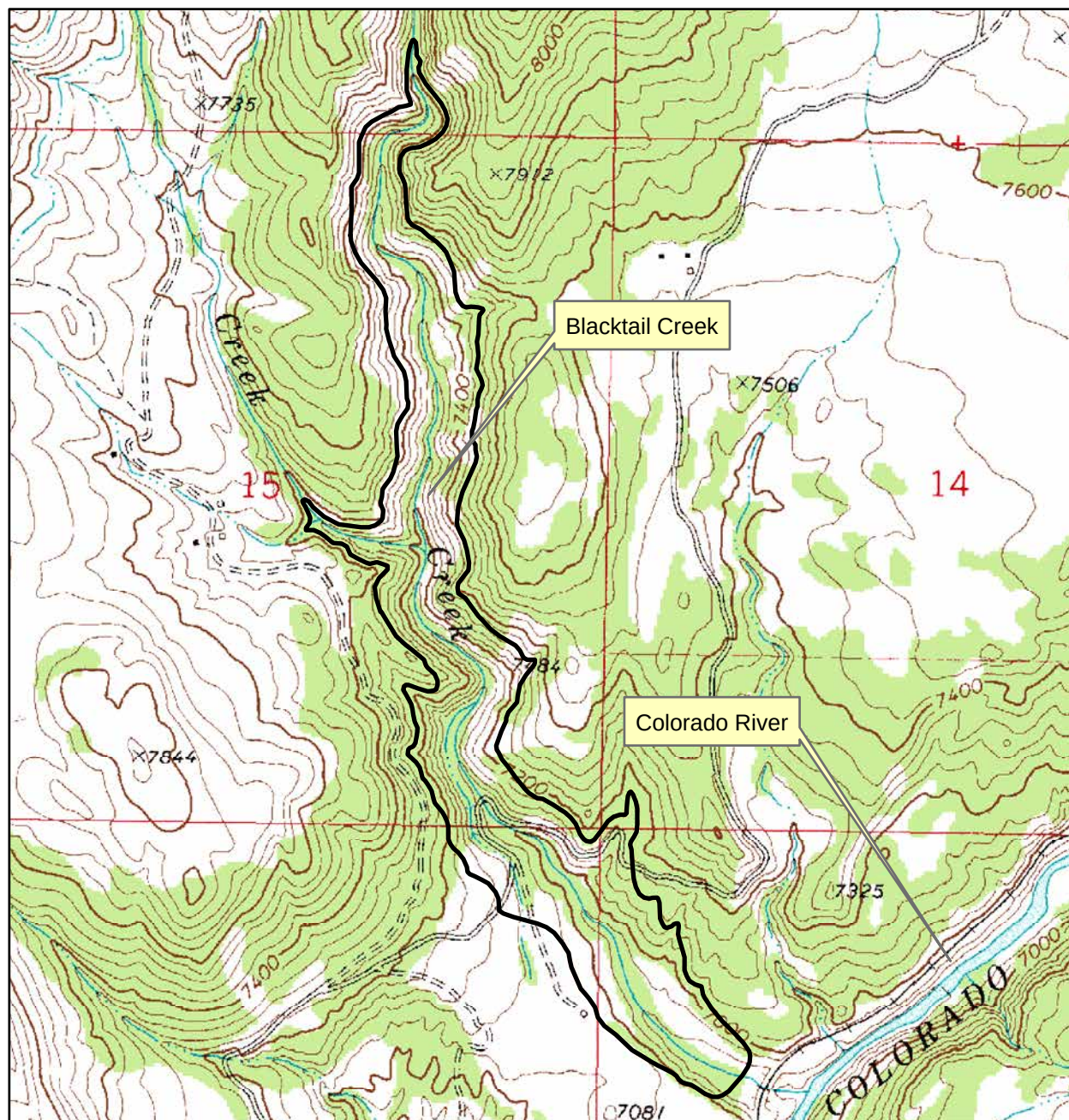
Protection Urgency Rank Comments (P4): The area is protected as the Walt Woodward Wildlife viewing area.

Management Urgency Rank Comments (M3): Management in the area is needed within five years or it will degrade. Non-native species are common along trails above drainage and are beginning to encroach along some areas of the stream. Trail maintenance is needed to ensure bridges are maintained properly and trails do not wash away during high water. This should prevent visitors from creating new trails that would cause deleterious effects to bank stability and streamside vegetation.

Land Use Comments: The dominant use of the area is for hunting and recreation.

Natural Hazard Comments: Flooding during spring run-off may become hazardous due to the narrow shape and steep side slopes of the valley along lower Blacktail Creek.

Exotic Species Comments: The majority of exotics found in the drainage occur along upper reaches of the trail and in disturbed areas. Exotics observed include Kentucky bluegrass (*Poa pratensis*), smooth brome (*Bromus tectorum*), hound's tongue (*Cynoglossum officinale*), and Canada thistle (*Breca arvensis*).



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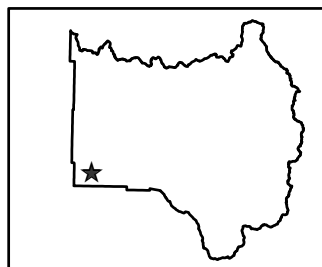
Legend

 PCA Boundary

Radium, 39106-H5

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 26. Lower Blacktail Creek at Radium Potential Conservation Area, B3: High Biodiversity Significance

Miller Gulch

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P2: Threat/Opportunity within 5 Years

Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss

U.S.G.S. 7.5-minute quadrangles: King Creek, Sheephorn Mountain

Size: 1,901 acres (769 ha)

Elevation: 7,783 - 8,200 ft. (2,372 - 2,499 m)

General Description: Miller Gulch is located in southern Grand County, west of the Williams Fork Mountains. Vegetation is somewhat heterogeneous, dominated by Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) that occupies loamy soils derived from Pierre and Niobrara shale, sedimentary rocks from the Cretaceous (Tweto 1979). Grayish-brown soils are deep, well drained soils that have formed in local alluvial material as it weathered from the shale. Soils are classified as Leavitt and Tine series (USDA NRCS 1994). Other associated plants found are Sandberg bluegrass (*Poa secunda*), snakeweed (*Gutierrezia sarothrae*), prairie sagewort (*Artemisia frigida*), blue grama (*Bouteloua gracilis*), and June grass (*Koeleria macrantha*). Vegetation within the ravines and ephemeral drainages is characterized by a moderately dense shrub layer and is dominated by Utah serviceberry (*Amelanchier utahensis*) with mountain snowberry (*Symphoricarpos oreophilus*), and bluebunch wheatgrass (*Pseudoroegneria spicata*) present in the herbaceous layer. Other shrubs include antelope bitterbrush (*Purshia tridentata*), skunkbrush (*Rhus trilobata*), and wax currant (*Ribes cereum*). The herbaceous layer includes ricegrass (*Achnatherum hymenoides*) with larkspur, upland larkspur (*Delphinium nuttallianum*), and prairie flax (*Linum lewisii*). Beaked and Nebraska sedge (*Carex utriculata* and *C. nebrascensis*) dominate a small, calcareous wetland located along a lateral seep. Hydrology is dependent on mineral-rich, groundwater. Calcium deposits are present within the rills between hummocked areas. Little green sedge (*Carex viridula*) is found on the hummocks the wetland with seaside arrowgrass (*Triglochin maritimum*). Associated plants surrounding the wetland are analogue sedge (*Carex simulata*), few-flower spikerush (*Eleocharis quinqueflora*), and Baltic rush (*Juncus balticus*). The upper soil profile consists of fine textured alluvium soils that are mottled near the surface because of the high water table most of the growing season. The B Horizon is composed of fibric peat for up to 40 cm, below 40 cm soils are about 50% mineral, 50% organic, becoming more mineral with depth with a very strong metallic smell. Hydrology is basic with pH around 7.5, but highly conductive at 2900 micromhos. Disturbances include roads along the sides of drainage and highway below the drainage, OHV use within drainage above county road, and livestock grazing. Exotic species are present in drier areas and are very prominent along the road and may be attributed to past land uses, intense grazing, and proximity to roads.

Key Environmental Factors: Pierre and shale soils dictate where Harrington beardtongue (*Penstemon harringtonii*) occurs. Wetland is dependent on unaltered groundwater flow.

Climate Description: Typical high mountain park weather with very cold, windy winters and dry summers with late summer rains.

Biodiversity Significance Rank Comments (B3): The Miller Gulch site supports a good (B-ranked) occurrence of the globally imperiled Utah serviceberry / blue bunch wheatgrass (*Amelanchier utahensis* / *Pseudoeugenia spicata* shrubland) (G2G3/S2S3). This shrubland is currently known only from Middle Park (NatureServe 2005). However, with additional surveys, this plant association is likely much more common. The wetland supports a good (B-ranked) occurrence of the state rare little green sedge (*Carex viridula*) (G5/S1). Noteworthy is its occurrence in a peat-accumulating wetland that is uncommon in Colorado and especially in seemingly arid shrublands. The globally vulnerable Harrington beardtongue (*Penstemon harringtonii*) (G3/S3) was documented to be in fair (C-ranked) condition due to the fragmentation and threats of roads and residential development.

Natural Heritage element occurrences at the Miller Gulch PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Amelanchier utahensis</i> / <i>Pseudoeugenia spicata</i> Shrubland	Mixed Mountain Shrublands	G2G3	S2S3				B	2005-06-25
Vascular Plants	<i>Penstemon harringtonii</i>	Harrington beardtongue	G3	S3			BLM/USFS	C	2005-06-21
Vascular Plants	<i>Carex viridula</i>	green sedge	G5	S1			BLM	B	2005-06-20

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

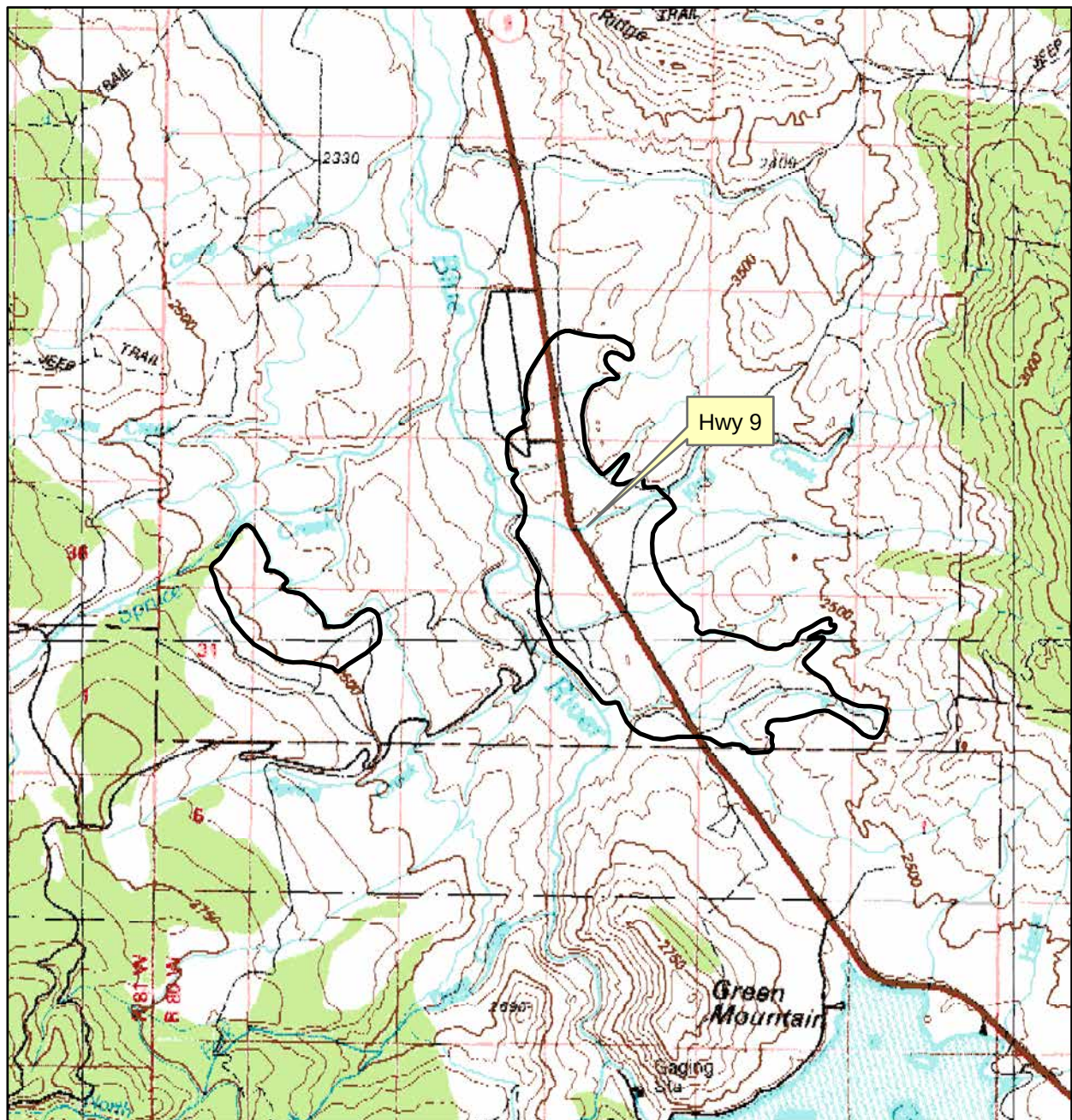
Boundary Justification: Boundaries are drawn to capture the elements and potential habitat. The east boundary extends from the Grand/Summit county line, along the foothills to Junction Butte. The majority of western boundary is located between the Blue River and Spring Creek subdivision.

Protection Urgency Rank Comments (P2): The majority of the site is under private ownership. Protection actions may be needed in 5 years to protect occurrences from residential and subsequent road and utility construction.

Management Urgency Rank Comments (M2): New management will be needed

within 5 years to prevent the loss of the occurrences mainly due to exotic plant introduction, hydrologic alterations, and habitat loss. Grazing management may be needed if bluebunch wheatgrass cover becomes diminished.

Natural Hazard Comments: Walking within the fen can be challenging without proper footwear.



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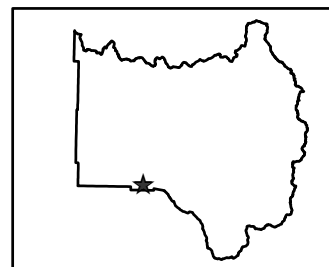
Legend

 PCA Boundary

Vail, 39106-E1

30 x 60 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 27. Miller Gulch Potential Conservation Area, B3: High Biodiversity Significance

Monarch Lake

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P5: No Action to be Taken on this Site

Management Urgency Rank - M5: Not Needed; No Threats Anticipated

U.S.G.S. 7.5-minute quadrangles: Monarch Lake

Size: 133 acres (54 ha)

Elevation: 8,375 - 8,450 ft. (2,553 - 2,576 m)

General Description: Monarch Lake is a man-made lake created by the damming of Arapaho Creek above Arapaho Bay of Lake Granby. Arapaho Creek is a second order tributary of the Upper Colorado River which originates in the glaciated mountains of the Indian Peaks Wilderness along the Continental Divide. The Monarch Lake area is a narrow moraine with multiple element occurrences and generally pristine habitat along its southeastern end. Two perennial drainages sustain the lake, Buchanan and Arapaho creeks, which rely on perennial sources such as springs and ephemeral sources such as snow melt and precipitation. General geology is metamorphic rock of the Precambrian Age, specifically biotite gneiss, schist, and migmatite along the northeastern lateral moraine and unconsolidated surficial deposits and rocks of Quaternary Age, specifically glacial drift of Pinedale and Bull lake glaciation, along the southwestern lateral moraine. Surrounding uplands are dominated by mature forests of mixed lodgepole pine (*Pinus contorta*), subalpine fir (*Abies lasiocarpa*), and Engelmann spruce (*Picea engelmannii*) with some blue spruce (*Picea pungens*) occurring along drainages. Wetland occurrences range from large willow carrs and narrow drainages to perennially saturated seeps and fens. The extent and usage of Monarch Lake and surrounding uplands are very important to the pristine nature of the site. It is within a designated national recreation area and is surrounded on all sides by large tracts of National Forest. A large *Salix* dominated shrubland at the southeastern end of the lake may be maintained by the water levels elevated by the dam. The fen at the southeastern end of the lake likely precedes the dam due to depth of hemic soils and is dependent on hydrology from local groundwater source.

Key Environmental Factors: Key environmental factors include seasonal flooding and snow pack, slope aspect, glaciated valley shape, flooding and retained water from dam, and pristine uplands of mature forest ecosystems.

Climate Description: Microclimate may be influenced by steep lateral moraine. General climate likely follows the typical patterns of Colorado weather systems being xeric, with wet spring seasons and late summer "monsoons".

Land Use History: Historically the area was the small town of Monarch Lake during the early 1900's. The creek was dammed to facilitate the town and the box-making

factory for which the town was built. The town and factory only lasted for about 7 years and then were abandoned.

Biodiversity Significance Rank Comments (B3): The site contains a concentration of multiple high quality element occurrences including a good (B-ranked) occurrence of a globally vulnerable (G3G4/S3) community, *Betula nana* / mesic forbs - mesic graminoids, an excellent (A-ranked) occurrence of a globally demonstrably secure (G5/S3) community, *Salix geyeriana* / *Calamagrostis canadensis*, and a good (B-ranked) occurrence of a globally apparently secure (G4/S2) community, *Picea engelmannii* / *Equisetum arvense*.

Natural Heritage element occurrences at the Monarch Lake PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Betula nana</i> / Mesic Forbs - Mesic Graminoids Shrubland	Subalpine Riparian Shrubland	G3G4	S3				B	2005-08-20
Natural Communities	<i>Picea engelmannii</i> / <i>Equisetum arvense</i> Forest	Coniferous Wetland Forests	G4	S2				B	2005-09-13
Natural Communities	<i>Salix geyeriana</i> / <i>Calamagrostis canadensis</i> Shrubland	Montane Riparian Willow Carr	G5	S3				A	2005-08-20

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundaries are drawn to encompass drainages that supply surface water to the area, the lake and the dam that may be responsible for the maintenance of groundwater levels at the southeastern end of the lake.

Protection Urgency Rank Comments (P5): The area is currently protected with no threats. It is a designated Natural Area.

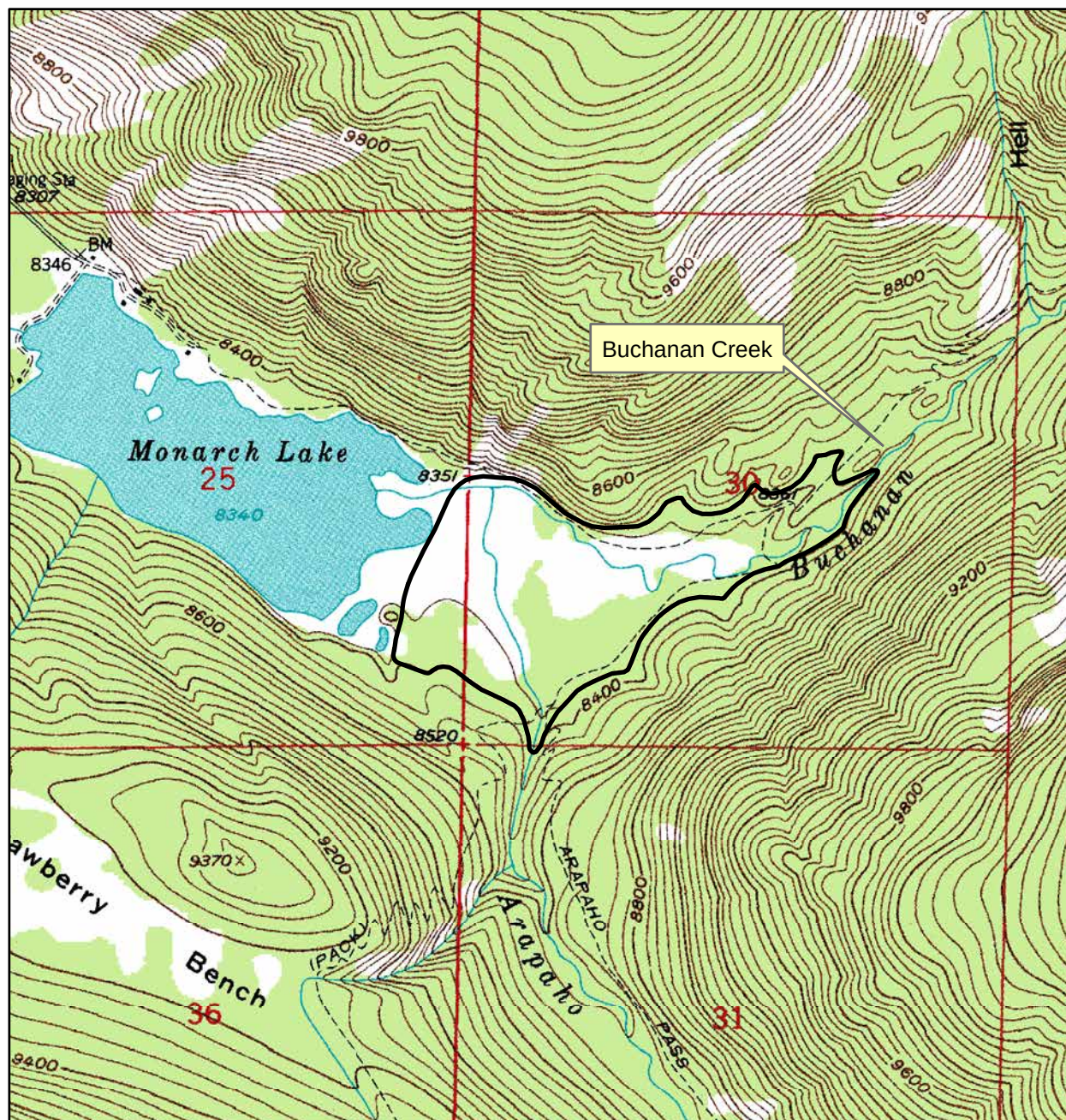
Management Urgency Rank Comments (M5): The area currently has no threats due to specific management of the site as a Natural Area. Management may need to be altered if visitor numbers are increased or hydrology is altered.

Land Use Comments: Area is currently protected for public use as a designated Natural Area and supports no development aside from a ranger station, bathroom, and dam.

Natural Hazard Comments: Spring flooding may cause hazards for visitors due to trail being very close to water level along the lake's southern end.

Exotic Species Comments: There are very few exotic species. Those present include Kentucky bluegrass (*Poa pratensis*) and common dandelion (*Taraxacum officinale*) which are confined to trail edges near the northern end of the lake near the park entrance.

Off-Site Considerations: The majority of surrounding uplands are owned by the USFS as part of the Arapaho National Forest and the Arapaho National Recreation Area. The most likely disturbance would be from logging or burning. Lodgepole pine (*Pinus contorta*) forests throughout the surrounding uplands are currently being heavily impacted by beetle infestation and may see intense losses in the near future.



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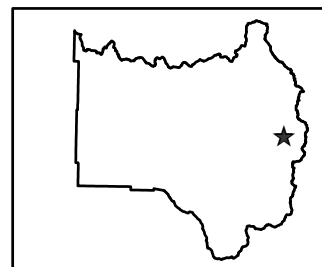
Legend

 PCA Boundary

Monarch Lake, 40105-A6

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 28. Monarch Lake Potential Conservation Area, B3: High Biodiversity Significance

Red Dirt Reservoir

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Tyler Mountain

Size: 61 acres (25 ha)

Elevation: 9,805 - 9,845 ft. (2,989 - 3,001 m)

General Description: Occurrences are small patch meadows fed by groundwater. Meadows are dominated by herbaceous species, but also support a consistent cover of evergreen tree species. Graminoid layer is dominated by water sedge (*Carex aquatilis*) with many areas that are strictly water sedge and fewflower spikerush (*Eleocharis quinqueflora*) with no other herbaceous cover. Other graminoids are also present including beaked sedge (*Carex utriculata*) in mesic areas and bluejoint reedgrass (*Calamagrostis canadensis*) and tufted hairgrass (*Deschampsia caespitosa*) in drier areas. Peatmoss (*Sphagnum* sp.) is a very important and dominant component throughout the stand occurring on hummocks and drying in some areas, being more dominant throughout the southern portion of the site. Peat soils of depths greater than 62 cm give this community the unique characteristics of a fen based on specific hydrology and soil structure. Tree species present include lodgepole pine (*Pinus contorta*), Engelmann spruce (*Picea engelmannii*), and subalpine fir (*Abies lasiocarpa*). Surrounding uplands are dominated by mature lodgepole pine, Engelmann spruce, and subalpine fir mixed forests. Diamondleaf willow (*Salix planifolia*) is also present in moderate cover along edges and to some degree in meadow. General geology consists of igneous rocks of the Precambrian Age, specifically, granitic rocks of 1,400 million years. Soils are saturated throughout with many areas of standing water.

Key Environmental Factors: Key environmental factors influencing the biota of the site include groundwater fed, year-round hydrology.

Climate Description: The area likely follows typical Colorado climate patterns being xeric year-round with wet spring weather and late summer "monsoon" season.

Biodiversity Significance Rank Comments (B3): This site is drawn for a good (B-ranked) occurrence of the globally vulnerable (G3/S3) community, water sedge (*Carex aquatilis*) - beaked sedge (*Carex utriculata*) perched wetland. This site is a unique wetland type due to its groundwater fed hydrology and deep, well-developed peat soils.

Natural Heritage element occurrences at the Red Dirt Reservoir PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	CAREX AQUATILIS - CAREX UTRICULATA PERCHED WETLAND	Wet Meadow - Perched Wetland	G3	S3				B	2005-08-28

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary is drawn to encompass the open meadows, buffered uplands and ecological processes that maintain site hydrology including upstream surface flows and groundwater discharge. However, the boundary does not encompass all uplands surrounding the site that may impact the area. Activities such as development, road maintenance, logging, or burning may negatively impact the site.

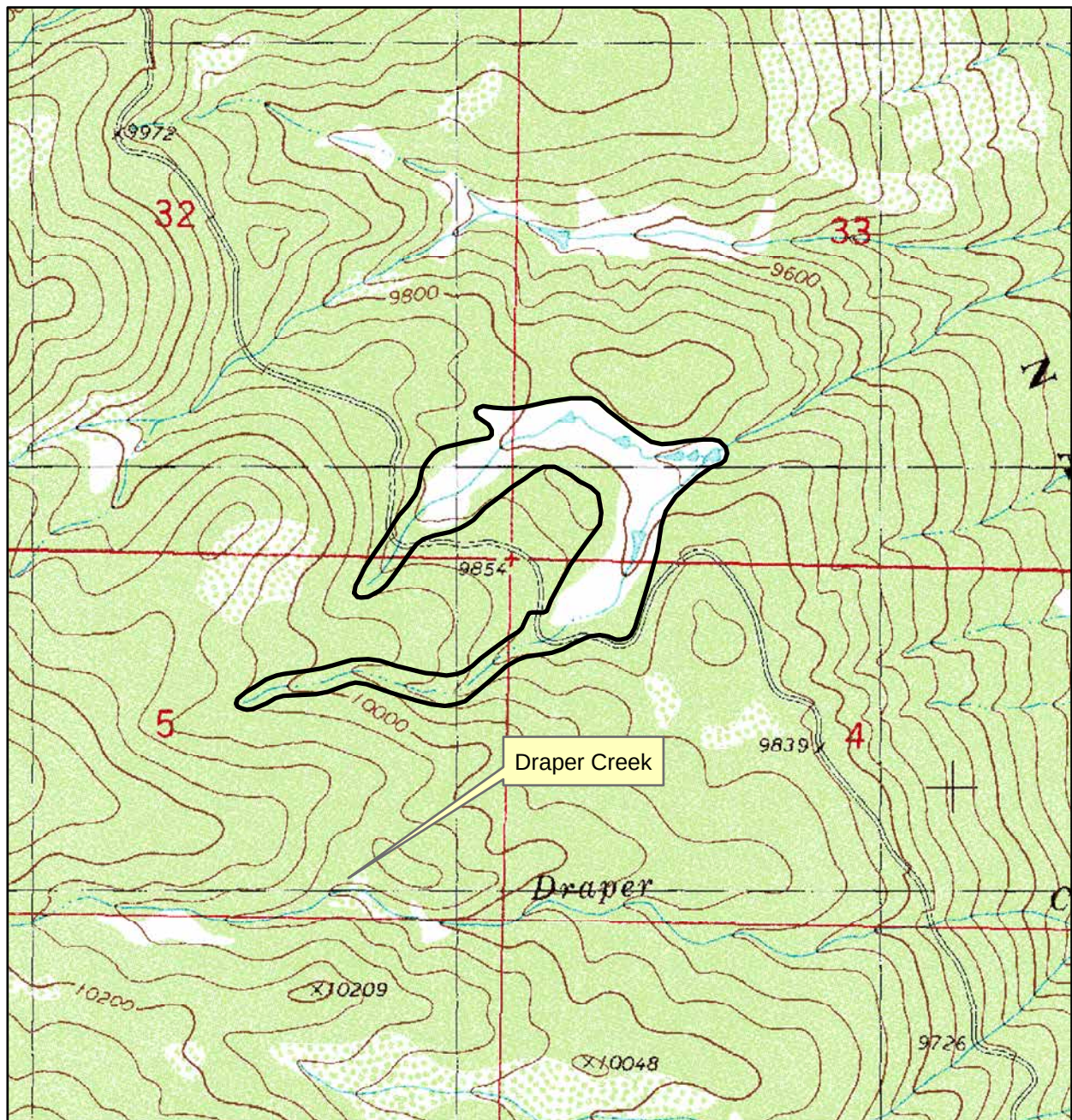
Protection Urgency Rank Comments (P3): The area does not need urgent protection. Possible threats include road expansion, toxins and sedimentation from adjacent road, exotic species invasion, and burning and logging of surrounding forests.

Management Urgency Rank Comments (M4): There are no current threats. Management may be needed in the future if management of surrounding uplands or site changes or if logging, road construction, water diversions, or other development is introduced.

Land Use Comments: Area is predominantly used for recreational purposes, hiking and hunting, and for logging.

Exotic Species Comments: There are very few exotics in the area and none seen within the site. There is a potential for exotic species invasion due to proximity to a forest service road.

Off-Site Considerations: Logging is the main off-site disturbance that may influence the area.



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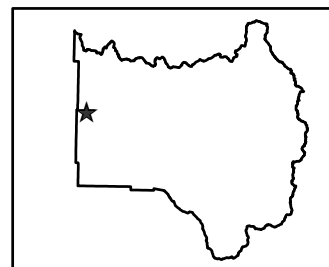
Legend

 PCA Boundary

Tyler Mountain, 40106-B5

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 29. Red Dirt Reservoir Potential Conservation Area, B3: High Biodiversity Significance

Rock Creek at Gore Pass

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Gore Pass, Lynx Pass

Size: 55 acres (22 ha)

Elevation: 8,760 - 8,860 ft. (2,670 - 2,701 m)

General Description: Occurrence inhabits approximately .65 mile of Rock Creek, a small, free-flowing, confined second order stream. Community structure is consistent throughout with a canopy layer dominated by lodgepole pine (*Pinus contorta*) and tall shrub layer of thinleaf alder (*Alnus incana*), and Drummond's willow (*Salix drummondiana*). Stream edges and small adjacent floodplains are dominated by the tall shrubs. Lodgepole pine is present as a consistent layer throughout with some Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*). Graminoids occur in very low cover with bluejoint reedgrass (*Calamagrostis canadensis*) being most common. Forbs present include arrowleaf ragwort (*Senecio triangularis*), common cowparsnip (*Heracleum maximum*), and Virginia strawberry (*Fragaria virginiana*). There are surprisingly few weedy species. General geology consists of igneous rocks of the Precambrian Age. Stream bottom consists of large boulders and a cobble layer interspersed with medium grain sand. There is a small floodplain of fine, sandy soils. Community is confined by Forest Service road and moderately sloped banks. Disturbances include fishing, camping, and general road proximity (dust, weeds, and wildlife). Community appears to be mature and stable, with coarse materials throughout, little erosion, and good vegetation cover. Past beaver activity evident just downstream of occurrence. Beavers may have been "removed" due to flooding of the road.

Key Environmental Factors: Key environmental factors contributing to site hydrology and biota include spring flooding, drainage shape being narrow, confined, perennial surface flows, and elevation.

Climate Description: Climate likely follows patterns typical of this region of Colorado, being generally xeric throughout the year, with wet spring seasons and late summer "monsoons".

Biodiversity Significance Rank Comments (B3): This site is drawn for a good (B-ranked) occurrence of the globally vulnerable (G3/S3) community, thinleaf alder (*Alnus incana*) / Drummond's willow (*Salix drummondiana*) shrubland.

Natural Heritage element occurrences at the Rock Creek at Gore Pass PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Alnus incana - Salix drummondiana Shrubland	Montane Riparian Shrubland	G3	S3				B	2005-08-12

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries include approximately one mile of Rock Creek, near its junction with Hwy 134. Boundaries include buffered upland area and encompass those ecological processes necessary to maintain site hydrology such as perennial surface flows, spring flooding and sediment deposition. However, boundaries do not include all ecological processes influencing the site and activities upstream and along adjacent slopes such as improper grazing, water diversion, and development may impact site hydrology and biota.

Protection Urgency Rank Comments (P3): Site is threatened by road proximity, recreational uses including fishing and camping, and livestock grazing. System is currently healthy, but may degrade with further or increased use.

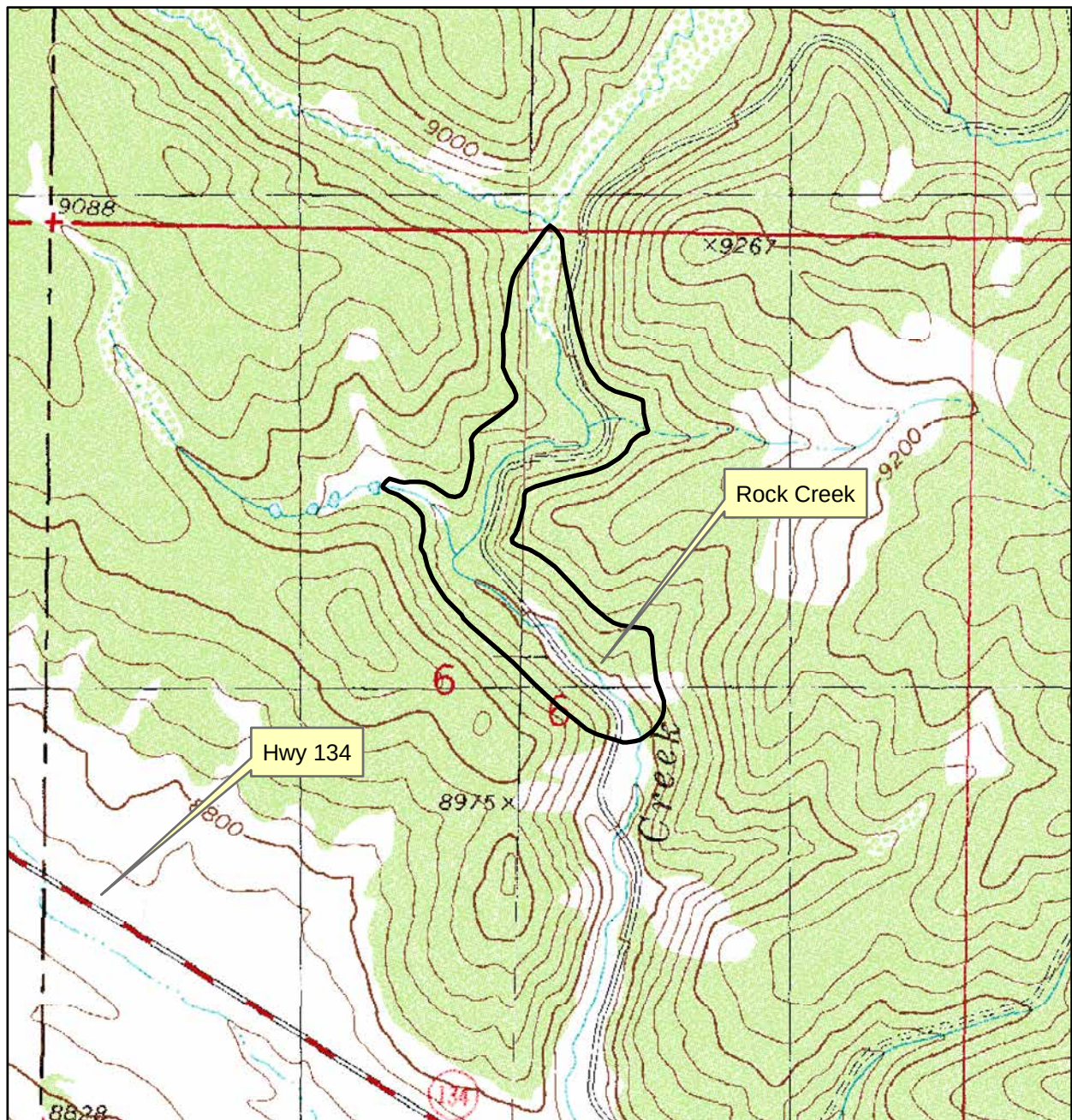
Management Urgency Rank Comments (M3): The site may need to be managed for exotic species and impacts to bank stability from fishing pressures and camping.

Land Use Comments: Predominant land uses include recreational use such as fishing, hunting, camping, hiking, biking, and OHV use. As well, areas upstream of this site are used for livestock grazing.

Natural Hazard Comments: Spring flooding may cause hazardous conditions along adjacent road as well as swift water.

Exotic Species Comments: Canada thistle (*Cirsium arvense*), Kentucky bluegrass (*Poa pratensis*), and common dandelion (*Taraxacum officinale*) are all present along drier areas within the drainage.

Off-Site Considerations: Off-site considerations for the drainage include adjacent road and logging of upland forests.



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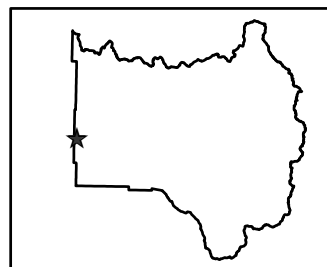
Legend

 PCA Boundary

Gore Pass, 40106-A5
Lynx Pass, 40106-A6

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 30. Rock Creek at Gore Pass Potential Conservation Area, B3: High Biodiversity Significance

Second Creek at Berthoud Pass

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Berthoud Pass

Size: 37 acres (15 ha)

Elevation: 11,185 - 11,425 ft. (3,409 - 3,482 m)

General Description: This site occurs along two first order tributaries of the Fraser River near Berthoud Pass, at and above treeline along variable western slopes. Hydrology is dependent on snowmelt and groundwater percolating through glacial till from above. Soils are rocky throughout except in areas of peat accumulation near groundwater discharge areas. Geologic structure is composed of igneous rocks of the Precambrian Age, specifically granitic rocks of 1,400 million years. Vegetation above the site is composed of alpine short shrub and herbaceous species. Forested areas below treeline are composed of Engelmann spruce (*Picea engelmannii*) / subalpine fir (*Abies lasiocarpa*) communities with whortleberry (*Vaccinium* sp.) species dominating the understory. Riparian areas are dominated by short shrub communities of diamondleaf willow (*Salix planifolia*) with some Engelmann spruce mixing in as an open short canopy layer. Groundwater fed areas are dominated by mesic graminoids including water sedge (*Carex aquatilis*), fewflower spikerush (*Eleocharis quinqueflora*), and sheep sedge (*Carex illota*) and have well-developed peat soils.

Key Environmental Factors: Environmental factors important to the occurrence and distribution of biota in the area include seasonal run-off/flooding, snow pack and snow melt, exposure, and groundwater percolation producing histosols in some areas.

Climate Description: The site occurs in exposed areas at high elevations. Trees exhibit flagging and general stunted growth from winds. Prevailing winds are typically south westerly, so there is likely a build-up of snow along the upper slopes in the area that aid in providing a consistent summer water source.

Land Use History: There is a ditch, Berthoud Pass Aqueduct, above the site that is currently not in use and there is a ski hut along the ridge between the two drainages.

Biodiversity Significance Rank Comments (B3): This site is drawn for two excellent (A-ranked) occurrences of globally apparently secure (G4) plant communities, *Eleocharis quinqueflora* herbaceous vegetation and *Salix planifolia* / mesic forbs, as well as one excellent (A-ranked) occurrence of a globally demonstrably secure plant

community (G5/S4), *Carex aquatilis* herbaceous vegetation. Although these elements are globally common, the area is a pristine example of a headwater tributary of the Fraser and Colorado rivers and therefore merits a B3 rank.

Natural Heritage element occurrences at the Second Creek at Berthoud Pass PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Eleocharis quinqueflora</i> Herbaceous Vegetation	Alpine Wetlands	G4	S3S4				A	2005-09-10
Natural Communities	<i>Salix planifolia</i> / Mesic Forbs Shrubland [Provisional]	Planeleaf Willow / Mesic Forbs	G4	S4				A	2005-09-11
Natural Communities	<i>Carex aquatilis</i> Herbaceous Vegetation	Montane Wet Meadows	G5	S4				A	2005-09-10

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary includes both first order tributaries of First and Second creeks along the upper reaches of the Second Creek Trail, north of Berthoud Pass. It was drawn to encompass important geographic features that help maintain the site's hydrology, specifically surface flows from upstream. Upstream areas of snow accumulation supply the majority of water, but are not included in the boundary. Alterations to these areas could have deleterious affects on this site. Boundaries are based on field surveys and topographic maps of the area.

Protection Urgency Rank Comments (P3): There is the potential for a definable threat if the Berthoud Pass Aqueduct were to be restored to dewater the system. The ditch would remove water from the system above the site and has the potential to deleteriously affect the site by removing the dominant hydrologic source.

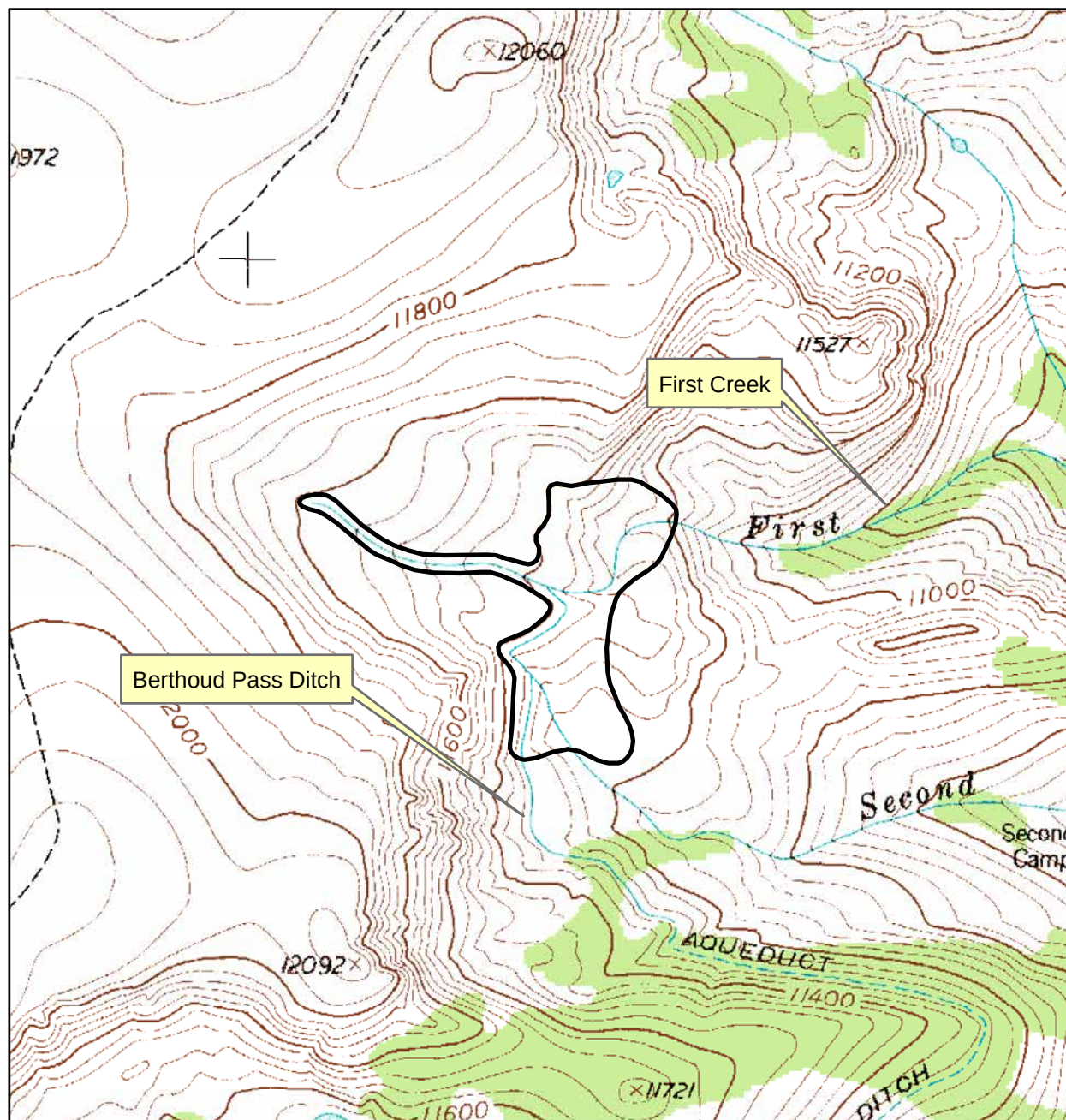
Management Urgency Rank Comments (M4): There are no current threats to the system, but restoration of the ditch has the potential to negatively affect the two drainages. Current management of the trail system and cabin area appears to be appropriate for the maintenance of the area.

Land Use Comments: The area is currently used predominantly for recreational purposes including hiking, camping, and back country skiing. The area may have supported some mining in the past and still contains a ditch that was used to provide water to the Front Range for either agricultural or municipal purposes.

Natural Hazard Comments: Avalanche danger is likely high during the fall, winter, and spring seasons from snow build-up along the upper ridgeline.

Exotic Species Comments: There may be a few exotic species present, but they are confined to areas near the main trail and are not present in the element occurrences.

Off-Site Considerations: The main feature off-site that has the potential to affect the area is the Berthoud Pass Aqueduct which could adversely affect water along the First Creek willow (*Salix*) shrubland and groundwater flows to the fens.



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Map Date: 02/13/2006

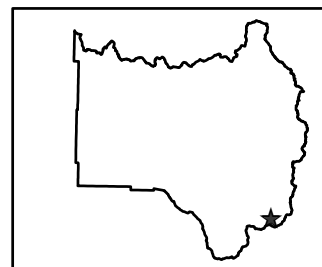
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 PCA Boundary

Berthoud Pass, 39105-G7

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 31. Second Creek at Berthoud Pass Potential Conservation Area, B3: High Biodiversity Significance

Sheephorn Creek at Radium

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Kremmling, Radium, Sheephorn Mountain

Size: 5,627 acres (2,277 ha)

Elevation: 7,360 - 7,500 ft. (2,243 - 2,286 m)

General Description: The Sheephorn Creek at Radium site is located in southwestern Grand County. Trough Road (CR 1) follows the Colorado River as it flows southwest to Radium. General geology consists of metamorphic rocks of the Precambrian Age, specifically granitic rocks of 1,700 MYA (Tweto 1979). Soils vary from brown loams (Forella) to cobbly loam (Dahlquist-Stunner) (USDA, NRCS 1994). Sheephorn Creek, a Colorado River tributary, bisects the site. Vegetation is dominated by pinon pine (*Pinus edulis*), Utah juniper (*Juniperus osteosperma*), and Douglas-fir (*Pseudotsuga menziesii*) with skunkbrush (*Rhus trilobata*). The shrub layer consists of mountain sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and yellow rabbitbrush (*Chrysothamnus viscidiflorus*). The forb and graminoid cover is dominated by mat penstemon (*Penstemon caespitosa*), Watson's penstemon (*P. watsonii*), Rocky Mountain penstemon (*P. strictus*), Harrington beardtongue (*P. harringtonii*), longleaf phlox (*Phlox longifolia*), needle-and-thread grass (*Hesperostipa comata*), rice grass (*Achnatherum hymenoides*) and bluebunch wheatgrass (*Pseudoroegneria spicata*).

Key Environmental Factors: Pierre and shale soils can be indicators for Harrington beardtongue (*Penstemon harringtonii*) locations.

Climate Description: Typical high mountain park weather with very cold, windy winters and dry summers with late summer rains.

Biodiversity Significance Rank Comments (B3): This site supports one excellent to good and one fair (AB and C-ranked) occurrence of the globally vulnerable (G3/S3) Harrington beardtongue (*Penstemon harringtonii*). Harrington beardtongue is known only from Colorado. It has been hypothesized that Harrington beardtongue may peak every 4 to 5 years due to its short-lived perennial life cycle. This may explain the drastic change in numbers of individuals seen over the years (NatureServe 2005).

Natural Heritage element occurrences at the Sheephorn Creek at Radium PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	Penstemon harringtonii	Harrington beardtongue	G3	S3			BLM/USFS	AB	2005-07-05
Vascular Plants	Penstemon harringtonii	Harrington beardtongue	G3	S3			BLM/USFS	C	2005-07-05

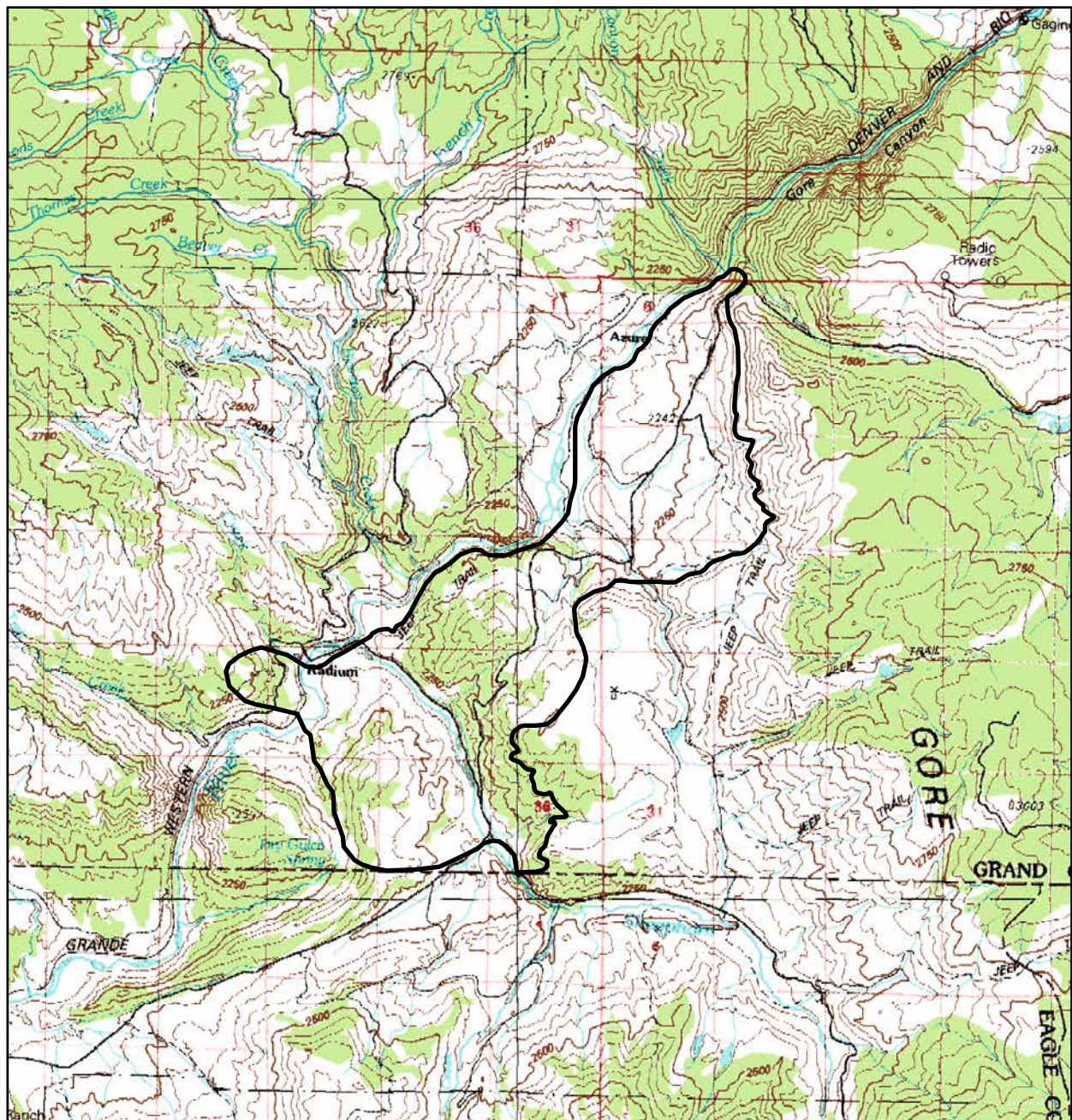
** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundaries extend from McPhee Gulch north to Inspiration Point pullout on Trough Road. The boundaries are drawn to capture the species and its pollinators and potential habitat for expansion. Private property is included in the boundaries, however, only public lands were surveyed.

Protection Urgency Rank Comments (P3): Protection actions may be needed but probably not within the next 5 years. The species was first documented in 1979 and has remained viable with current ownership. The majority of the site is located on the Division of Wildlife Radium State Wildlife Area and BLM properties. There is no special designation for BLM lands.

Management Urgency Rank Comments (M3): New management actions may be needed in 5 years to maintain the current quality of the species. Little or no sign of recent grazing. Monitoring of the populations is recommended due to increase traffic along Trough Road.

Information Needs: In 1990, populations showed evidence of predation by a beetle. The effects are unknown.



0 0.5 1 2 3 Miles



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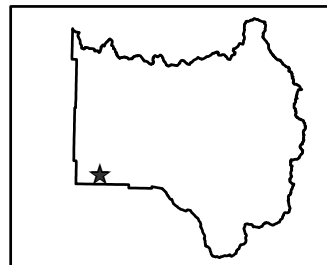
Legend

 PCA Boundary

Vail, 39106-E1
Steamboat Springs, 40106-A1

30 x 60 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 32. Sheephorn Creek at Radium Potential Conservation Area, B3: High Biodiversity Significance

South Fork Mule Creek

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Battle Mountain

Size: 320 acres (130 ha)

Elevation: 8,480 - 8,645 ft. (2,585 - 2,635 m)

General Description: Community inhabits just over a 1 mile stretch of the South Fork of Mule Creek, a small second order tributary of the Williams Fork River. The creek is a type C channel with perennial hydrology. The drainage is dominated by tall shrubs with Geyer's willow (*Salix geyeriana*) being most abundant. The understory is dominated by mesic graminoids including beaked sedge (*Carex utriculata*) along old ponds and more mesic, open areas, and bluejoint reedgrass (*Calamagrostis canadensis*) along drying edges and under dense shrub cover. Some forb species are present throughout, but do not dominate, and become more prevalent downstream. Uplands are dominated by either climax, xeric lodgepole pine (*Pinus contorta*) forest or successional quaking aspen (*Populus tremuloides*) stands. Lodgepole have been heavily impacted by current beetle outbreak. Soils are silty clay loams over sandy clays with water at about 20 cm. Immediate uplands show evidence of intense grazing, with non-natives and soil compaction. Areas downstream within the community also show the negative grazing impacts of channel erosion, weedy species invasion, loss of native wetland species, soil compaction, and heavy grazing. Beaver activity is abundant upstream and there are many ponds. *Bufo boreas* has been documented in the drainage, but was not seen by ecologists during the 2005 field survey.

Key Environmental Factors: Key environmental factors influencing the area include spring flooding, perennial surface flows, slope, and sediment deposition.

Climate Description: Climate likely follows patterns typical of this region of Colorado, being generally xeric throughout the year with wet spring seasons and late summer "monsoons".

Land Use History: There is an old homestead present along the northwestern side of the drainage. The adjacent meadow may have been cultivated in the past and water may have been diverted for use by occupants.

Biodiversity Significance Rank Comments (B3): This site is drawn for a good (B-ranked) occurrence of the globally vulnerable (G3?/S3) plant community, Geyer's willow (*Salix geyeriana*) / mesic graminoids shrubland.

Natural Heritage element occurrences at the South Fork Mule Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Salix geeyeriana / Mesic Graminoids Shrubland	Geyer's Willow / Mesic Graminoid	G3?	S3				B	2005-09-10

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries include approximately 1.25 miles of the South Fork of Mule Creek. Boundaries are drawn with a buffered upland area to encompass those ecological processes necessary to maintain site hydrology including perennial surface flows, upstream tributaries, and spring flooding. However, boundaries do not include all ecological processes influencing the site and activities upstream and along adjacent slopes such as improper grazing, water diversion, and development may impact site hydrology and biota.

Protection Urgency Rank Comments (P3): The site is threatened by natural and anthropogenic disturbances, but is currently stable and may need to be reevaluated in five years.

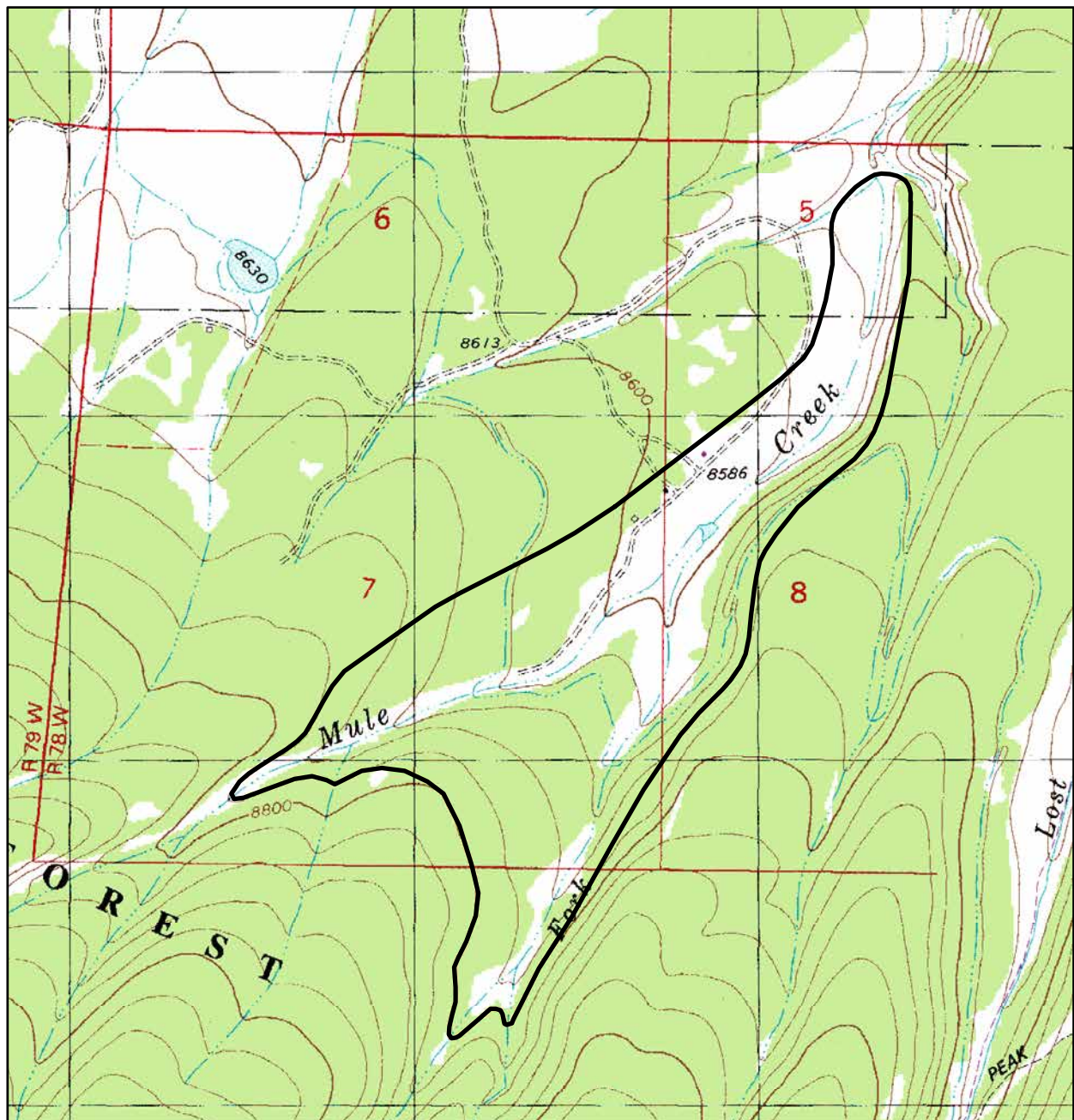
Management Urgency Rank Comments (M3): Management actions may need to be taken to reduce exotic species invasion and reduce the impacts of livestock along banks.

Land Use Comments: Predominant land uses include livestock grazing and recreational uses such as hunting and camping.

Natural Hazard Comments: Spring flooding may produce high flows along the creek.

Exotic Species Comments: Kentucky bluegrass (*Poa pratensis*), Timothy (*Phleum pratense*), and common dandelion (*Taraxacum officinale*) are all present within the drainage, but only at lower reaches where creek is open and accessible to cattle. Adjacent meadow harbors many exotic graminoids which may have been planted for forage.

Off-Site Considerations: Off-site considerations include cattle grazing, exotic species, logging within watershed, beetle kill of lodgepole pine, and recreational use.



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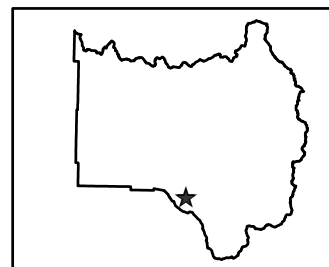
Legend

 PCA Boundary

Battle Mountain, 39106-H2

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 33. South Fork Mule Creek Potential Conservation Area, B3: High Biodiversity Significance

South Fork of the Williams Fork

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Dillon, Loveland Pass, Ute Peak

Size: 3,170 acres (1,283 ha)

Elevation: 8,750 - 10,200 ft. (2,667 - 3,109 m)

General Description: Site encompasses approximately 10 miles of the Upper Williams Fork River and its southern fork. The Upper Williams Fork is a glaciated drainage containing variable stream, valley, and wetland types. Lower reaches of the drainage are dominated by tall shrub communities of Geyer's willow (*Salix geyeriana*) and mountain willow (*Salix monticola*) with other shrub species including Drummond's willow (*Salix drummondiana*), greenleaf willow (*Salix lucida* ssp. *caudata*), diamondleaf willow (*Salix planifolia*), and dwarf birch (*Betula nana*) mixing. Middle and upper reaches of the drainage are dominated by short shrub communities of diamondleaf willow, Wolf's willow (*Salix wolfii*), and dwarf birch. The understory is also variable throughout the drainage with more stable areas being dominated by mesic graminoids dispersing along the soil moisture gradient with beaked sedge (*Carex utriculata*) and water sedge (*Carex aquatilis*) along ponds, rivulets, and inundated areas and bluejoint reedgrass (*Calamagrostis canadensis*) along drying edges with moist soils. Some weedy species including *Poa pratensis* and *Bromus inermis* are present along lower reaches of the drainage and may be indicative of past land uses and proximity to the road. Along the upper reaches, two populations of grapefern (*Botrychium* sp.) were documented. Both subpopulations occur in forest openings approximately ten meters above the valley bottom on dry, rocky soils which appear to be disturbed from either sloughing due to slope severity or other natural disturbance. Grapefern species found in the area include reflected moonwort (*Botrychium echo*), western moonwort (*Botrychium hesperium*), common moonwort (*Botrychium lunaria*), and lanceleaf grapefern (*Botrychium lanceolatum*). Associated species include Mt. Albert goldenrod (*Solidago simplex* var. *nana*), Virginia strawberry (*Fragaria virginiana*), alpine false springparsley (*Pseudocymopterus montanus*), Parry's arnica (*Arnica parryi*), autumn dwarf gentian (*Gentianella acuta*), pussytoes (*Antennaria* sp.), cinquefoil (*Potentilla* sp.), bracted lousewort (*Pedicularis bracteosa*), lodgepole pine (*Pinus contorta*), and boletes (*Boletus* sp.). Disturbances along the lower reaches include mine activity just upstream of the occurrence, logging along slopes of basin, beaver activity and a high percentage of beetle-killed lodgepole pine throughout surrounding forests. Upper reaches of the Williams Fork and its South Fork are pristine with little or no disturbances and very few weedy species. Uplands

surrounding the drainage are dominated by mixed lodgepole pine, subalpine fir (*Abies lasiocarpa*), and Engelmann spruce (*Picea engelmannii*). General geology consists of unconsolidated surficial deposits and rocks of the Quaternary Age along the drainage and metamorphic rocks of the Precambrian Age along adjacent slopes. Soils vary from rocky and xeric to saturated and seasonally inundated with high organic content.

Key Environmental Factors: Key environmental factors driving the hydrology and biota of the site include perennial surface flows, beaver activity, valley shape and stream type, spring flooding, and winter snowpack.

Climate Description: Climate likely follows patterns typical of the mountainous areas of Colorado being generally xeric throughout the season with the majority of precipitation falling during the spring season and a late summer "monsoon" season of afternoon showers.

Biodiversity Significance Rank Comments (B3): This site is drawn for a good (B-ranked) occurrence of the globally vulnerable (G3/S3) plant community, Geyer's willow (*Salix geyeriana*) - mountain willow (*Salix monticola*) / bluejoint reedgrass (*Calamagrostis canadensis*) montane willow carr, excellent (A-ranked) occurrences of the globally vulnerable to globally apparently secure (G3G4/S3) plant community, dwarf birch (*Betula nana*) / mesic forb - mesic graminoid subalpine riparian shrubland, an excellent (A-ranked) occurrence of the globally demonstrably secure (G5/S4) community *Salix planifolia* / *Carex aquatilis* subalpine riparian willow carr, an excellent (A-ranked) occurrence of the globally vulnerable (G3/S3) plant, reflected moonwort (*Botrychium echo*), an excellent (A-ranked) occurrence of the state rare (G4/S1) plant, Mingan's moonwort (*Botrychium minganense*), and a good (B-ranked) occurrence of the state rare (G3G4/S2) plant, western moonwort (*Botrychium hesperium*).

Natural Heritage element occurrences at the South Fork of the Williams Fork PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Salix geyeriana - Salix monticola / Calamagrostis canadensis Shrubland	Montane Willow Carrs	G3	S3				B	2005-09-07
Natural Communities	Betula nana / Mesic Forbs - Mesic Graminoids Shrubland	Subalpine Riparian Shrubland	G3G4	S3				A	1993-09-09
Natural Communities	Betula nana / Mesic Forbs - Mesic Graminoids Shrubland	Subalpine Riparian Shrubland	G3G4	S3				A	1994-07-15
Natural Communities	Betula nana / Mesic Forbs - Mesic Graminoids Shrubland	Subalpine Riparian Shrubland	G3G4	S3				A	2005-07-31
Natural Communities	Salix planifolia / Carex aquatilis Shrubland	Subalpine Riparian Willow Carr	G5	S4				A	2005-07-31
Vascular Plants	Botrychium echo	reflected moonwort	G3	S3				A	2005-08-16
Vascular Plants	Botrychium hesperium	western moonwort	G3G4	S2				B	2005-08-16
Vascular Plants	Botrychium minganense	Mingan's moonwort	G4	S1				A	2005-08-16

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries include approximately 10 miles of the upper reaches of the Williams Fork River and its southern fork. Boundaries are drawn to encompass buffered uplands and those ecological processes important to the maintenance of site hydrology and its constituent biota including seasonal flooding, beaver activity and sediment deposition. However, boundaries do not encompass all ecological processes important to the system and activities within the drainage such as water diversion, logging, improper grazing techniques, trail maintenance, and development may be detrimental to site functionality.

Protection Urgency Rank Comments (P3): Site is threatened by upstream activities such as dewatering and industry. Currently the site is stable, but it is vulnerable due to the activities upstream and may be negatively impacted if activities in

surrounding uplands are increased or altered.

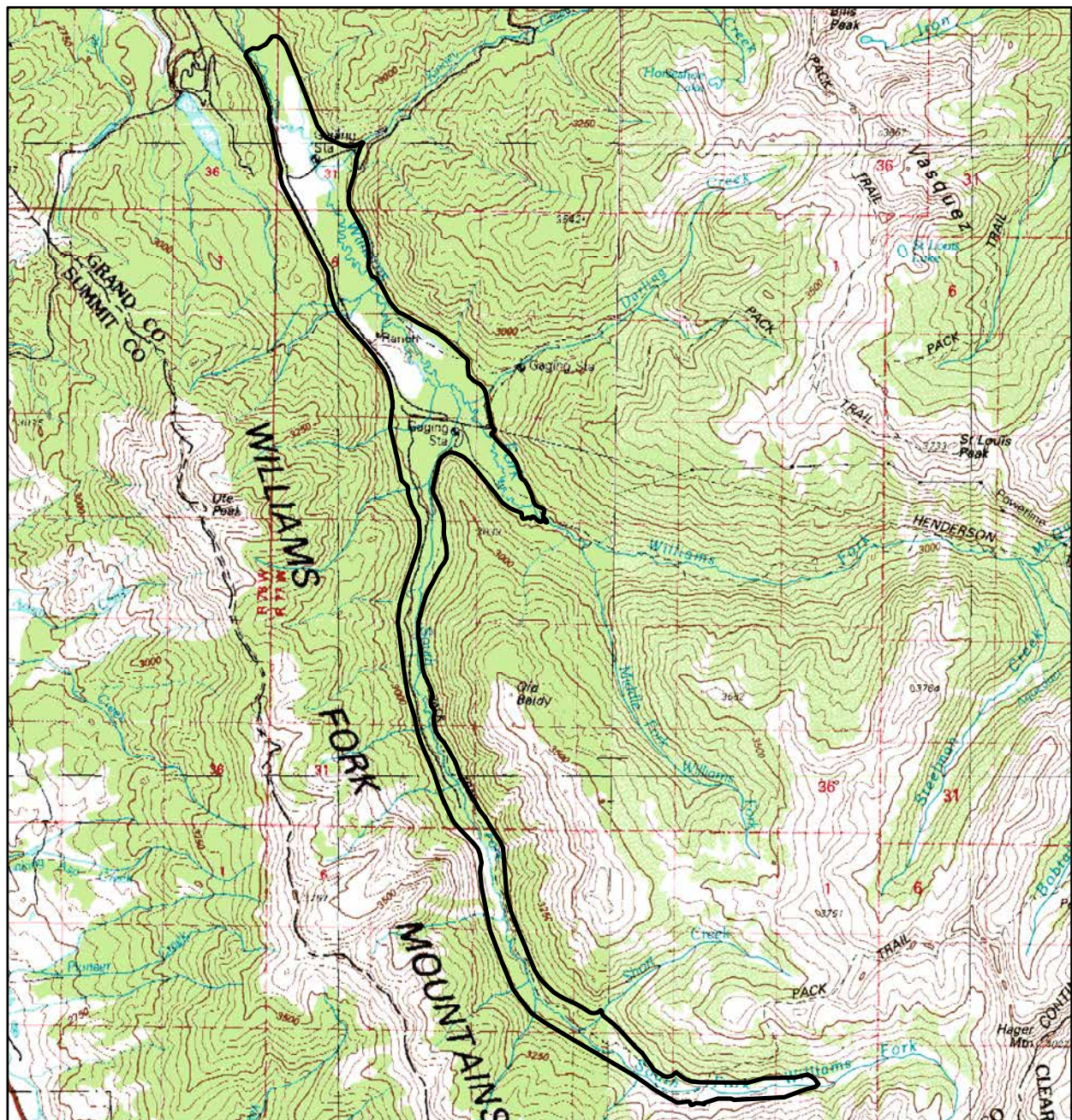
Management Urgency Rank Comments (M4): There are no immediate needs. The main impacts to the area are exotic species which are common to dominant in adjacent meadows.

Land Use Comments: Surrounding uplands along lower reaches of the area have been heavily altered by logging, mining, and water diversion. Lands are also use for recreational activities including hunting, hiking, OHV use, camping, and fishing. Lands are likely an important natural resource for the county and may be subject to logging and other extraction.

Natural Hazard Comments: Spring flooding may be hazardous along parts of drainage. Moose have been sited in the drainage with young.

Exotic Species Comments: Kentucky bluegrass (*Poa pratensis*) is common along edges and in some areas of the lower reaches. Smooth brome (*Bromus inermis*), common dandelion (*Taraxacum officinale*), and white clover (*Trifolium repens*) are common along adjacent meadows at lower reaches, but are not abundant within the wetland. Virginia strawberry (*Fragaria virginiana*) was very abundant in some areas and may be acting as an increaser species from past disturbances. Upper reaches above ranch, campsites, and water diversion are pristine with little or no exotic species present.

Off-Site Considerations: Impacts from surrounding uplands and upstream include mining, water diversion for large aqueduct (Henderson Tunnel), logging, adjacent road, and livestock grazing.



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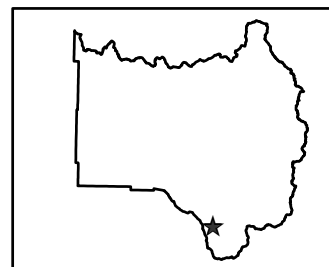
Legend

 PCA Boundary

Vail, 39106-E1
Denver West, 39105-E1

30 x 60 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 34. South Fork of the Williams Fork Potential Conservation Area, B3: High Biodiversity Significance

Stillwater Creek Tributary

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Trail Mountain

Size: 454 acres (184 ha)

Elevation: 8,565 - 8,680 ft. (2,611 - 2,646 m)

General Description: The community inhabits portions of the first order, western tributary of Stillwater Creek. Stillwater is a tributary of Lake Granby, formerly the Upper Colorado River. The community occurs along the creek and its floodplain for more than 1.5 miles of river. Soils are silty to sandy clays with a consistent layer of organic matter. General geology consists of sedimentary rocks of the Tertiary Age, specifically of the Troublesome Formation. The drainage is dominated by a tall shrub layer of Geyer's willow (*Salix geyeriana*) with a mixture of Booth's willow (*Salix boothii*) and mountain willow (*Salix monticola*). The understory is dominated by a consistent layer of mesic graminoids, beaked sedge (*Carex utriculata*) in saturated areas and bluejoint reedgrass (*Calamagrostis canadensis*) under dense shrubs and in drying areas. There are very little weedy species in lower reaches, where the community is consistent and concentrated along the creek and floodplain. Upper reaches harbor more exotic species and show more impacts from livestock use where wetland forms a mosaic with upland big sagebrush (*Artemisia* sp.) community in many areas. Immediate uplands are dominated by xeric big sagebrush shrubland communities. Forested uplands are dominated by lodgepole pine (*Pinus contorta*) with Geyer's sedge (*Carex geyeri*), russet buffaloberry (*Shepherdia canadensis*), and common juniper (*Juniperus communis*) in the understory. Beetle kill is abundant and may impact the community within the next decade. Small rivulets and ponds are present within the system and exhibit the negative effects of use by livestock. Lower reaches have revegetated, but rivulets are incised. Upper reaches show evidence of recent livestock use with trampled and grazed vegetation and absence of vegetation from many banks. Creek banks are eroded and incised and some areas harbor many non-native species. However, the area could be easily reclaimed with more intensive management of livestock. Forest Road 123 parallels community in many areas, but recreational use does not seem to impact the stand or its hydrology. Beaver activity is present only on Stillwater Creek above the occurrence.

Key Environmental Factors: Key environmental factors include spring flooding, beaver activity, valley shape, sediment deposition, and perennial surface flows.

Climate Description: Climate likely follows patterns typical of this region of

Colorado being generally xeric throughout the year, with wet spring seasons and late summer "monsoons".

Biodiversity Significance Rank Comments (B3): This site is drawn for a good (B-ranked) occurrence of the globally vulnerable (G3?/S3) plant community, Geyer's willow (*Salix geyeriana*) / mesic graminoid shrubland.

Natural Heritage element occurrences at the Stillwater Creek Tributary PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Salix geyeriana</i> / Mesic Graminoids Shrubland	Geyer's Willow / Mesic Graminoid	G3?	S3				B	2005-09-03

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The site encompasses approximately 1.25 miles of a western tributary of Stillwater Creek, near its junction with Stillwater Pass. Boundaries include buffered upland areas and are drawn to encompass those ecological processes necessary to maintain site hydrology including perennial surface flows, valley shape, and slope degree. However, boundaries do not include all ecological processes influencing the site and activities upstream and along adjacent slopes such as improper grazing, water diversion, road maintenance, and development may negatively impact site hydrology and biota.

Protection Urgency Rank Comments (P3): Site is protected as public land under the supervision of the USFS. Private uses, including recreational use and livestock grazing, may need to be altered to protect the area.

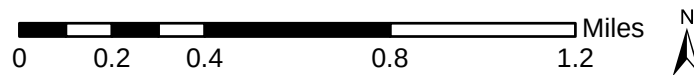
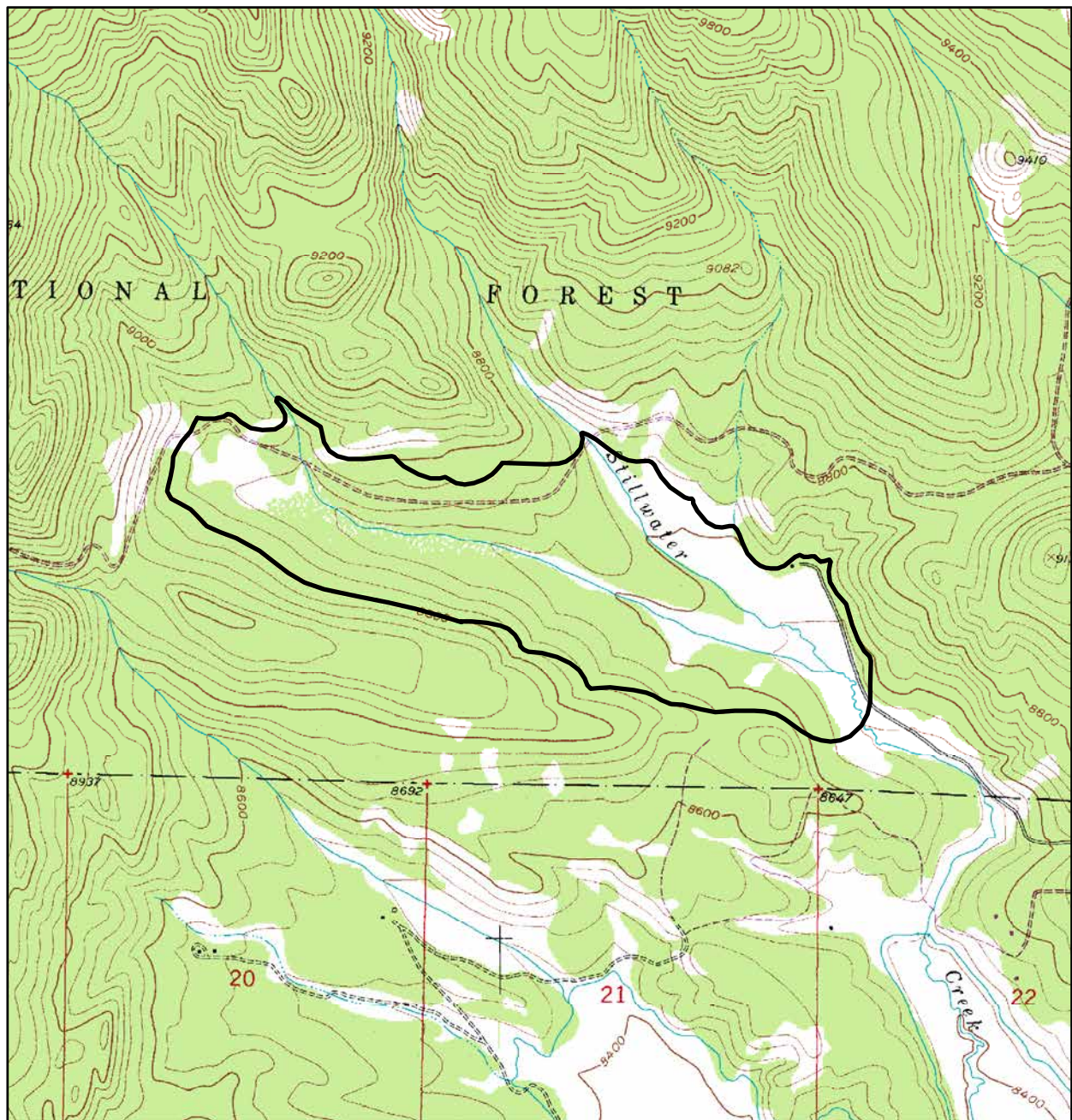
Management Urgency Rank Comments (M3): Management may be needed within five years to maintain site quality due to intense use for grazing and by outdoor recreation users.

Land Use Comments: Predominant uses include hunting, fishing, camping, hiking, biking, and OHV use. The area is also used to graze livestock.

Natural Hazard Comments: Flooding may be hazardous during spring run-off.

Exotic Species Comments: Common dandelion (*Taraxacum officinales*) is present throughout. Kentucky bluegrass (*Poa pratensis*) is common along the edges of the wetland. Virginia strawberry (*Fragaria virginiana*) is common throughout and may indicate heavy grazing.

Off-Site Considerations: Off-site considerations include adjacent forest service road and recreational uses along the drainage, such as camping, and OHV use.



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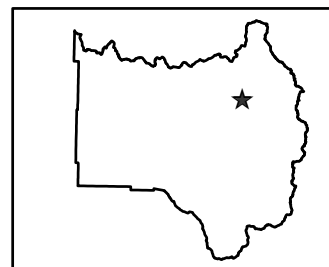
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 PCA Boundary

Trail Mountain, 40105-B8

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 35. Stillwater Creek Tributary Potential Conservation Area, B3: High Biodiversity Significance

Strawberry Creek at Caribou Trail

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Monarch Lake, Strawberry Lake

Size: 251 acres (102 ha)

Elevation: 9,475 - 9,975 ft. (2,888 - 3,040 m)

General Description: Communities inhabit small to large open meadows along Strawberry Creek. Hydrology is dependent on Strawberry Creek, a small, free-flowing stream that forms multiple rivulets and ponds in the meadow as well as groundwater discharges along the drainage. Some areas along the drainage were inhabited by beaver in the past creating diverse hydrologic gradients throughout the larger meadow. Vegetation is variable along the drainage with some meadows being shrub dominated and others being dominated by graminoid species. The most common shrub found in the drainage is diamondleaf willow (*Salix planifolia*). Graminoids which are dominant in many areas include water sedge (*Carex aquatilis*), beaked sedge (*Carex utriculata*), bluejoint reedgrass (*Calamagrostis canadensis*), and fewflower spikerush (*Eleocharis quinqueflora*). Forb species are also present including white marsh marigold (*Caltha leptosepala*), arrowleaf ragwort (*Senecio triangularis*), and redpod stonecrop (*Rhodiola rhodantha*), but are not dominant in any areas. There is little to no anthropogenic disturbance in the area besides the small, little used Caribou Trail along the northern edge of the creek. General geology consists of igneous rocks of the Precambrian Age, specifically, granitic rocks of 1,700 MYA. Mesic soils are variable throughout with some areas of deep histic epipedons over silty clay loam and buried peat layers and small, groundwater fed areas of well-developed peat.

Key Environmental Factors: Key environmental factors influencing the biota of the drainage and its contingent elements include perennial hydrology of surface flows and groundwater discharge, spring flooding, and water retaining clayey soil structure.

Climate Description: Climate patterns likely follow typical weather patterns for this region of Colorado being generally xeric throughout the year with a wet spring season and late summer "monsoons".

Biodiversity Significance Rank Comments (B3): This site is drawn for an excellent (A-ranked) occurrence of a globally vulnerable to globally apparently secure (G3G4/S2) plant community, diamondleaf willow / beaked sedge (*Salix planifolia* / *Carex utriculata*) subalpine riparian willow carr, an excellent (A-ranked) occurrence

of a globally apparently secure (G4/S2S3) plant community, diamondleaf willow / bluejoint reedgrass (*Salix planifolia* / *Calamagrostis canadensis*), and an excellent (A-ranked) occurrence of a globally apparently secure (G4/S3S4) plant community, fewflower spikerush (*Eleocharis quinqueflora*) herbaceous vegetation.

Natural Heritage element occurrences at the Strawberry Creek at Caribou Trail PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Salix planifolia</i> / <i>Carex utriculata</i> Shrubland	Diamondleaf Willow / Beaked Sedge	G3G4	S2				A	2005-09-12
Natural Communities	<i>Eleocharis quinqueflora</i> Herbaceous Vegetation	Alpine Wetlands	G4	S3S4				A	2005-09-12
Natural Communities	<i>Salix planifolia</i> / <i>Calamagrostis canadensis</i> Shrubland	Subalpine Riparian Willow Carr	G4	S2S3				A	2005-09-12

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries encompass approximately one mile of Upper Strawberry Creek and include buffered upland areas and hydrologic processes important to the maintenance of species composition including surface flows, groundwater recharge and discharge, and spring flooding. However, boundaries do not include all ecological processes necessary to the maintenance of site stability and hydrology and activities such as improper grazing, development, or water diversions may impact site hydrology and biota.

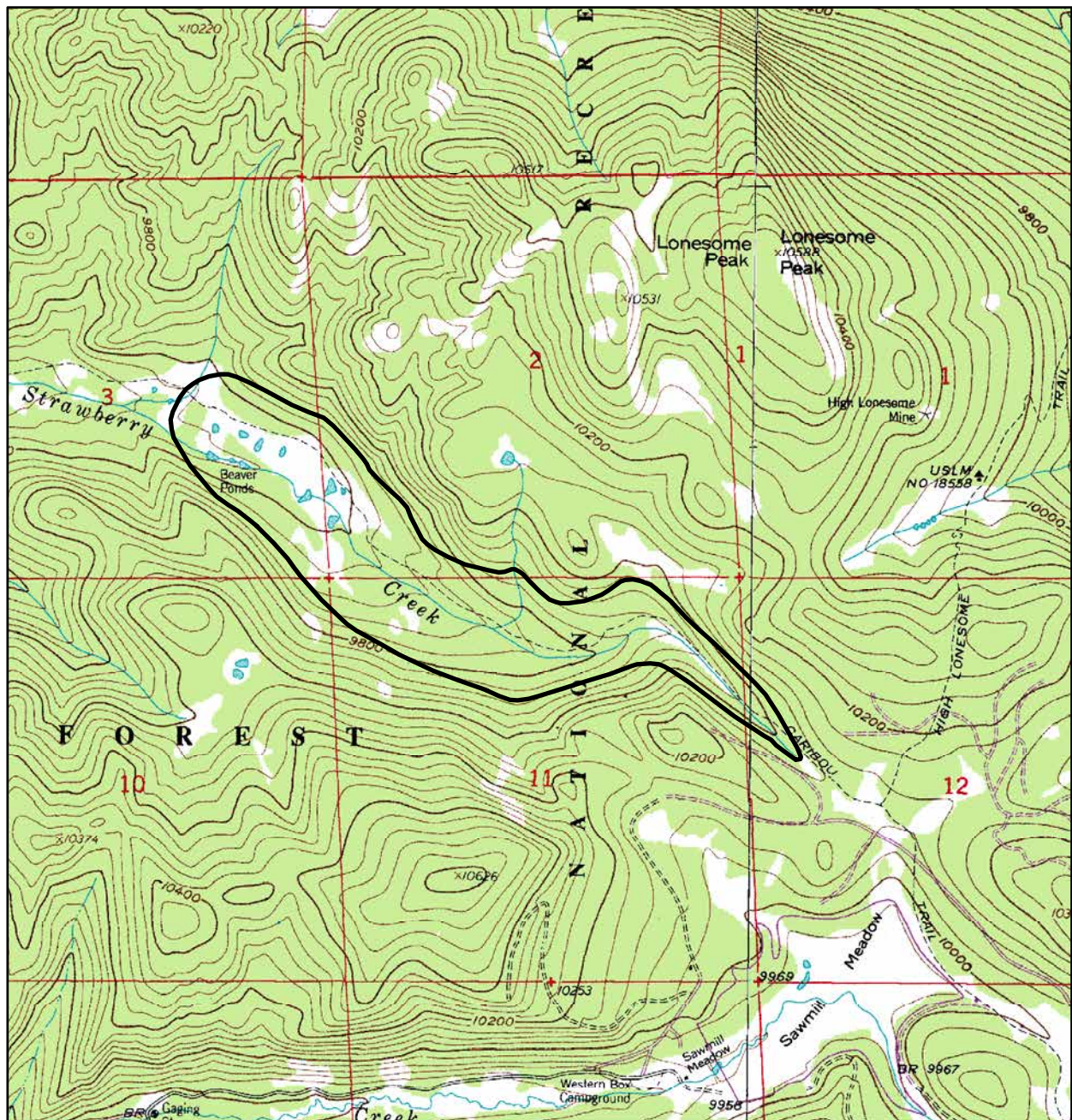
Protection Urgency Rank Comments (P4): There are no current threats or special protection for this area.

Management Urgency Rank Comments (M4): There are no current management needs, but the area may need management in the future.

Natural Hazard Comments: Hummocky peat soils may cause difficult walking.

Exotic Species Comments: Currently, elements along the drainage do not support exotic species; however, adjacent trail adjoins to a well-traveled forest road and may act as a conduit for exotic species.

Off-Site Considerations: Off-site considerations include logging, road maintenance and development, and a man-made reservoir above the site, which may increase groundwater levels and enhance groundwater discharge.



0 0.15 0.3 0.6 0.9 Miles



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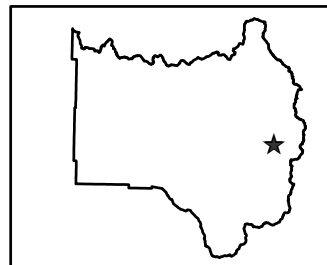
Legend

 PCA Boundary

Monarch Lake, 40105-A6
Strawberry Lake, 40105-A7

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 36. Strawberry Creek at Caribou Trail Potential Conservation Area, B3: High Biodiversity Significance

Upper Pole Creek

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Bottle Pass

Size: 100 acres (41 ha)

Elevation: 8,835 - 9,055 ft. (2,693 - 2,760 m)

General Description: Occurrence inhabits a first order tributary of Pole Creek, along the upper reaches of Pole Creek. The drainage is free-flowing with a constricted floodplain that is seasonally flooded. Stream course is moderately sinuous and has a coarse material component of large rocks and wood. The drainage is dominated in the upper reaches by a tall shrub layer of thinleaf alder (*Alnus incana*) and Drummond's willow (*Salix drummondiana*). A sparse canopy is consistent along the drainage which is composed of Engelmann spruce (*Picea engelmannii*), blue spruce (*Picea pungens*), subalpine fir (*Abies lasiocarpa*), and lodgepole pine (*Pinus contorta*). These species are also present in the regeneration layer and could likely become a more dominant stratum in the future. There is a persistent herbaceous component that is dominated by forb species including common cowparsnip (*Heracelum maximum*), heartleaf bittercress (*Cardamine cordifolia*), and largeleaf avens (*Geum macrophyllum*). Adjacent surrounding uplands are dominated by weedy species such as Kentucky bluegrass (*Poa pratensis*) and smooth brome (*Bromus inermis*). Forested uplands consist of mature lodgepole pine forests with a quaking aspen (*Populus tremuloides*) component. General geology consists of sedimentary rocks of the Cretaceous Age, specifically Pierre Shale. Soils consist of sandy loams over sandy clays. Disturbances present include road which crosses the drainage in two places, a parking area for adjacent trails, and a pack trail along the drainage's upper, eastern side. Uplands immediately surrounding the stand are very weedy due to horse use and roads.

Key Environmental Factors: Key environmental factors influencing the biota of the site include seasonal flooding, perennial surface flows, soils, and slope.

Climate Description: Climate likely follows patterns typical of this area of Colorado being generally xeric throughout the year with wet spring seasons and late summer "monsoons".

Biodiversity Significance Rank Comments (B3): This site is drawn for a good (B-ranked) occurrence of a globally vulnerable (G3/S3) community, thinleaf alder (*Alnus incana*) - Drummond's willow (*Salix drummondiana*).

Natural Heritage element occurrences at the Upper Pole Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Alnus incana</i> - <i>Salix drummondiana</i> Shrubland	Montane Riparian Shrubland	G3	S3				B	2005-09-10

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries include approximately one mile of the middle to upper reaches of Pole Creek and a southern tributary. Boundaries include adjacent buffered uplands and are drawn to encompass those ecological processes important to the maintenance of site hydrology and biota including perennial surface flows, and seasonal flooding. Boundaries do not include all ecological processes driving the site. Activities upstream and adjacent to the site such as development, road work, and water diversions may negatively impact biota and site hydrology.

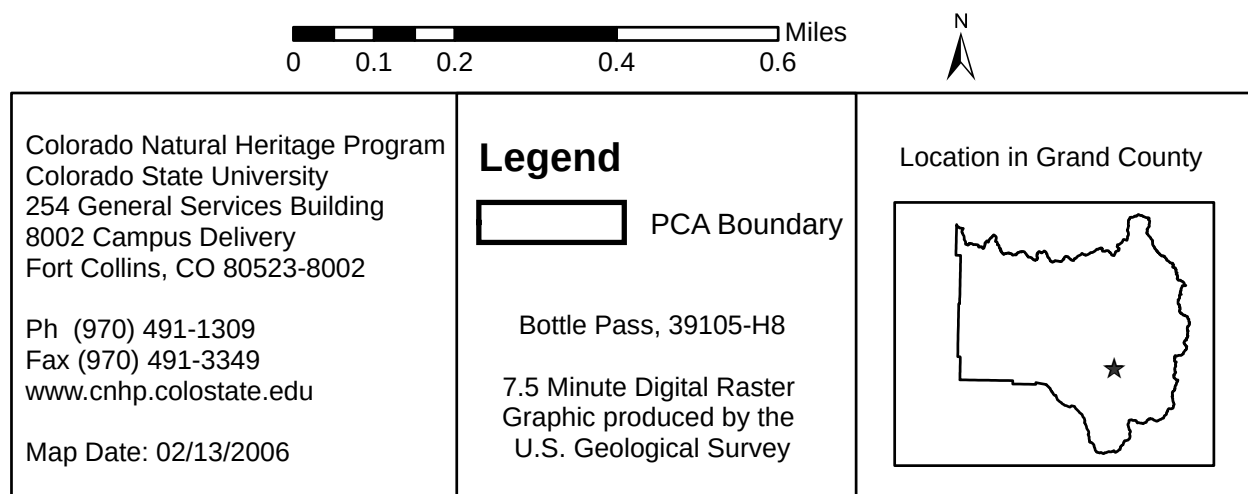
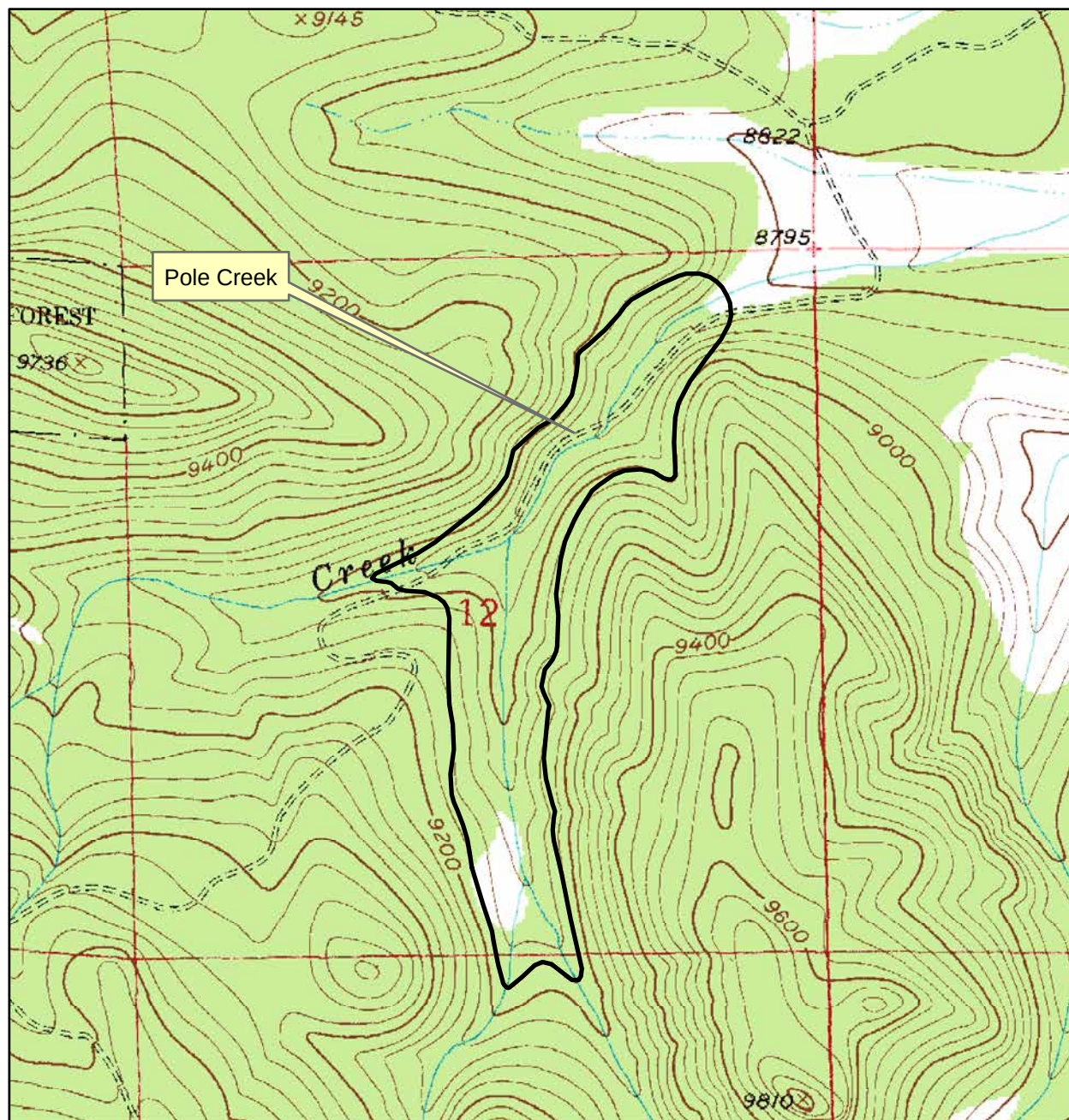
Protection Urgency Rank Comments (P4): There are no current threats aside from condition and exotic species. However, it is privately owned and could be developed by property owner.

Management Urgency Rank Comments (M3): Management is needed within five years or the area will degrade due to exotic species invasion, adjacent use for trails, and development and maintenance of road along lower reaches of the occurrence.

Land Use Comments: Predominant land uses are for recreational activities including hiking, horseback riding, snowshoeing, and cross-country skiing.

Exotic Species Comments: Kentucky bluegrass (*Poa pratensis*) and smooth brome (*Bromus inermis*) are common and in some areas dominate in adjacent meadows.

Off-Site Considerations: Off-site considerations include lodgepole pine beetle epidemic, maintenance of road, water diversions downstream of site, and exotic species invasion and introduction from horse trails.



Map 37. Upper Pole Creek Potential Conservation Area, B3: High Biodiversity Significance

Upper Williams Fork

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M1: Essential within 1 Year to Prevent Loss

U.S.G.S. 7.5-minute quadrangles: Byers Peak, Dillon, Loveland Pass, Ute Peak

Size: 9,289 acres (3,759 ha)

Elevation: 8,900 - 11,600 ft. (2,713 - 3,536 m)

General Description: Upper Williams Fork, South Fork of the Williams Fork, McQueary, Steelman, and Bobtail creeks all included as important high elevation riparian areas creating habitat for both the boreal toad and the Colorado Cutthroat Trout. The site is a Lodgepole pine, Englemann spruce, Sub-alpine fir forest within 20 meters of ponds. Dominate plant community: *Carex utriculata*, *Carex aquatilis*, *Calamagrostis canadensis*.

Biodiversity Significance Rank Comments (B3): The site supports an excellent (A-ranked) occurrence of the globally vulnerable (G4T3/S3) Colorado River Cutthroat Trout and a fair (C-ranked) breeding occurrence of the globally critically imperiled (G4T1/S1) boreal toad.

Natural Heritage element occurrences at the Upper Williams Fork PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Amphibians	Bufo boreas pop. 1	Boreal Toad (Southern Rocky Mountain Population)	G4T1Q	S1		SE	USFS	C?	2005-08-29
Fish	Oncorhynchus clarkii pleuriticus	Colorado River Cutthroat Trout	G4T3	S3		SC	USFS	A	1996-99-99
Fish	Oncorhynchus clarkii pleuriticus	Colorado River Cutthroat Trout	G4T3	S3		SC	USFS	E	9999-99-99

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary includes the upper Williams Fork, South Fork of the Williams Fork, McQuery, Steelman, and Bobtail creeks. A buffer of between 0.5 and 1 km is included on either side of the riparian areas. This should be adequate to protect the toads upland habitat and the streams from degradation by maintaining natural streamside vegetation and runoff.

Protection Urgency Rank Comments (P3): The entire site is within National Forest

(USFS), however one of two breeding sites in this site has had toads tested Bd (*Batrachochytrium dendrobatitis*) positive. Recent developments strongly suggest this is a major causative agent in the toads decline.

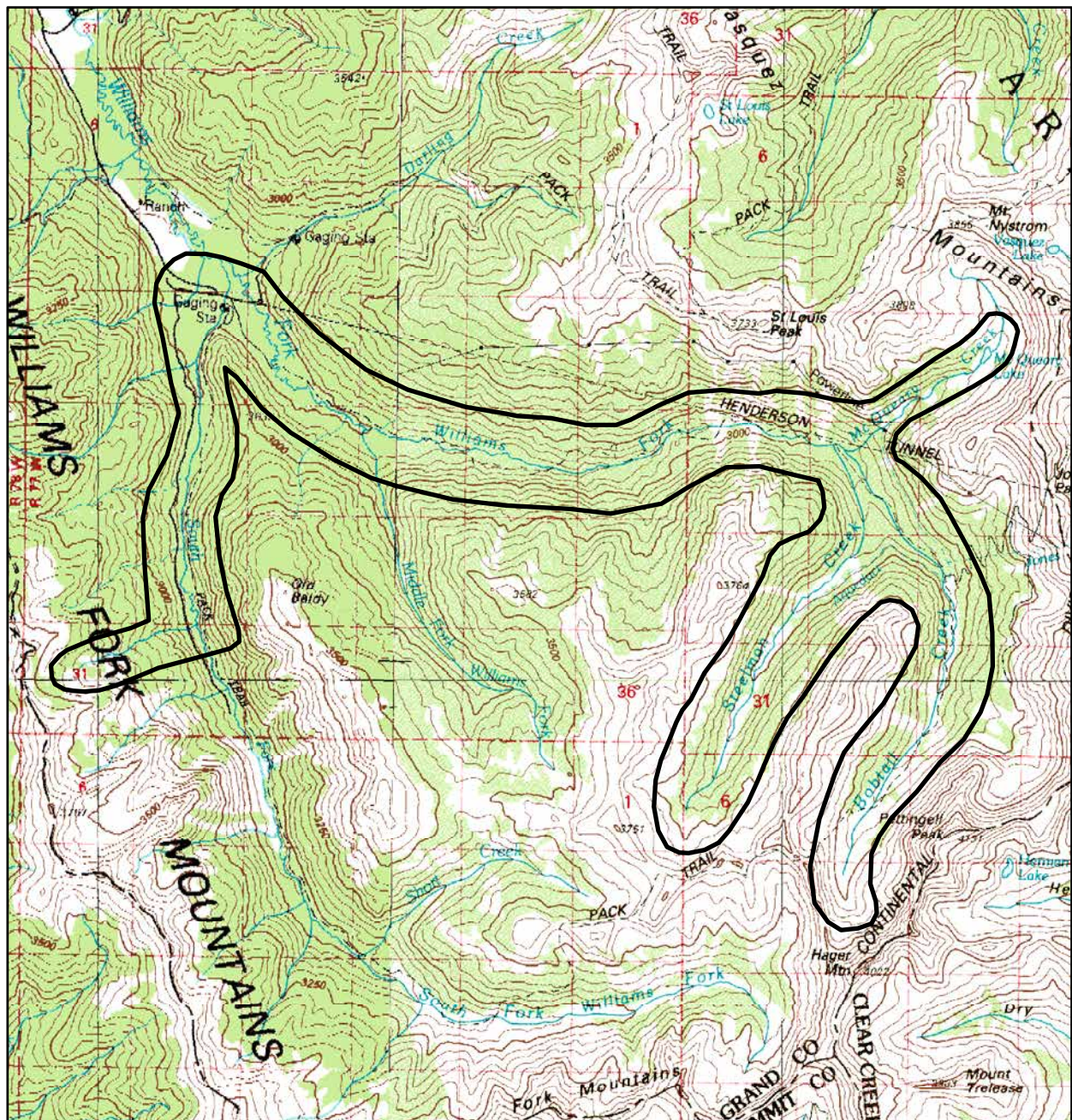
Management Urgency Rank Comments (M1): Bd is a known threat to the toad and may impact the population throughout the drainage. Decontaminating boots and equipment between the breeding sites (McQueary Lake tested positive in 2003, Upper Williams Fork tested negative in 2003) helps reduce the chance of introducing these pathogens into sites (Livo 2001). Also, genetic purity of trout needs to be reevaluated.

Land Use Comments: Recreationists and researchers alike should decontaminate equipment between McQueary Creek and the Upper Williams Fork.

Exotic Species Comments: Exotic species: red top (*Agrostis stolonifera*) and Canada thistle (*Cirsium arvense*).

Off-Site Considerations: Maintaining natural hydrologic regime will require careful evaluation of activities within this watershed for impacts to the element.

Information Needs: Updated population information is needed for the trout.



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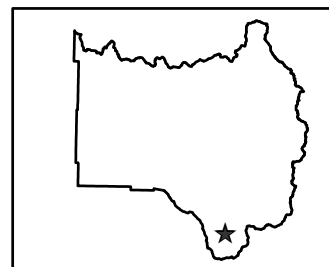
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 PCA Boundary

Denver West, 39105-E1
Vail, 39106-E1

30 x 60 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 38. Upper Williams Fork Potential Conservation Area, B3: High Biodiversity Significance

Vasquez Creek

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Berthoud Pass, Fraser

Size: 1,045 acres (423 ha)

Elevation: 9,300 - 10,800 ft. (2,835 - 3,292 m)

General Description: Site occurs along Vasquez Creek, a second order tributary of the Fraser River. The drainage occurs along the moraine of a large glaciated valley. General geology consists of unconsolidated surficial deposits and rocks of the Quaternary Age, specifically glacial drift of Pinedale and Bull lakes glaciation. Hydrology is dependent on surface water flows, snow melt from upstream snow pack, and man-made diversions of the drainage. Surrounding uplands are composed of mixed mature forests of lodgepole pine (*Pinus contorta*), subalpine fir (*Abies lasiocarpa*), Engelmann spruce (*Picea engelmannii*), and quaking aspen (*Populus tremuloides*). The main drainage has been developed and contains a forest service road that is not well-maintained. As well, the system is being dewatered by a large aquifer. Wetland communities are dependent on perennial hydrology from snow melt and groundwater, while upland species appear to be dependent on continuous disturbances to maintain site biota.

Key Environmental Factors: Key environmental factors influencing the biota of the site include spring flooding, beaver activity, and perennial surface water flows. Key anthropogenic factors include water diversion and maintenance of the aqueduct.

Climate Description: Area likely follows typical climate patterns of the Colorado Rockies being generally xeric throughout the year, with wet spring seasons and late summer "monsoons".

Biodiversity Significance Rank Comments (B3): The site encompasses a good (B-ranked) occurrence of a globally vulnerable (G3/S3) plant community, *Salix drummondiana* / *Calamagrostis canadensis* shrubland, a fair (C-ranked) occurrence of a globally vulnerable (G3/S3) plant, reflected moonwort (*Botrychium echo*), a good (B-ranked) occurrence of a globally vulnerable to globally apparently secure (G3G4/S2) plant, western moonwort (*Botrychium hesperium*), and an excellent (A-ranked) occurrence of a globally demonstrably secure (G5/S4) plant community, *Salix planifolia* / *Carex aquatilis* shrubland.

Natural Heritage element occurrences at the Vasquez Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Salix drummondiana / Calamagrostis canadensis Shrubland	Lower Montane Willow Carrs	G3	S3				B	2005-08-01
Natural Communities	Salix planifolia / Carex aquatilis Shrubland	Subalpine Riparian Willow Carr	G5	S4				A	1993-08-13
Vascular Plants	Botrychium echo	reflected moonwort	G3	S3				C	2005-08-10
Vascular Plants	Botrychium hesperium	western moonwort	G3G4	S2				B	2005-08-10

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary is drawn to encompass the upper reaches of Vasquez Creek and approximately 2 miles of the adjacent aqueduct. Boundaries encompass all ecological processes important to element composition including surface water flows, spring run-off, sediment deposition, man-made water diversions, and disturbance. However, boundaries do not include all of the ecological processes. Activities such as logging, water diversion, development, and road maintenance may negatively or positively impact site biota and hydrology.

Protection Urgency Rank Comments (P3): Area appears to be currently stable. If management practices continue at current rate and prescription, site will likely remain stable.

Management Urgency Rank Comments (M3): Botrychium populations along the aqueduct appear to be dependent on disturbances. Continuation of current management regime is likely the best way to insure the continuance of the species composition. Management alterations to dewatering of Vasquez Creek by the aqueduct could significantly change hydrology along lower reaches of the creek. Increased use of the adjacent road for recreation and management could also increase non-native species invasion, erosion, and sediment additions to lower reaches of the creek.

Land Use Comments: Predominant land uses are recreation including hiking, biking, hunting, and camping. Other uses include aqueduct maintenance and natural resource extraction (logging).

Natural Hazard Comments: Spring run-off may cause flooding along the main drainage of Vasquez Creek. There may be avalanche hazards along the upper reaches of the drainage during the fall, winter, and spring seasons.

Exotic Species Comments: Exotic species are present along roads, but are not common within elements.

Off-Site Considerations: Off-site considerations include logging, avalanche, road maintenance, and aqueduct maintenance.



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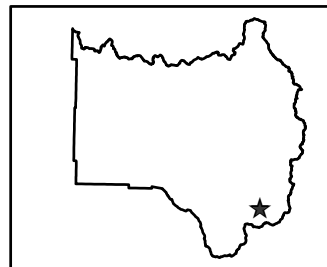
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 PCA Boundary

Denver West, 39105-E1

30 x 60 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 39. Vasquez Creek Potential Conservation Area, B3: High Biodiversity Significance

West Slope of Junction Butte

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M5: Not Needed; No Threats Anticipated

U.S.G.S. 7.5-minute quadrangles: Junction Butte

Size: 289 acres (117 ha)

Elevation: 7,950 - 8,150 ft. (2,423 - 2,484 m)

General Description: Community occurs as an open, dispersed shrubland along a steep, west-facing slope. Slope has a few small draws, but is predominantly straight, with little ground cover and rocky soils. General geology consists of metamorphic rocks of the Precambrian Age, specifically biotic gneiss, schist, and migmatite. Utah serviceberry (*Amelanchier utahensis*) and alderleaf mountain mahogany (*Cercocarpus montanus*) are the dominant shrubs, with *Cercocarpus* being more common on upper slopes and *Amelanchier* on lower slopes. Other shrubs present include roundleaf snowberry (*Symphoricarpos rotundifolius*), wax currant (*Ribes cereum*), chokecherry (*Prunus virginiana*), and skunkbush sumac (*Rhus trilobata*). Graminoids dominate the herbaceous layer, but are not dense in any areas. Bluebunch wheatgrass (*Pseudoroegneria spicata*) is the dominant herbaceous species throughout, with Indian ricegrass (*Achnatherum hymenoides*) also common. Forbs present include tufted evening-primrose (*Oenothera caespitosa*), sulphur-flower buckwheat (*Eriogonum umbellatum*), white sagebrush (*Artemisia ludoviciana*), *Cryptantha* sp., and silverleaf phacelia (*Phacelia hastata*). Main disturbances are sloughing due to slope severity, wind, and freeze/thaw conditions.

Key Environmental Factors: Key environmental factors contributing to the biota of the site are slope, aspect, soil type, and elevation.

Climate Description: Climate likely follows patterns typical of this region of Colorado, being generally xeric throughout the year, with wet spring seasons and late summer "monsoons".

Biodiversity Significance Rank Comments (B3): This site is drawn for a good (B-ranked) occurrence of the globally imperiled to globally vulnerable (G2G3/S2S3) plant community, Utah serviceberry / bluebunch wheatgrass (*Amelanchier utahensis* / *Pseudoroegneria spicata*) shrubland. This community type is probably more common than the global rank implies (most likely a G3 instead of a G2G3).

Natural Heritage element occurrences at the West Slope of Junction Butte PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Amelanchier utahensis / Pseudoroegneria spicata Shrubland	Mixed Mountain Shrublands	G2G3	S2S3				B	2005-09-07

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries include approximately 290 acres along the western slope of Junction Butte. Boundaries are drawn to encompass those environmental factors necessary to the maintenance of site biota including rocky soils, steep slope, western aspect, and generally xeric conditions. However, boundaries do not include all ecological processes influencing the site and activities along adjacent slopes such as improper grazing or recreational use and development may impact site biota.

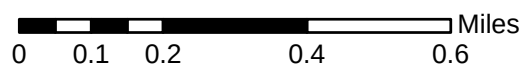
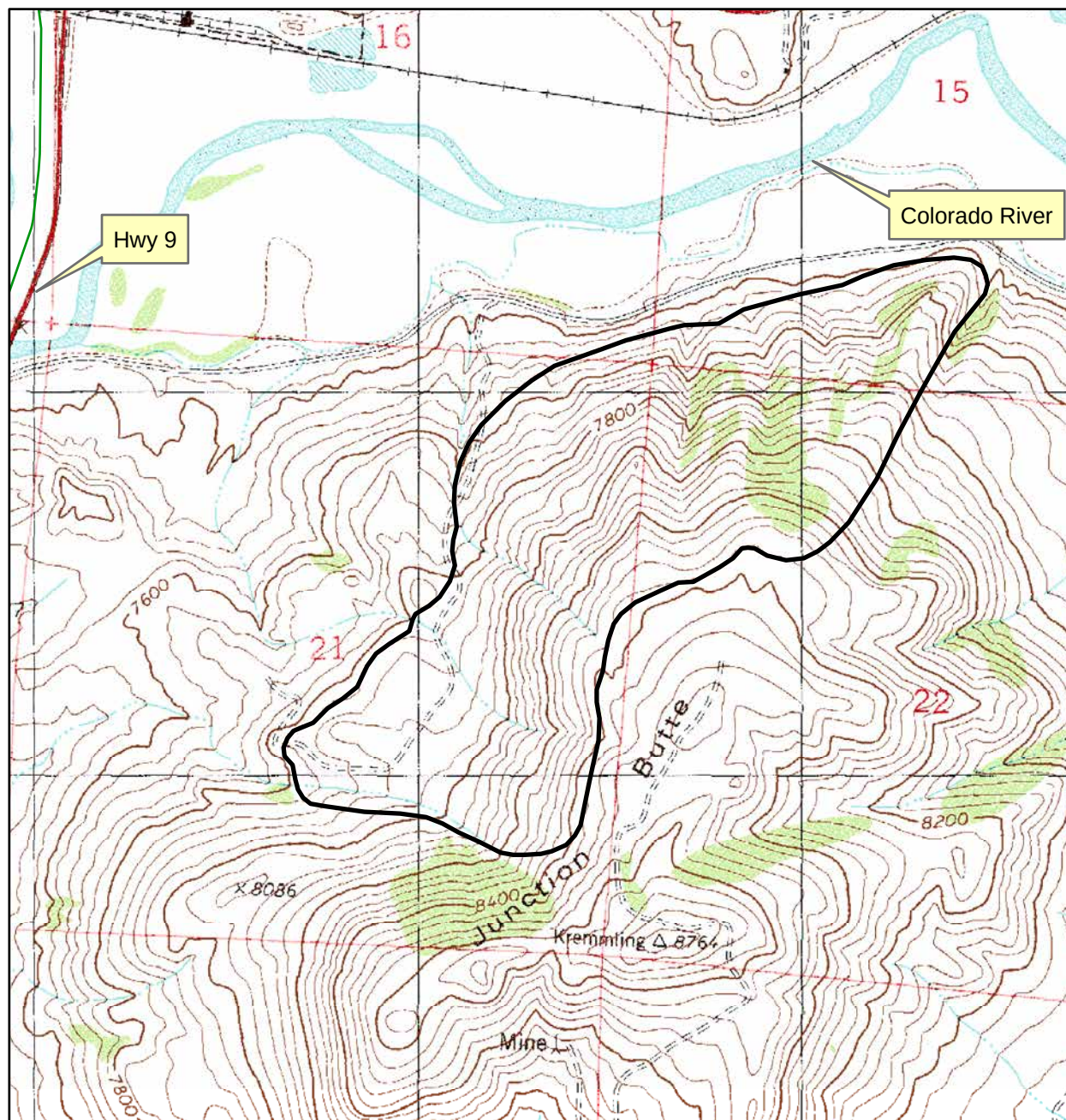
Protection Urgency Rank Comments (P4): Currently there are no threats other than natural disturbances including soil sloughing and exposure.

Management Urgency Rank Comments (M5): The area requires no management at this time.

Land Use Comments: Predominant land uses include livestock grazing and recreational uses such as hunting and OHV use.

Natural Hazard Comments: Steep slopes may be hazardous for travel.

Exotic Species Comments: There are some exotic species along roads, but none were observed within the occurrence.



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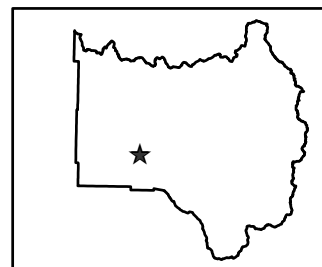
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 PCA Boundary

Junction Butte, 40106-A3

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 40. West Slope of Junction Butte Potential Conservation Area, B3: High Biodiversity Significance

Willow Creek Pass

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Bowen Mountain, Cabin Creek, Corral Peaks, Parkview Mountain, Radial Mountain, Trail Mountain

Size: 9,309 acres (3,767 ha)

Elevation: 8,200 - 12,300 ft. (2,499 - 3,749 m)

General Description: Willow Creek begins its 25 mile journey to the Colorado River at the Continental Divide between the Rabbit Ears Range and Never Summer Mountains. It is the first drainage west of the headwaters of the Colorado River and west of Lake Granby. The drainage runs primarily north to south in the Troublesome Range through rolling spruce-fir and lodgepole forested mountains. The high peaks in this drainage reach over 12,000 feet; the confluence with the Colorado River is at 7,900 feet. The boundaries include the headwaters and all of the tributaries down to Trail Creek (8,200 feet). The hydrology of Willow Creek is nearly entirely natural, a unique feature in the Colorado Basin. Floods are uncontrolled and no diversions exist. The natural hydrologic regime, along with nearly 20 miles of excellent riparian habitat, makes this site unique within the Colorado Basin. Nearly the entire length of Willow Creek is a meandering wide-valley stream with a mosaic of willow carrs and sedge meadows dominating the wider stretches. The sedge meadows are dominated by either water sedge (*Carex aquatilis*) or beaked sedge (*C. utriculata*), while the willow carrs are dominated by mountain willow (*Salix monticola*), Geyer's willow (*S. geyeriana*), or wolf willow (*S. wolfii*). Many of its tributaries, such as Pass, Trout, Buffalo, and Bronco creeks are also willow dominated on the lower reaches. The narrow stretches of Willow Creek and its tributaries support lodgepole pine (*Pinus contorta*), blue spruce (*Picea pungens*), and alder (*Alnus incana*) with few willows. Below 8,400 feet near Cabin Creek, approximately 10 miles above the Colorado River confluence, cottonwood trees (*Populus angustifolia*) replace the willows. The floodplain is a mixture of cottonwood and Engelmann spruce (*Picea engelmannii*) along with willows. On the south-facing slopes north of Trail Creek are large open stands of western slope sagebrush shrublands (*Artemisia cana* ssp. *viscidula* / *Festuca thurberi*). Most patches are thick with bunchgrasses and are in excellent ecological condition. The open park near the head of Trail Creek appears to have been grazed more recently than other sagebrush parks along this creek, as indicated by cow pies, a lower density of bunchgrasses, and an increase in shrubby cinquefoil (*Pentaptylloides floribunda*) relative to other local sagebrush area. The Willow Creek drainage does contain a number of roads. Hwy 125 runs parallel to Willow and Pass creeks, gravel

or unpaved roads parallel Cabin and Buffalo creeks, and 4-wheel drive roads parallel a few of the other smaller tributaries. Two Forest Service campgrounds are along Hwy 125. Logging has or is taking place within the drainage, although this seems to be at a minimum. Much of the area has been free of grazing since the early 1990's; however, incidental trespass occurs (Doreen Sumerlin, personal communication, 2003). These impacts appear to have only minor observed effects on the riparian ecosystems within the Willow Creek watershed.

Key Environmental Factors: Key environmental factors contributing to the maintenance of site biota include seasonal flooding, valley shape, slope, aspect, and perennial surface flows.

Climate Description: Climate likely follows patterns typical of this region of Colorado, being generally xeric throughout the season, with wet spring seasons and a late summer "monsoon" season.

Land Use History: Old gold mining operations are evident along Bronco Creek.

Biodiversity Significance Rank Comments (B3): This site contains a good (B-ranked) occurrence of a globally imperiled (G2G3/S2S3) plant community, *Artemisia cana* ssp. *viscidula* / *Festuca thurberi*, and good (B-ranked) occurrences of three globally vulnerable (G3) riparian plant communities: *Picea pungens* / *Alnus incana*, *Salix wolfii* / *Calamagrostis canadensis*, and *Salix monticola* / *Calamagrostis canadensis*. The hydrology of upper Willow Creek is nearly entirely natural, a unique feature in the Colorado River Basin. Following 10 years of statewide wetland and riparian surveys, CNHP is currently unaware of other comparatively sized areas in the state, which exhibit such high quality riparian areas. Portions of other rivers or creeks of similar quality do exist in Colorado, but there are few entire watersheds at a similar elevation, which exhibit the same quality and functional integrity as the Willow Creek watershed. Thus, the Willow Creek Pass site provides an invaluable resource as a reference watershed from which the quality and integrity of riparian areas, water quality, and wildlife populations from other portions of the Southern Rocky Mountain Ecoregion could be compared. Such areas are uncommon as few have been without human-induced disturbance for any extended amount of time. For example, nearly 70% of U.S. Forest Service lands in the Southern Rocky Mountain Ecoregion are under active grazing allotments (Southern Rockies Ecosystem Project 2000). These resource reference areas are invaluable as they provide land managers with baseline conditions for which management can strive, they provide numerous opportunities for researchers, and they likely harbor greater biological diversity than other areas, which have commonly been more impacted.

Natural Heritage element occurrences at the Willow Creek Pass PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Artemisia cana ssp. viscidula / Festuca thurberi Shrubland	Western Slope Sagebrush Shrublands	G2G3	S2S3				B	2003-10-02
Natural Communities	Picea pungens / Alnus incana Woodland	Montane Riparian Forests	G3	S3				AB	1993-08-23
Natural Communities	Salix monticola / Calamagrostis canadensis Shrubland	Montane Willow Carr	G3	S3				B	1993-08-24
Natural Communities	Salix wolfii / Calamagrostis canadensis Shrubland	Subalpine Riparian Willow Carr	G3	S2S3				B	1993-08-23
Natural Communities	Artemisia tridentata ssp. wyomingensis / Pseudoroegneria spicata Shrub Herbaceous Vegetation	Xeric Sagebrush Shrublands	G4	S3?					1981-99-99
Vascular Plants	Cylactis arctica ssp. acaulis	nagoon berry	G5T5	S1			USFS	E	1993-08-23
Vascular Plants	Cylactis arctica ssp. acaulis	nagoon berry	G5T5	S1			USFS		1998-07-14

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundaries encompass over two thirds of the Willow Creek watershed. All major tributaries are included. In order to protect the riparian elements, the entire watershed must be protected. A natural hydrologic regime is necessary to support and maintain riparian communities and all seral stages.

Protection Urgency Rank Comments (P3): About 90% of the land is managed by the Arapaho National Forest. A few private parcels exist in the lower part of the site below Cabin Creek and along a one mile section of Willow Creek near Bronco and Pass creeks and another less than one mile reach in the upper reach. Small BLM parcels occur along the lower stretches. Neither the public or private land has any special conservation designation.

Management Urgency Rank Comments (M4): Roads occur adjacent to the mainstem and many of its major tributaries. Aside from Hwy 125, these roads are primarily recreation roads. There are impacts to the creek and along some of the

tributaries associated with camping, roads, and recreation. A few pack trails are scattered throughout. Two Forest Service campgrounds are maintained along the main stem. Fishing is a popular sport throughout the area. In order to maintain the riparian habitat and its extensive willow carr-sedge meadow ecosystem, a natural hydrological regime must be maintained. Invasions from alien species should be monitored and controlled. Logging or other activities which cause erosion may adversely affect stream quality and the riparian vegetation, thus these practices should be monitored closely. Upland slopes should be managed so as to minimize sedimentation and exotic species invasion.

Land Use Comments: Doreen Sumerlin, wildlife biologist with the Sulphur Ranger District, Arapaho National Forest, noted the following in 1995: "Cabin Creek has been significantly impacted by roads and dispersed camping along the creek. There is a lot of beaver activity. Sawmill Gulch is relatively pristine, but there is a major campground at the confluence. Gold Run has no public access; grazing has been discontinued. Hall Creek is not impacted by human activity. The main fork of Buffalo Creek is heavily impacted by unpaved road. There are a lot of beaver. All forks have moderate livestock grazing, but the riparian areas are fairly healthy. Denver Creek and Kaufman Creek are heavily logged with many roads. Trail Creek is moderately grazed but is in good shape. There are a lot of beaver here. Bronco Creek is degraded. There is a road bed running right up the creek and mining with high pressure water hoses. Upper Bronco Creek is logged as well. Pass Creek and Elk Creek are in good shape. Trout Creek and Trail Creek have motorized trails for dirt bikes and there are some problems in the wetlands. The Forest Service is aware of these areas and is improving them. The headwaters of Willow Creek were logged extensively in the 50's and 60's. There are a lot of old roads (closed now) and natural landslides. There are lots of natural sediment sources up high." Arapaho National Forest owns a large portion of the site, although a few private parcels exist below Cabin Creek and along a one mile section of Willow Creek near Bronco and Pass creeks. The mainstem and many of its major tributaries have roads along the drainage. Aside from Hwy 125, these roads are primarily recreation roads. A few pack trails are scattered throughout. Two Forest Service campgrounds are maintained along the main stem. Fishing is a popular sport throughout the area. Placer mining has taken place along Bronco Creek during the early part of the century, but no mining operation is taking place currently.

Exotic Species Comments: Invasions from non-native species should be monitored and controlled.

Off-Site Considerations: Off-site considerations include logging of adjacent forests, road maintenance and development, and impacts from recreational uses such as OHV use and camping along drainages.

Information Needs: The site should be visited during the summer months to assess all of the riparian communities along the tributaries of Willow Creek.



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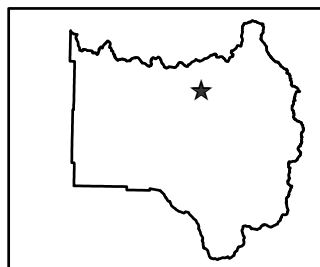
Legend

 PCA Boundary

Greeley, 40104-A1
Craig, 40106-A1

1 x 2 Degree Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 41. Willow Creek Pass Potential Conservation Area, B3: High Biodiversity Significance

Blue River

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Junction Butte, King Creek, Kremmling, Sheephorn Mountain

Size: 558 acres (226 ha)

Elevation: 7,380 - 7,420 ft. (2,249 - 2,262 m)

General Description: Site occurs along lower portions of the Blue River, a third order, C channel type tributary of the Colorado River. Narrowleaf cottonwood (*Populus angustifolia*) dominates the canopy layer with some blue spruce (*Picea pungens*) mixing. Narrowleaf cottonwood occupies a wide area along the floodplain and backwater sloughs, ponds, and mesic areas. The tall shrub layer is dominated by water birch (*Betula occidentalis*) with codominant species greenleaf willow (*Salix laucida* ssp. *caudata*), strapleaf willow (*Salix ligulifolia*), and thinleaf alder (*Alnus incana*). There is a consistent layer of short shrubs that does not have a dominant component. The herbaceous layer is mainly dominated by graminoids which are commonly invasive species such as smooth brome (*Bromus inermis*) and forbs including Canada thistle (*Cirsium arvense*). Surrounding uplands are dominated by various mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) shrublands except in areas that have been converted for hay production. Hydrology has been heavily altered due to the Dillon Reservoir upstream and subsequent ditches for agricultural use between Silverthorne and the site. As well, multiple backwater sloughs and ponds have been created on the property for wildlife habitat. Hydrologic alterations may have a profound impact on the current species composition which seems to rely on a perennial water source to thrive (Carsey et al. 2003). There is no beaver activity along the Blue River in this area, but there is beaver activity along tributaries and upstream of the stand. General geology consists of unconsolidated surficial deposits and rocks of the Quaternary age, specifically modern alluvium. Soils are sandy loams to loamy sands with a thick top layer of organic material. The river bottom consists of alluvial deposits of rocky beds with large boulders and large cobble providing excellent habitat for aquatic animals.

Key Environmental Factors: Key environmental factors include soil type, water retention increased by the shape of the valley, and control of hydrology by the Dillon Dam and Green River Reservoir which creates consistent, year-round moderate flows.

Climate Description: Climate likely follows typical patterns of Colorado weather being dry year round with a wet spring season and late summer "monsoon" season. Temperatures may be moderated by water temperatures.

Land Use History: Historically the area was split into multiple homesteads which were farmed by early settlers.

Cultural Features: Uplands surrounding the river still have many old homesteads from early settlers.

Biodiversity Significance Rank Comments (B4): This site is drawn for a fair (C-ranked) occurrence of a globally vulnerable (G3/S2) plant community, narrowleaf cottonwood / water birch (*Populus angustifolia* / *Betula occidentalis*) montane riparian forest.

Natural Heritage element occurrences at the Blue River PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Populus angustifolia</i> / <i>Betula occidentalis</i> Woodland	Montane Riparian Forest	G3	S2				C	2005-09-14

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary encompasses a large section of the lower Blue River that is dominated by narrowleaf cottonwood / mixed tall shrub woodlands. Boundaries include an upland buffer and backwater sloughs and rivulets that contribute to the maintenance of site hydrology. Not all hydrologic processes important to the site are contained within the boundary and activities upstream and along tributaries of the site including water diversions, agriculture, development, and grazing may be detrimental to the quality of the elements.

Protection Urgency Rank Comments (P4): Area is currently protected due to property owner's desire to restore and protect the site and surrounding uplands as a natural area.

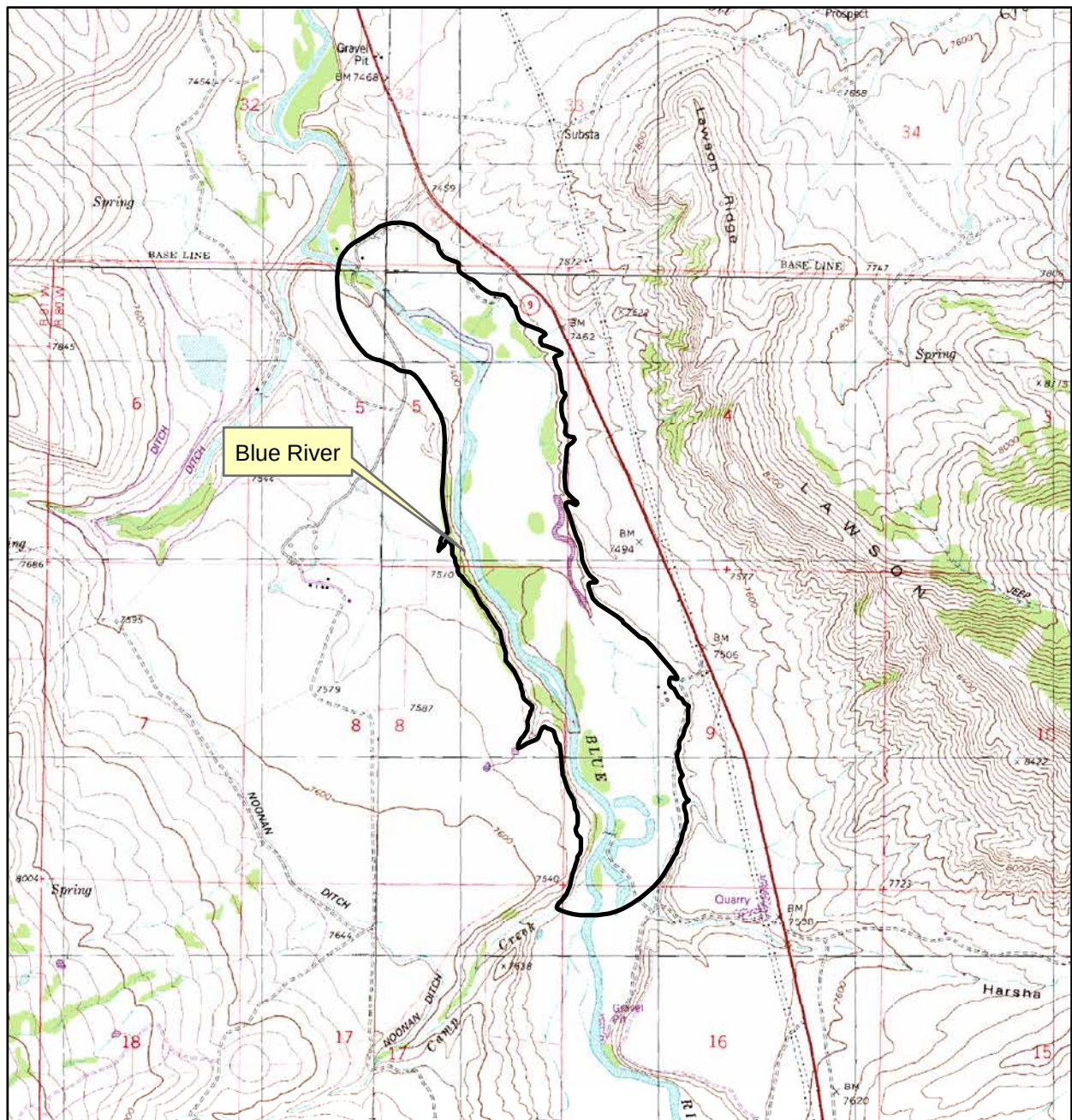
Management Urgency Rank Comments (M3): Overall integrity and wetland functional values for the area are very high. However, there are multiple possibilities for degradation to the system including upstream hydrology alterations and non-native species invasion. Exotic species have very high cover and are dominant in many areas. Management may be necessary to ensure the problem does not worsen.

Land Use Comments: The land is currently used by property owner as a private trout stream which sees very few visitors yearly. There are some 200 head of cattle that are grazed on the 25,000 acres ranch that do not impose much impact to the riparian areas due to intense management.

Natural Hazard Comments: Natural hazards may include high water during high release flows.

Exotic Species Comments: Many areas along the riparian corridor are dominated by non-native species, likely due to past uses of agriculture and livestock cultivation in the area. These species include, but are not limited to, Canada thistle (*Cirsium arvense*), smooth brome (*Bromus inermis*), orchardgrass (*Dactylis glomerata*), Kentucky bluegrass (*Poa pratensis*), and common dandelion (*Taraxacum officinale*).

Off-Site Considerations: Off-site considerations include adjacent hay cultivation, control of flows based on winter snow packs and Front Range water needs, and Hwy 9, which runs adjacent to the river and may add additional sediment and toxins to the system.



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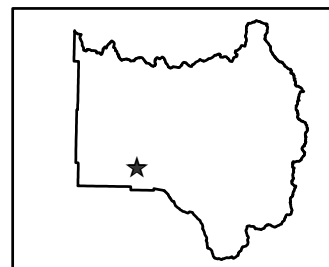
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 PCA Boundary

King Creek, 39106-H3
Sheephorn Mountain, 39106-H4
Junction Butte, 40106-A3
Kremmling, 40106-A4

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 42. Blue River Potential Conservation Area, B4: Moderate Biodiversity Significance

Cow Gulch

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Junction Butte, Kremmling

Size: 11 acres (4 ha)

Elevation: 7,660 - 7,670 ft. (2,335 - 2,338 m)

General Description: Community inhabits a very small draw, a tributary of Cow Gulch. Hydrology is groundwater fed from a very small seep about 150 meters north of the occurrence. There is a small rivulet of running water feeding the occurrence. Draw is dominated by the graminoid woolly sedge (*Carex pellita*). Other species include beaked sedge (*Carex utriculata*), Baltic rush (*Juncus balticus*), and American speedwell (*Veronica americana*), obligate and facultative wetland species, which occur along the small rivulet through the middle of the occurrence indicating a perennial water source. Some upland species occurring along edges include big sagebrush (*Artemisia tridentata*), Rocky Mountain juniper (*Juniperus scopulorum*), and whitestem gooseberry (*Ribes inerme*). Immediate uplands are dominated by xeric big sagebrush (*Artemisia tridentata*) shrublands with very clayey soils. Transition from mesic draw bottom to xeric uplands is very distinct and sharp, with some mixing of upland species along edges, but no mixing of mesic species into uplands. Surrounding landscape exhibits some use by livestock, but there is no evidence of use in the draw, possibly due to steep slopes. Deer sign is evident throughout the area. Occurrence is very small and likely to be negatively impacted from any hydrologic changes or disturbances. Soils are sandy clays and general geology is sandstones and siltstones of the Troublesome Formation.

Key Environmental Factors: Key environmental factors include groundwater recharge and discharge, ephemeral flows, clay soils, solar exposure, and dry climate.

Climate Description: Climate likely follows general Colorado weather patterns being xeric throughout the year, with wet spring seasons, and late summer "monsoons".

Biodiversity Significance Rank Comments (B4): This site is drawn for a fair (C-ranked) occurrence of a globally vulnerable (G3/S3) woolly sedge (*Carex pellita*) herbaceous vegetation plant community.

Natural Heritage element occurrences at the Cow Gulch PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Carex pellita Herbaceous Vegetation	Montane Wet Meadows	G3	S3				C	2005-06-14

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries are drawn to encompass small draw and uplands that buffer the draw. Boundaries do not include all ecological processes important to site hydrology and biota. Activities such as improper grazing, road maintenance, or development may negatively impact the site.

Protection Urgency Rank Comments (P3): There is no definable threat at present, but there is the possibility of threats including improper grazing practices and non-native species invasion.

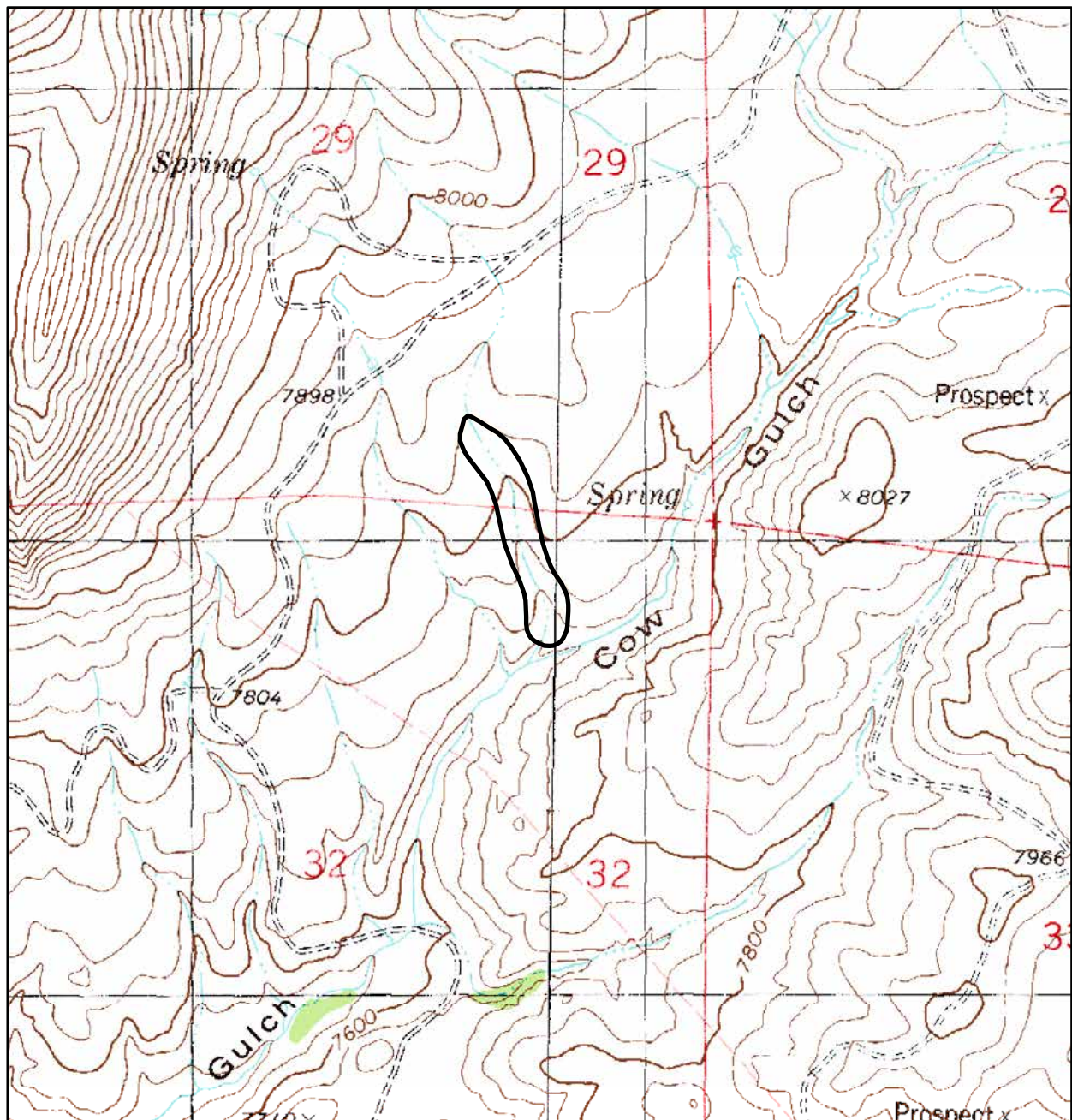
Management Urgency Rank Comments (M4): There are no current threats. Management may be needed if grazing, road development, land use, or hydrologic alterations are made in the area.

Land Use Comments: Area has been under a grazing management plan to improve riparian health since the 1980s. In 2005, a Travel Management Plan was implemented for the Wolford Area that focuses on limiting roads in Cow Gulch. Currently, predominant land use of this area is for livestock grazing, hunting, and recreation.

Natural Hazard Comments: Travel becomes very difficult along roads in wet weather due to clay soils.

Exotic Species Comments: Kentucky bluegrass (*Poa pratensis*) occurs along drying edges in the draw, but does not dominate.

Off-Site Considerations: County Road 224 crosses the upper reaches of the area above the spring origin. There are developed springs in the area for livestock, but this one and adjacent springs are not developed.



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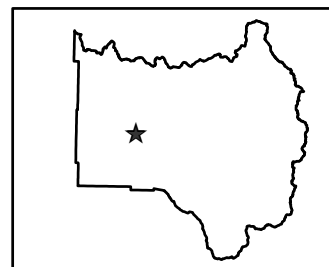
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 PCA Boundary

Junction Butte, 40106-A3
Kremmling, 40106-A4

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 43. Cow Gulch Potential Conservation Area, B4: Moderate Biodiversity Significance

East Fork of Fishhook Creek

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Mount Werner

Size: 24 acres (10 ha)

Elevation: 9,995 - 9,995 ft. (3,046 - 3,046 m)

General Description: Community inhabits a small slope wetland along the western slope of the upper reaches of Muddy Creek near Rabbit Ears Pass. Plants inhabit a small seep uphill from a moderately sized diamondleaf willow (*Salix planifolia*) and water sedge (*Carex aquatilis*) dominated shrubland. Marsh cinquefoil (*Comarum palustre*) is codominant with water sedge and both occur at about 45-55% cover along the seep. Soils are moist to saturated with high organic content. General geology consists of igneous rocks of the Precambrian Age, specifically granitic rocks of 1,700 MYA. Surrounding uplands are variable from dry open meadows to diamondleaf willow mesic shrublands. Forested areas are dominated by lodgepole pine (*Pinus contorta*), subalpine fir (*Abies lasiocarpa*), and Engelmann spruce (*Picea engelmannii*). Other species present include sheep sedge (*Carex illota*), white marsh marigold (*Caltha leptosepala*), and tufted hairgrass (*Deschampsia caespitosa*), which all occur at low percent cover.

Key Environmental Factors: Key environmental factors contributing to the biota of the site include perennial groundwater hydrology, water table, aspect, slope, and substrate.

Climate Description: Climate likely follows patterns typical of this region of Colorado, being generally xeric throughout the year, with wet spring seasons and late summer "monsoons".

Biodiversity Significance Rank Comments (B4): This site is drawn for an excellent (A-ranked) occurrence of the globally demonstrably secure (G5) plant species, marsh cinquefoil (*Comarum palustre*). The element critically imperiled (S1S2) in the state of Colorado.

Natural Heritage element occurrences at the East Fork of Fishhook Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Comarum palustre</i>	marsh cinquefoil	G5	S1S2				A	2005-09-27

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

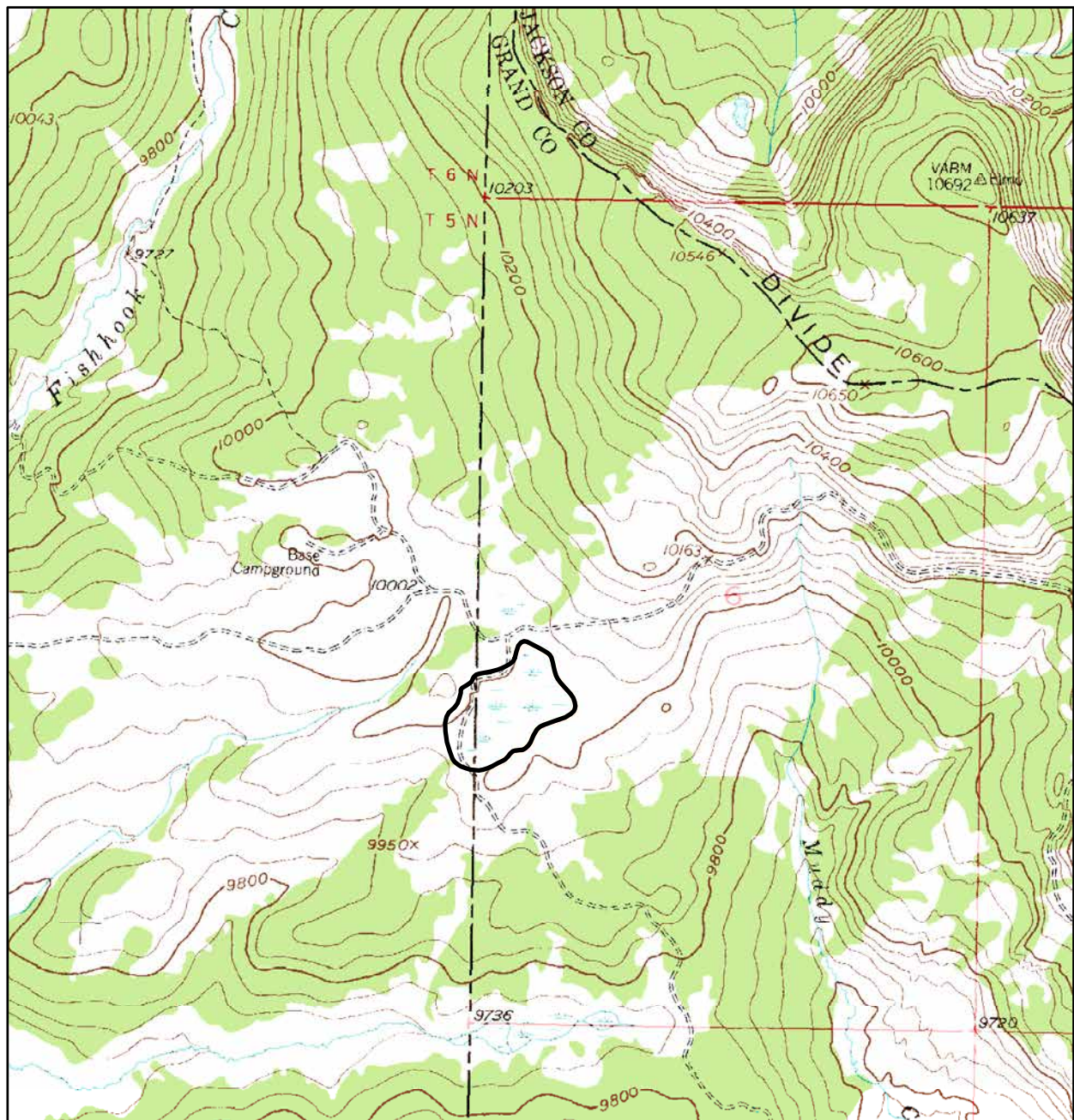
Boundary Justification: The site encompasses approximately 675 square meters of seep wetland along the upper reaches of Muddy Creek. Boundaries are drawn to include those ecological processes necessary to maintain site hydrology and biota including groundwater discharge, seasonal flooding, and organic matter accumulations. Boundaries do not include all ecological processes influencing the site. Activities upstream and along adjacent slopes such as improper grazing, water diversion, and development may impact site hydrology and biota.

Protection Urgency Rank Comments (P4): Site is situated on USFS land within the Routt National Forest and needs no further protection unless usage is altered.

Management Urgency Rank Comments (M3): Management may be needed within the next five years due to the presence of grazing sheep and the possibility of exotic species invasion.

Land Use Comments: Predominant land uses are recreational activities such as camping, hiking, biking, fishing, hunting, and OHV use. Livestock grazing occurs, sheep were seen in the area, and the possibility of natural resource extraction exists.

Off-Site Considerations: Off-site considerations include grazing in adjacent meadows and road maintenance which may introduce exotic species to the area and alter hydrology and sediment deposition.



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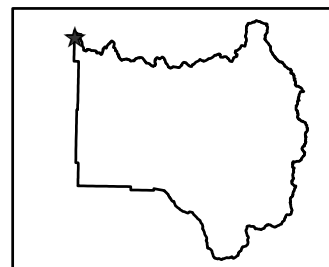
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 PCA Boundary

Mount Werner, 40106-D6

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 44. East Fork of Fishhook Creek Potential Conservation Area, B4: Moderate Biodiversity Significance

Iron Creek Fen

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P5: No Action to be Taken on this Site

Management Urgency Rank - M5: Not Needed; No Threats Anticipated

U.S.G.S. 7.5-minute quadrangles: Byers Peak

Size: 45 acres (18 ha)

Elevation: 10,050 - 10,060 ft. (3,063 - 3,066 m)

General Description: Community inhabits large partially treed meadow along Iron Creek. Iron Creek is a first order tributary of St. Louis Creek which is a small, perennial, type E stream along this section. General geology consists of metamorphic rocks of the Precambrian Age. Groundwater is a major source of perennial hydrology for the meadow surrounding the stream due to high water table. Community has variable cover throughout, with water sedge (*Carex aquatilis*) being the most common and dominant species in most areas. Other species that may be present due to a drying, seral trend in the meadow include Engelmann spruce (*Picea engelmannii*), diamondleaf willow (*Salix planifolia*), and bluejoint reedgrass (*Calamagrostis canadensis*). It appears that the meadow may be succeeding from a former beaked sedge (*Carex utriculata*) inundated meadow, past a mesic water sedge meadow to its current planeleaf willow/water sedge status. Inundated areas are dominated by strictly herbaceous vegetation of *Carex aquatilis* and fewflower spikerush (*Eleocharis quinqueflora*) in some areas. Engelmann spruce is also present in a consistent layer throughout, also forming areas dominated by Engelmann spruce / bluejoint reedgrass. Other graminoids present include Norway sedge (*Carex norvegica*), analogue sedge (*Carex simulata*), and Tracy's rush (*Juncus tracyi*). Forbs present include heartleaf bittercress (*Cardamine cordifolia*), white marsh marigold (*Caltha leptosepala*), and arrowleaf ragwort (*Senecio triangularis*). Surrounding uplands are dominated by Engelmann spruce - subalpine fir (*Abies lasiocarpa*) / whortleberry (*Vaccinium* sp.) forests. Peat soils are hemic and well developed throughout the fen suggesting long history of perennial groundwater. There are no evident disturbances present other than some wildlife browsing on willow (*Salix*). Site appears to be seral or in the process of filling or drying evidenced by the occurrence of many canopy species, Engelmann spruce and planeleaf willow, within the meadow.

Key Environmental Factors: Key environmental factors driving the biota include a perennial water source from groundwater and surface flows, organic matter and sediment deposition, saturated to inundated soils, and well-developed peat soils.

Climate Description: Site likely follows typical Colorado weather patterns being generally xeric throughout the year with a wet spring season and late summer "monsoons". The area may experience some microclimate differences from

surrounding forested areas due to perennial standing water, low tree cover, and its low-lying position within a narrow valley.

Land Use History: Site does not show any evidence of historic use, but has likely been used in the past by local wildlife as a feeding area due to its species composition.

Biodiversity Significance Rank Comments (B4): This site is drawn for an excellent (A-ranked) occurrence of a globally demonstrably secure (G5/S4) diamondleaf willow / water sedge (*Salix planifolia* / *Carex aquatilis*) subalpine riparian willow carr.

Natural Heritage element occurrences at the Iron Creek Fen PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Salix planifolia</i> / <i>Carex aquatilis</i> Shrubland	Subalpine Riparian Willow Carr	G5	S4				A	2005-07-22

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundary is drawn to include large, open meadow of peat soils along lower Iron Creek. Boundary encompasses meadow and the hydrologic features that support its unique biota and soil structure including groundwater seeps and upstream surface flows. All surrounding uplands and hydrologic processes necessary to the area are not fully contained within the boundary and the area may be adversely affected if activities such as development, logging, or water diversions are introduced.

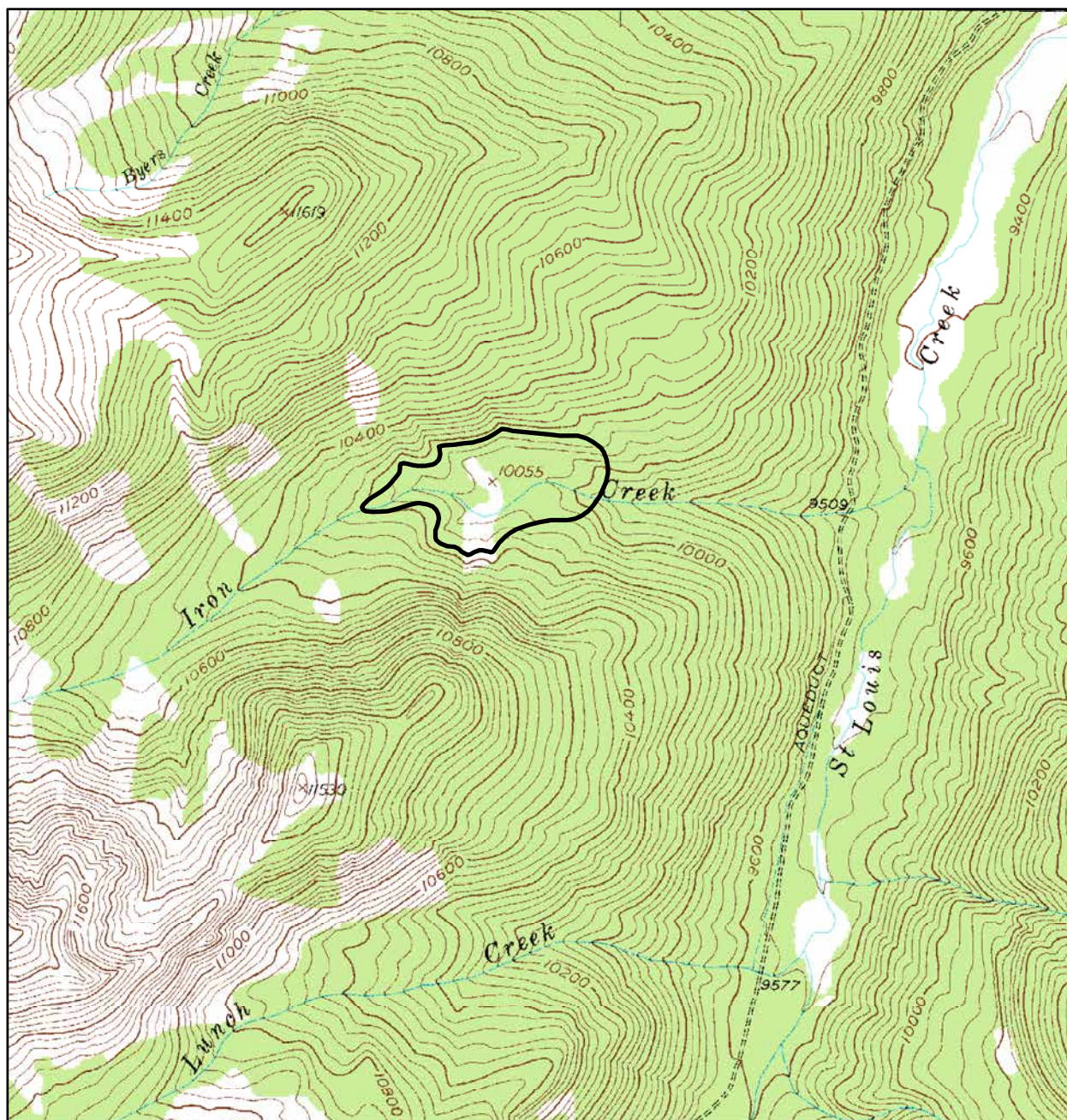
Protection Urgency Rank Comments (P5): Site is currently protected by the USFS as part of the Fraser Experimental Forest for Forest Service research.

Management Urgency Rank Comments (M5): Currently, there is no management needed. The area is pristine and well-managed.

Natural Hazard Comments: Soils are very hummocky in some areas and may cause difficult or hazardous walking. There is no defined trail to the site.

Exotic Species Comments: The site is pristine and supports no exotic species. Iron Creek is transected by a well-traveled road at its confluence with St. Louis Creek and may act as a conduit for exotic species.

Off-Site Considerations: Surrounding uplands are dominated by lodgepole pine (*Pinus contorta*), Engelmann spruce, and subalpine fir (*Abies lasiocarpa*) forests. There is currently a devastating beetle infestation impacting the lodgepole pine population and it has been predicted that spruce beetle infestation is likely.



0 0.15 0.3 0.6 0.9 Miles



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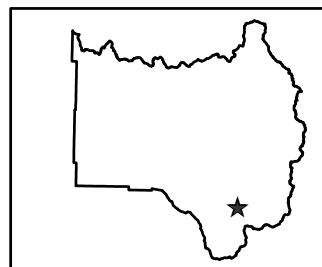
Legend

 PCA Boundary

Byers Peak, 39105-G8

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 45. Iron Creek Fen Potential Conservation Area, B4: Moderate Biodiversity Significance

Jim Creek Trail

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Empire

Size: 36 acres (15 ha)

Elevation: 10,280 - 10,345 ft. (3,133 - 3,153 m)

General Description: This association occurs as multiple slope fens along the upper reaches of Jim Creek drainage. General geology consists of unconsolidated surficial deposits and rocks of the Quaternary Age, specifically glacial drift of the Pinedale and Bull Lake glaciations. Vegetation is dominated by herbaceous species throughout with some encroaching diamondleaf willow (*Salix planifolia*) and Engelmann spruce (*Picea engelmannii*) along edges. Water sedge (*Carex aquatilis*) and fewflower spikerush (*Eleocharis quinqueflora*) are the most common species. Other graminoids present include beaked sedge (*Carex utriculata*), rough bentgrass (*Agrostis scabra*), bluejoint reedgrass (*Calamagrostis canadensis*), and tufted hairgrass (*Deschampsia caespitosa*). Forbs present include elephanthead lousewort (*Pedicularis groenlandica*), white marsh marigold (*Caltha leptosepala*), Rocky Mountain hemlockparsley (*Conioselinum scopulorum*), and scentbottle (*Platanthera dilatata* var. *albiflora*). Soils consist of fibric to hemic peats and are inundated throughout. Disturbances are limited to elk browsing and spring flooding from adjacent stream. There are no recent anthropogenic disturbances. Surrounding uplands are dominated by Engelmann spruce, subalpine fir (*Abies lasiocarpa*), lodgepole pine (*Pinus contorta*) mixed, mature forests that appear to be very healthy forming a stable, continuous ecosystem throughout the drainage.

Key Environmental Factors: Key environmental factors include spring flooding, perennial groundwater discharge, high groundwater levels, organic soil structure, gentle slope, wind protection by steep adjacent slopes, and extreme temperatures.

Climate Description: Climate likely follows typical Colorado weather patterns being generally xeric throughout the year with wet spring seasons and late summer "monsoons".

Land Use History: Site occurs adjacent to an old homestead that is no longer inhabited and may have been used as a hunting camp, but would have been difficult to use year-round because of extreme temperatures.

Biodiversity Significance Rank Comments (B4): This site is drawn for an excellent (A-ranked) occurrence of a globally demonstrably secure (G5/S4) water sedge

(*Carex aquatilis*) herbaceous vegetation plant community.

Natural Heritage element occurrences at the Jim Creek Trail PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Carex aquatilis</i> Herbaceous Vegetation	Montane Wet Meadows	G5	S4				A	2005-09-01

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundary is drawn to include portions of upper Jim Creek and hydrologic processes that help maintain site hydrology including surface flows and groundwater discharge and recharge. Boundaries also include some buffered uplands, but do not include all ecological processes important to the site. Activities such as development, water diversion, and improper grazing could be detrimental to site hydrology and biota.

Protection Urgency Rank Comments (P4): There are no current threats. Site may be threatened if private property upstream is developed.

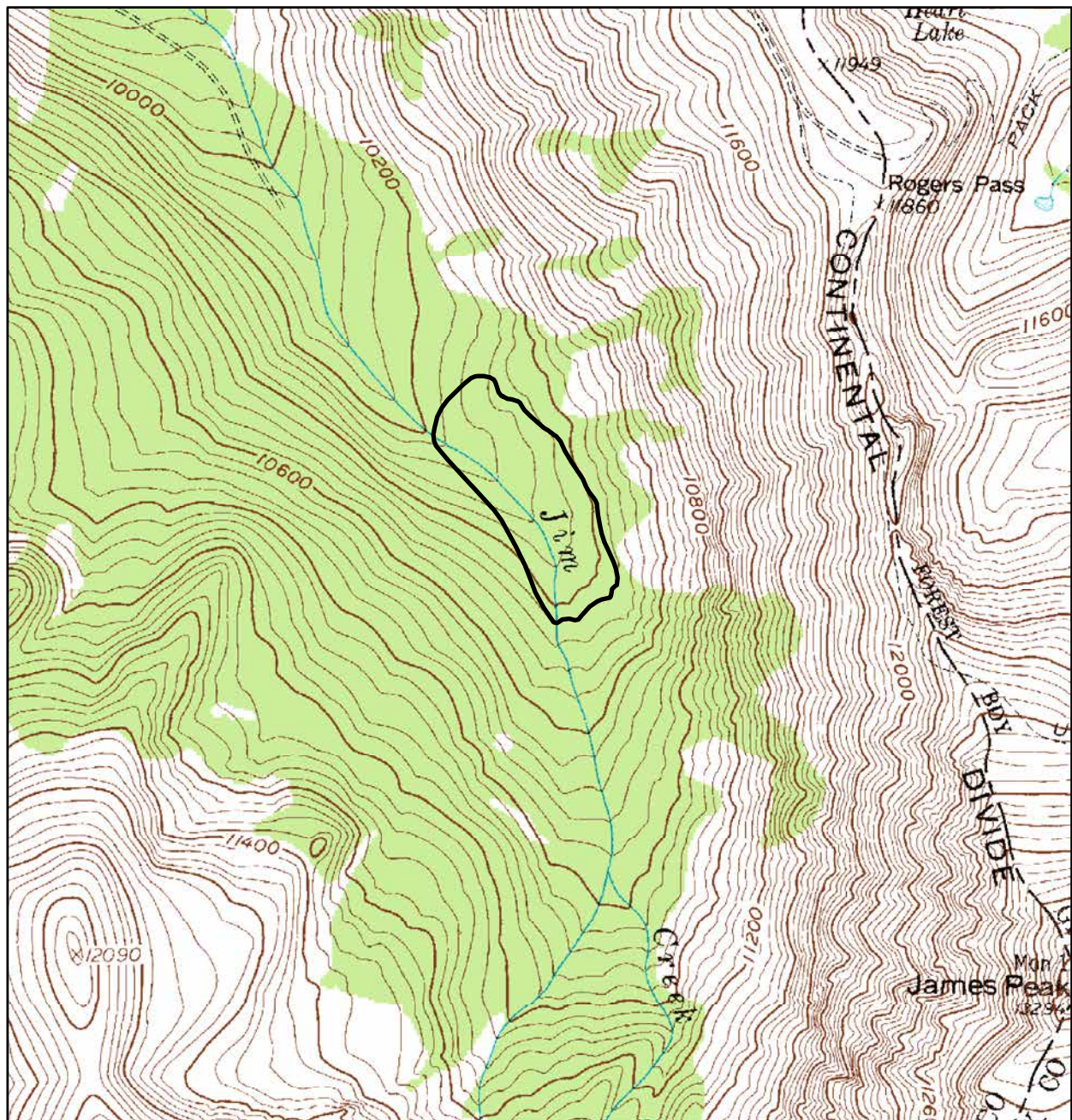
Management Urgency Rank Comments (M4): There are no current management needs. If usage of the area changes, management needs may be altered.

Land Use Comments: The dominant land use of this drainage is for recreational purposes. Drainage supports old growth forests and does show evidence of logging in the past 100 years. Lower portions of the trail were formerly a maintained road, but are now maintained for non-vehicular use. In order to develop the private property upstream of the site, the property owner would need permission to use motor vehicles along the old road.

Natural Hazard Comments: Avalanche danger is likely high during the fall, winter, and spring seasons due to the severity of adjacent slopes.

Exotic Species Comments: The area currently supports no exotic species along the upper reaches of the trail. Lower reaches of trail, not included in the site, support some non-natives including timothy (*Phleum pratense*) and oxeye daisy (*Leucanthemum vulgare*).

Off-Site Considerations: The most prevalent off-site land use is dewatering of Jim Creek at the trailhead. At this point, water is diverted from its course towards the confluence with the Fraser River and fed into the Moffat Tunnel Aqueduct which provides water for agricultural and municipal needs along the Front Range. Approximately 300 acres of land upstream of the site is privately owned. The owner has the intentions of developing the property as a homesite, but must first secure right-of-way by the Forest Service to do so.



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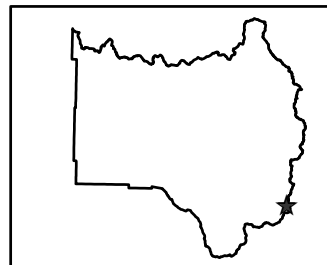
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 PCA Boundary

Empire, 39105-G6

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 46. Jim Creek Trail Potential Conservation Area, B4: Moderate Biodiversity Significance

Jones Pass

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Byers Peak

Size: 48 acres (19 ha)

Elevation: 12,500 - 12,640 ft. (3,810 - 3,853 m)

General Description: The Jones Pass site is located along the Continental Divide and county line. Alpine habitat prevails, dominated by Ross's avens (*Geum rossii*), moss campion (*Silene acaulis* ssp. *subcaulescens*), Rocky Mountain nailwort (*Paronychia pulvinata*), twinflower sandwort (*Minuartia obtusiloba*), narrow-leaf bluebells (*Mertensia lanceolata*), dwarf clover (*Trifolium nanum*), and alpine spring beauty (*Claytonia megarhiza*). The thick-leaf whitlow-grass (*Draba crassa*) is found within the granite crevices. Soils are stony sand loam, typical of alpine slopes (USDA, NRCS 1994). The granitic rocks are derived from igneous rocks of Cambrian Age (Tweto 1979). The Jones Tunnel (August P. Glimlick Tunnel) and powerline bisect the site.

Climate Description: Climate follows typical weather patterns of high mountain valleys, low precipitation/snowfall (<12-15 inches/year) and late summer "monsoons".

Biodiversity Significance Rank Comments (B4): The Jones Pass site supports a good (B-ranked) occurrence of the globally imperiled (G3/S3) thick-leaf whitlow-grass (*Draba crassa*). This species is found throughout the alpine region in Montana, Wyoming, and Utah. Additionally, threats to the alpine are low, except for globally warming. Therefore, this site is given a moderate biodiversity significance rank.

Natural Heritage element occurrences at the Jones Pass PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Draba crassa</i>	thick - leaf whitlow - grass	G3	S3				B	2005-08-03

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

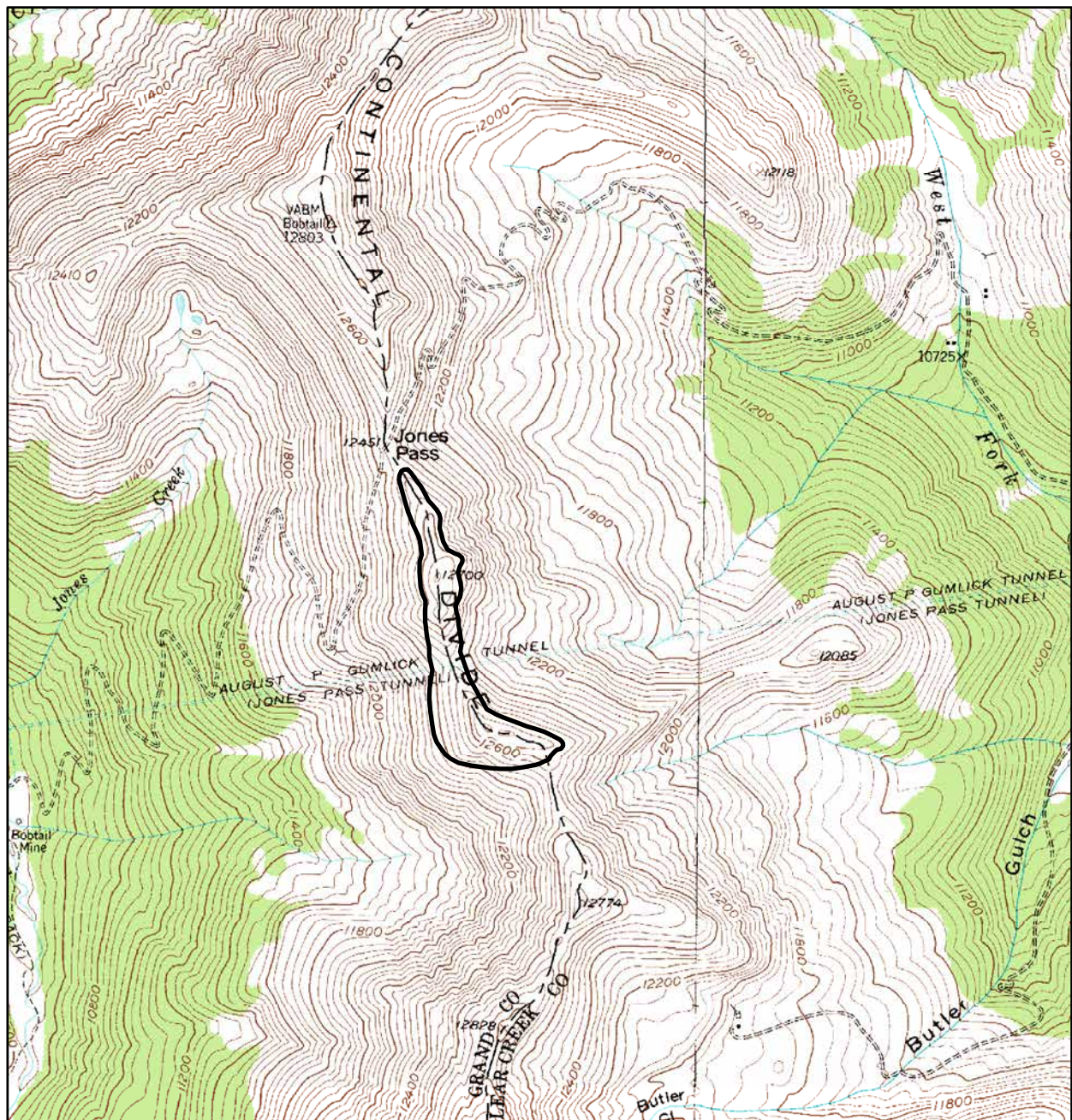
Boundary Justification: Boundary is drawn along the Continental Divide, depicting the occurrence as well as potential habitat. It is very likely that this species occurs

throughout the alpine region of Continental Divide.

Protection Urgency Rank Comments (P3): Protection actions maybe needed in the next 5 years, due to potential threats of mining and expansion/maintenance of the Jones Tunnel. The site is located in the Arapaho National Forest.

Management Urgency Rank Comments (M4): Management actions appear to favor persistence of the species. Its population numbers have remained consistent from 1997. It is likely that future surveys would discover new individuals.

Information Needs: Pollinators are unknown.



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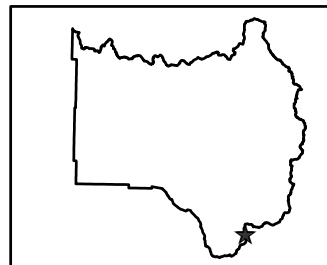
Legend

 PCA Boundary

Byers Peak, 39105-G8

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 47. Jones Pass Potential Conservation Area, B4: Moderate Biodiversity Significance

Lower Corral Creek

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Parshall

Size: 39 acres (16 ha)

Elevation: 7,800 - 7,900 ft. (2,377 - 2,408 m)

General Description: The community inhabits Corral Creek, a narrow second order tributary of the Colorado River, and occurs in a type A section of river where the canyon walls are steep on both sides. Along this section, vegetation is dominated by thinleaf alder (*Alnus incana*) in the tall shrub layer and red-osier dogwood (*Cornus sericea*) in the short shrub layer. Thinleaf alder is present in associations both up and downstream of the occurrence, but red-osier dogwood is confined to the narrow, more shaded sections of the river. A consistent tall shrub and short shrub layer of other species are present throughout including Drummond's willow (*Salix drummondiana*), Bebb's willow (*Salix bebbiana*), mountain willow (*Salix monticola*), whitestem gooseberry (*Ribes inerme*), and twinberry honeysuckle (*Lonicera involucrata*). The herbaceous layer is dominated by forb species such as cutleaf coneflower (*Rudbeckia laciniata* var. *ampla*), red raspberry (*Rubus idaeus*), and western water hemlock (*Cicuta douglasii*). There is an adjacent road along the stream side which is mowed and possibly treated with chemicals for vegetation encroachment. However, there are surprisingly few weedy species within the community. Water is both dammed and diverted upstream causing low flows, algal growth and some silt and sediment build-up in the stream. Soils along the creek banks are sands over cobble. General geology consists of igneous rocks of the Precambrian Age. Beaver activity is present above and below the community, but not within and may impact site hydrology. Uplands are dominated by stable *Artemisia* shrublands. Uplands are fragmented by a few roads, but are mainly continuous farmlands outside of adjacent BLM lands.

Key Environmental Factors: Key environmental factors include spring flooding, drainage shape and slope, and perennial surface flows.

Climate Description: Climate likely follows patterns typical of this region of Colorado, being generally xeric throughout the year, with wet spring seasons and late summer "monsoons".

Biodiversity Significance Rank Comments (B4): This site is drawn for a fair (C-ranked) occurrence of the globally vulnerable to globally apparently secure (G3G4/S3) plant community, thinleaf alder (*Alnus incana*) / red-osier dogwood

(*Cornus sericea*) riparian shrubland.

Natural Heritage element occurrences at the Lower Corral Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Alnus incana</i> / <i>Cornus sericea</i> Shrubland	Thinleaf Alder - Red - osier Dogwood Riparian Shrubland	G3G4	S3				C	2005-09-04

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries encompass approximately 0.6 mile of Lower Corral Creek near its confluence with the Colorado River, include a buffered upland area and encompass those ecological processes necessary to maintain site hydrology including spring flooding, and perennial surface flows. However, boundaries do not include all ecological processes influencing the site and activities upstream and along adjacent slopes such as improper grazing, beaver activity, water diversion, road maintenance, and development may impact site hydrology and biota.

Protection Urgency Rank Comments (P3): No special strategies are in place. Area is threatened by encroaching road, possible exotic species invasion, and water diversions upstream.

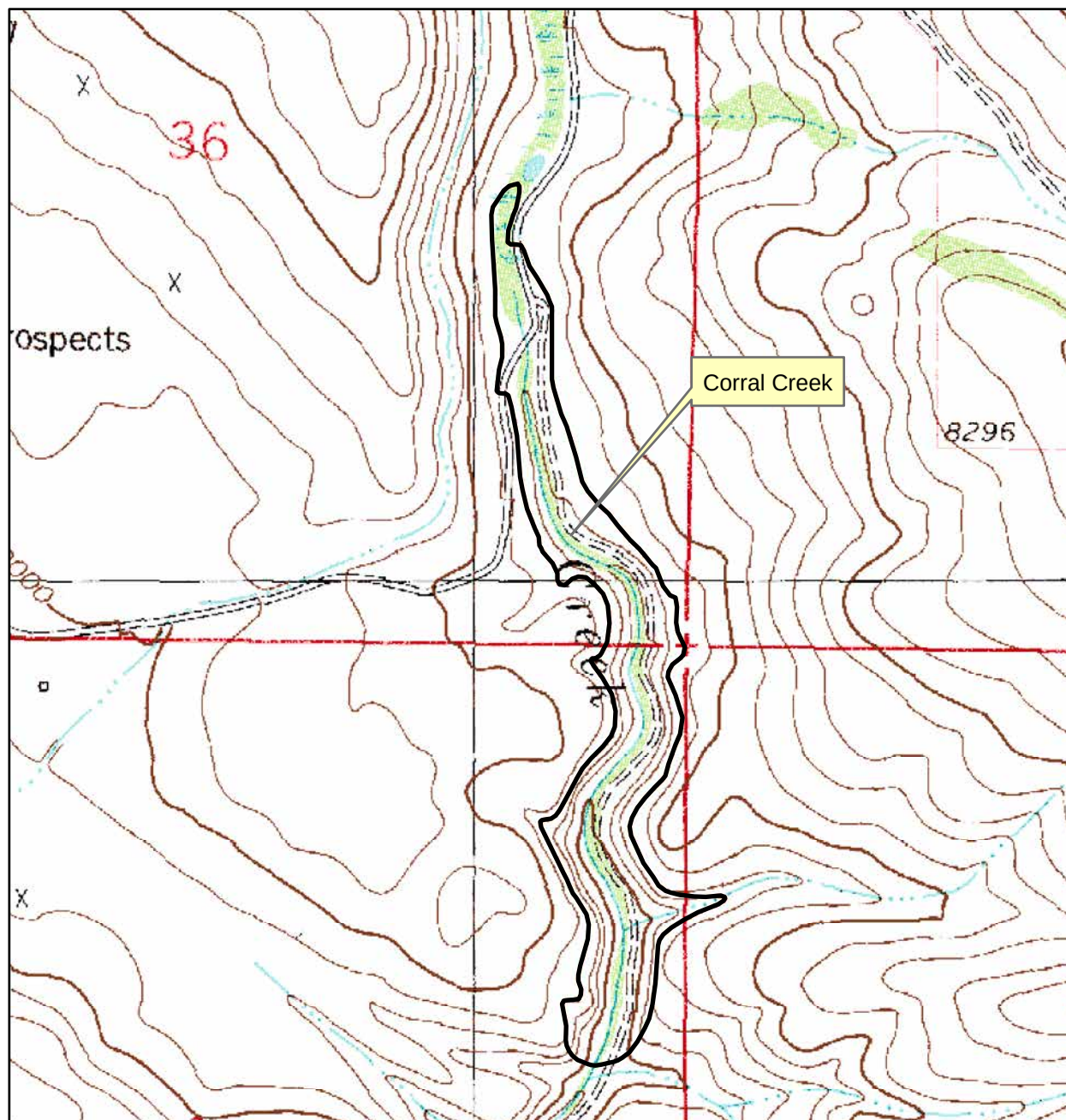
Management Urgency Rank Comments (M3): Management may be needed within five years or quality may be degraded.

Land Use Comments: Predominant land use of immediate adjacent areas include road access to private property and access to adjacent BLM lands for recreational activities. Predominant use of surrounding uplands is for livestock grazing.

Natural Hazard Comments: Spring flooding may cause hazardous conditions along road due to narrow, confined shape of the drainage.

Exotic Species Comments: Canada thistle (*Cirsium arvense*) and orchardgrass (*Dactylis glomerata*) are both present with more cover along drying edges near road.

Off-Site Considerations: Off-site considerations include road maintenance, water diversions, and livestock grazing along adjacent uplands.



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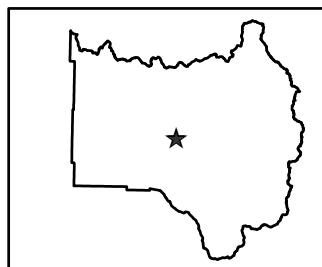
Legend

 PCA Boundary

Parshall, 40106-A2

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 48. Lower Corral Creek Potential Conservation Area, B4: Moderate Biodiversity Significance

Road End Seep at Strawberry Creek

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Strawberry Lake

Size: 45 acres (18 ha)

Elevation: 9,200 - 9,550 ft. (2,804 - 2,911 m)

General Description: Community occurs along small, perennial seep drainage. Seep has intermittent running water, but soils are saturated throughout. Soils consist of sandy loams with high organic content over medium to coarse grain sands. General geology consists of igneous rocks of the Precambrian Age, specifically, granitic rocks of 1,700 MYA. The stream created below the seep/wash is a first order, type G drainage, being moderately sloped and narrow. Drainage is dominated by a tall shrub layer of thinleaf alder (*Alnus incana*). The understory is dominated by mesic forbs including common cowparsnip (*Heracleum maximum*), arrowleaf ragwort (*Senecio triangularis*), and tall fringed bluebells (*Mertensia ciliata*). Graminoids present include bluejoint reedgrass (*Calamagrostis canadensis*), smallflowered woodrush (*Luzula parviflora*), and fringed brome (*Bromus ciliatus*). All mesic species are confined to depressions and mesic soils around the seep. Surrounding landscape is dominated by mature lodgepole pine (*Pinus contorta*) forests with some recent logging activity evident. Community may extend past surveyed boundaries and along adjacent perennial stream. Other disturbances include a road that does not seem to be heavily used. There are multiple game trails, indicating that this area is an important water source for wildlife.

Key Environmental Factors: Key environmental factors influencing the hydrology and biota of the site include perennial groundwater hydrology, ephemeral flows, percent slope, and porous soils.

Climate Description: Climate likely follows patterns typical of this region of Colorado, being generally xeric throughout the year, with wet spring seasons and late summer "monsoons".

Biodiversity Significance Rank Comments (B4): This site is drawn for a fair (C-ranked) occurrence of the globally vulnerable (G3/S3) plant community, thinleaf alder (*Alnus incana*) / mesic forbs shrubland.

Natural Heritage element occurrences at the Road End Seep at Strawberry Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Alnus incana / Mesic Forbs Shrubland	Thinleaf Alder / Mesic Forb Riparian Shrubland	G3	S3				C	2005-08-19

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries include areas of small seep south of Strawberry Creek. Boundaries are drawn to encompass those ecological processes necessary to maintain site hydrology including perennial groundwater flows and ephemeral surface flows. Boundaries do not include all ecological processes influencing the site. Activities upstream and along adjacent slopes such as improper grazing, water diversion, logging, and development may negatively impact site hydrology and biota.

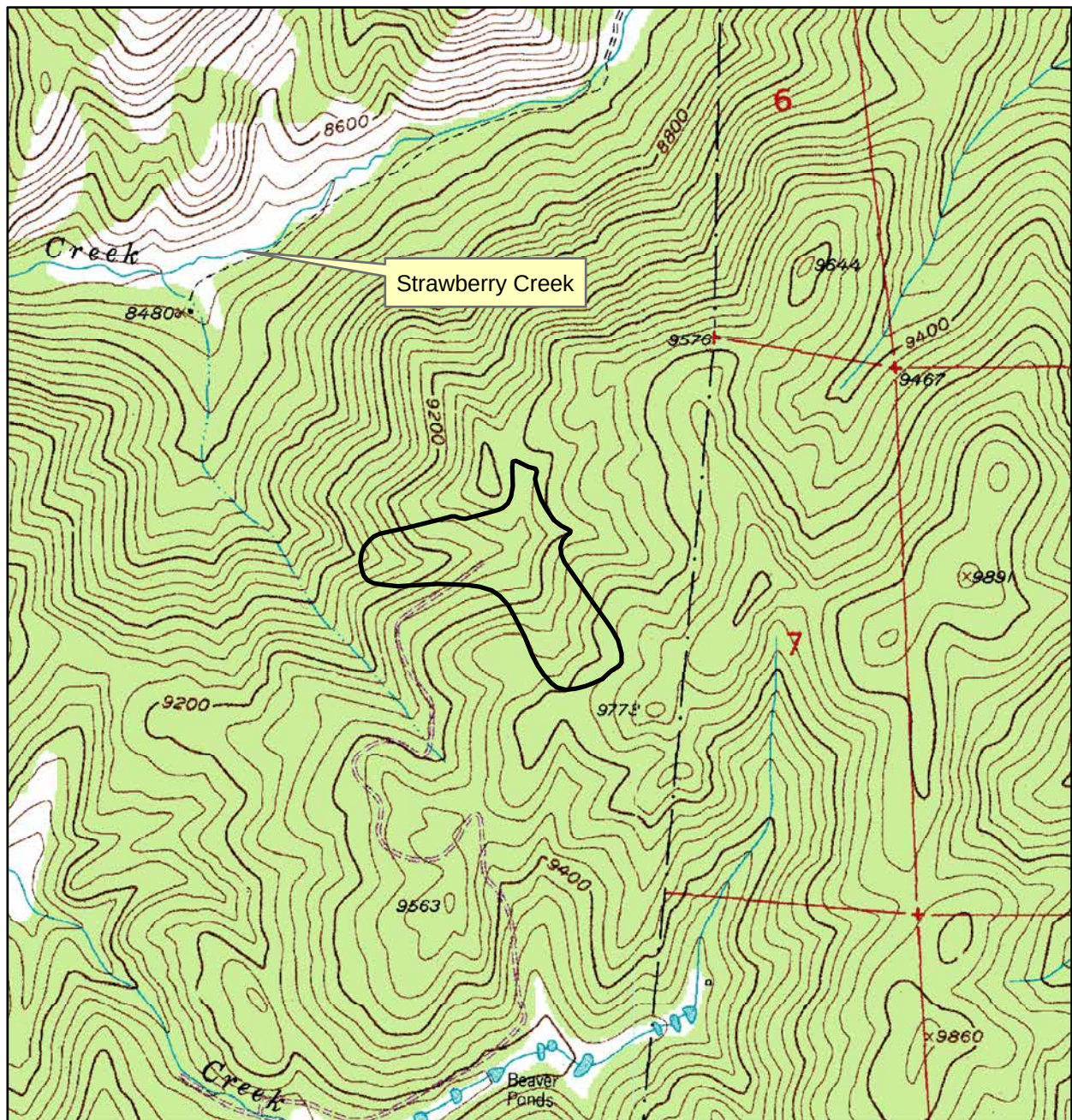
Protection Urgency Rank Comments (P3): The area appears to be recovering from past logging activities located adjacent the wetland.

Management Urgency Rank Comments (M4): Current management appears to be adequate for the persistence of the plant community.

Land Use Comments: Site immediately adjacent to the spring has been logged in the past 10 years. Road is used primarily for recreational uses including hunting access, OHV use, and camping and hiking.

Exotic Species Comments: Kentucky bluegrass (*Poa pratensis*) is present throughout the area, but in low cover.

Off-Site Considerations: The main off-site considerations include adjacent logging and recreational use.



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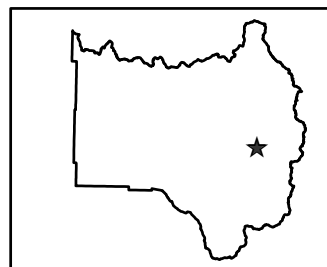
Legend

 PCA Boundary

Strawberry Lake, 40105-A7

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 49. Road End Seep at Strawberry Creek Potential Conservation Area, B4:
Moderate Biodiversity Significance

Rollins Pass

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: East Portal

Size: 738 acres (299 ha)

Elevation: 11,330 - 11,620 ft. (3,453 - 3,542 m)

General Description: The community inhabits the upper subalpine and lower alpine areas of exposed ridges south of Rollins Pass. It consists of a mosaic of thickets of shortfruit willow (*Salix brachycarpa*) and open alpine meadows dominated by Ross' avens (*Geum rossii*) and tufted hairgrass (*Deschampsia caespitosa*). It inhabits very large areas of local exposed slopes and likely adjacent slopes of surrounding areas. Soils are loamy and rocky throughout and contain large amounts of coal in the top layers near the track of the former Moffat Railroad. General geology consists of metamorphic and igneous rocks of the Precambrian Age. The area was historically transected by the Moffat Railroad, and is now transected by Moffat Road and the Continental Divide Trail. Surrounding communities are composed of alpine meadow vegetation dominated by tufted hairgrass and further upslope by dwarf alpine communities. Subalpine communities of Engelmann spruce (*Picea engelmannii*) form open woodlands of flagged and densely growing trees downslope.

Climate Description: Climate likely follows patterns typical of this region of Colorado, being generally xeric throughout the year, with wet spring seasons and late summer "monsoons".

Land Use History: The area was used as the first route through the Rockies from Denver to Salt Lake during the late 1800's, early 1900's. There is still evidence of the town of Corona that was established at the top of the pass to aid trains and crews and later tourists visiting the area. The site was abandoned in the mid 1900's after the Moffat Tunnel was built.

Cultural Features: Cultural features include remains of the old town of Corona and housing where trains were stored.

Biodiversity Significance Rank Comments (B4): This site is drawn for an excellent (A-ranked) occurrence of the globally apparently secure (G4/S3S4) plant community, shortfruit willow (*Salix brachycarpa*) / Ross' avens (*Geum rossii*) - tufted hairgrass (*Deschampsia caespitosa*) shrubland.

Natural Heritage element occurrences at the Rollins Pass PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	SALIX BRACHYCARPA /DESCHAMPSI A CESPITOSA - GEUM ROSSII	Alpine Willow Scrub	G4	S3S4				A	2005-08-24

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries include approximately 350 acres along the Continental Divide east of Rollins Pass. Boundaries are drawn to encompass those ecological processes necessary to maintain site biota including extreme exposures, seasonal snowpack, and rocky, undeveloped substrates. Boundaries do not include all ecological processes influencing the site. Activities along adjacent slopes such as improper development and road maintenance may negatively impact site biota.

Protection Urgency Rank Comments (P3): The main threat is recreational use and slow-recovering impacts to the alpine.

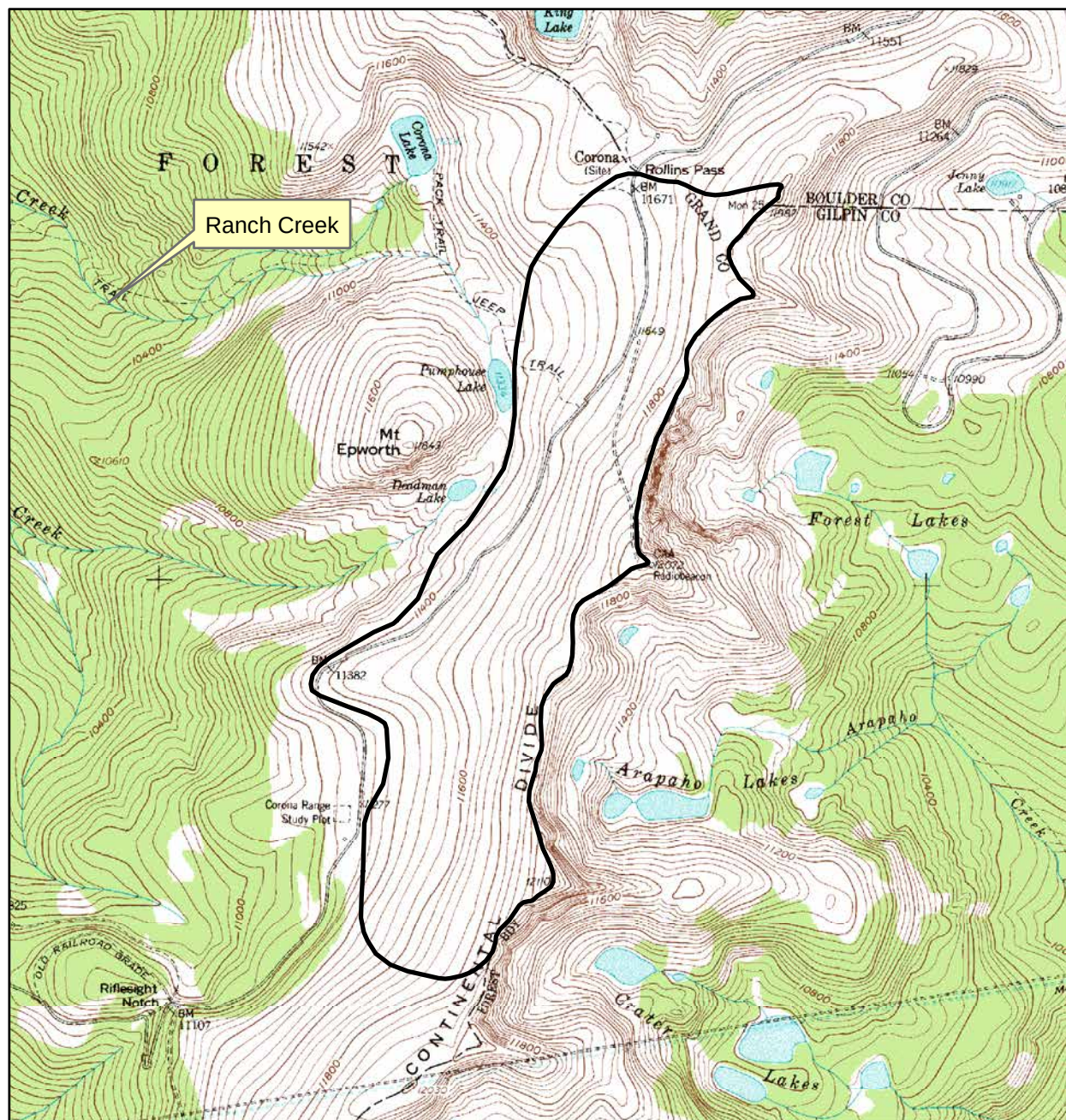
Management Urgency Rank Comments (M4): Area is currently stable, but may need management if usage increases.

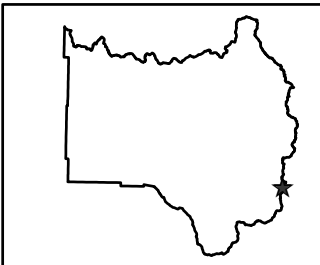
Land Use Comments: Predominant land uses include hiking, biking, camping, hunting, and sight-seeing.

Natural Hazard Comments: Winds and temperatures may cause exposure hazards during colder seasons. Avalanches may occur during the fall, winter, and spring seasons.

Exotic Species Comments: There were no exotic species observed during the survey. However, the road may act as a conduit for non-native species.

Information Needs: Further survey is needed. Occurrence likely continues along adjacent ridges in both directions along the Continental Divide and is a very important although common community along the lower alpine reaches in this region of the Colorado Rockies.



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Map 50. Rollins Pass Potential Conservation Area, B4: Moderate Biodiversity Significance

South Fork of Ranch Creek

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: East Portal

Size: 103 acres (42 ha)

Elevation: 10,050 - 10,300 ft. (3,063 - 3,139 m)

General Description: Site occurs along the South Fork of Ranch Creek, a second order tributary of the Fraser River. The creek is a type A stream along this section. General geology consists of metamorphic rocks of the Precambrian Age, specifically biotitic gneiss, schist, and migmatite. Soils are xeric and rocky throughout. Upland areas are saturated with a moderate organic component along wetland areas. Surrounding forests are dominated by lodgepole pine (*Pinus contorta*), Engelmann spruce (*Picea engelmannii*), and subalpine fir (*Abies lasiocarpa*) with short shrub understories of kinnikinnick (*Arctostaphylos uva-ursi*) or whortleberry (*Vaccinium* sp.). Drainage is dominated by Engelmann spruce and subalpine fir with mesic forbs in the understory. Open meadow along lower reaches of drainage is dominated by a diamondleaf willow (*Salix planifolia*) and water sedge (*Carex aquatilis*) community. Soils are saturated to inundated throughout this area. Moonworts (*Botrychium* sp.) found along the train truss adjacent to road include lanceleaf moonwort (*Botrychium lanceolatum*) which is most common, western moonwort (*Botrychium hesperium*) and reflected moonwort (*Botrychium echo*) which was least common. The location of the moonwort populations is constantly disturbed due to severity of slope and sloughing. Common herbaceous species occurring with the moonwort include Virginia strawberry (*Fragaria virginiana*), Mt. Albert goldenrod (*Solidago simplex* var. *nana*), and rosy pussytoes (*Antennaria rosea*). Disturbances include old train truss, adjacent/upstream road, camp sites, and parking area for nearby trail. Area sees heavy use during the summer months.

Key Environmental Factors: Key environmental factors contributing to the biota of the site include spring flooding, elevation, perennial surface flows, and slope. Anthropogenic disturbances appear to impact the moonworts.

Climate Description: Climate likely follows patterns typical of this region of Colorado, being generally xeric throughout the year, with wet spring seasons and late summer "monsoons".

Land Use History: The area was used as the first route through the Rockies from Denver to Salt Lake during the late 1800's, early 1900's. There is still evidence of the

town of Corona that was established at the top of the pass to aid trains and crews and later tourists visiting the area. The site was abandoned in the mid 1900's after the Moffat Tunnel was built.

Biodiversity Significance Rank Comments (B4): This site is drawn for an excellent (A-ranked) occurrence of the globally demonstrably secure (G5/S4) community, diamondleaf willow (*Salix planifolia*) / water sedge (*Carex aquatilis*), and fair (C-ranked) occurrences of the globally vulnerable plants, reflected moonwort (*Botrychium echo*) (G3/S3) and western moonwort (*Botrychium hesperium*) (G3G4/S2).

Natural Heritage element occurrences at the South Fork of Ranch Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Salix planifolia</i> / <i>Carex aquatilis</i> Shrubland	Subalpine Riparian Willow Carr	G5	S4				A	1993-08-12
Vascular Plants	<i>Botrychium echo</i>	reflected moonwort	G3	S3				C	2005-08-03
Vascular Plants	<i>Botrychium hesperium</i>	western moonwort	G3G4	S2				C	2005-08-03

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The site contains approximately .65 mile of the South Fork of Ranch Creek. Boundaries include buffered uplands and encompass those ecological processes necessary to maintain site biota including seasonal flooding, perennial surface flows, and disturbances such as sloughing of severe slopes. However, boundaries do not include all ecological processes influencing the site and activities upstream and along adjacent slopes such as improper grazing, road maintenance, water diversion, and development may impact site hydrology and biota.

Protection Urgency Rank Comments (P3): There are definable threats present, but not within five years. Site occurs on public land.

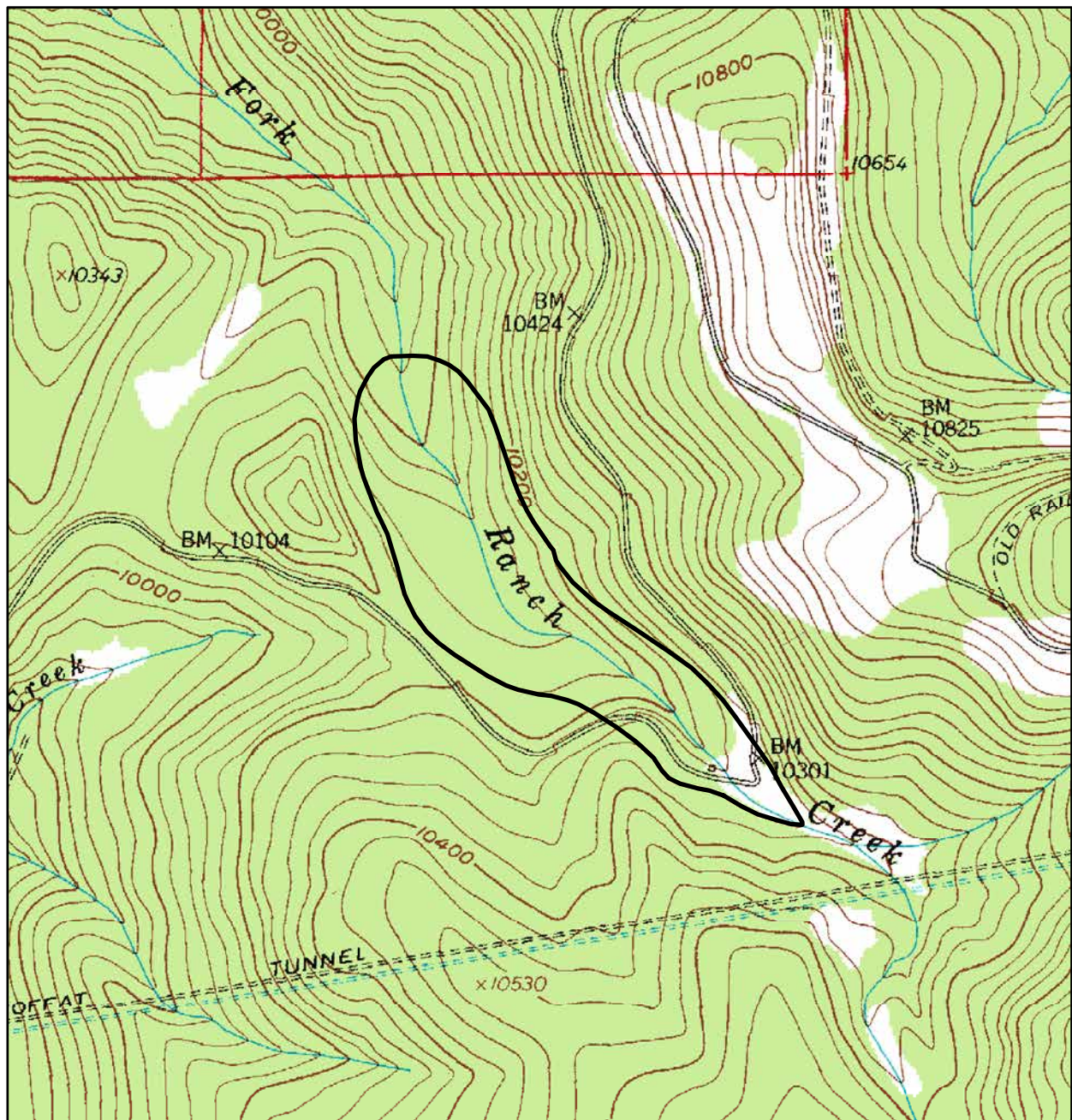
Management Urgency Rank Comments (M4): There are no current management needs. Site may need management in the future due to amount of use of the area and proximity to roadway.

Land Use Comments: Predominant land uses are recreational including camping, hiking, biking, OHV use, fishing, hunting, and site-seeing.

Exotic Species Comments: Exotic species include white clover (*Trifolium repens*), thistle (*Cirsium* sp.), and possibly Kentucky bluegrass (*Poa pratensis*). Exotic species

are not common, but are present along roadways and trails.

Off-Site Considerations: Off-site considerations include water diversion, adjacent roadway, and recreational uses. These activities may alter hydrology and introduce exotic species.



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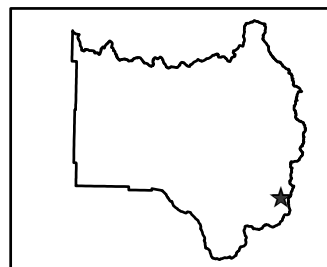
Legend

 PCA Boundary

East Portal, 39105-H6

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 51. South Fork of Ranch Creek Potential Conservation Area, B4: Moderate Biodiversity Significance

South Supply Creek

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Bowen Mountain

Size: 170 acres (69 ha)

Elevation: 9,085 - 9,150 ft. (2,769 - 2,789 m)

General Description: Site encompasses approximately 0.75 mile along South Supply Creek and an adjacent meadow. South Supply Creek is a free-flowing, first order tributary of Supply Creek. The creek is a small type E drainage along this section. General geology consists of unconsolidated surficial deposits and rocks of the Quaternary Age and igneous rocks of the Precambrian Age. Soils along the drainage and the meadow consists of an upper horizon with high organic content over clays with some areas of fibric peat. The shrub community along South Supply Creek occurs as a mosaic of graminoid dominated meadows and dense shrublands. Shrub layer is dominated by thickets of the short shrub Wolf's willow (*Salix wolfii*). Other shrubs present include diamondleaf willow (*Salix planifolia*), shrubby cinquefoil (*Dasifora floribunda*), and dwarf water birch (*Betula nana*). Common graminoids along the main drainage include water sedge (*Carex aquatilis*), beaked sedge (*Carex utriculata*), tufted hairgrass (*Deschampsia caespitosa*), clustered field sedge (*Carex praeegracilis*), and Kentucky bluegrass (*Poa pratensis*). Forbs present include largeleaf aven's (*Geum macrophyllum*), white-marsh marigold (*Caltha leptosepala*), common yarrow (*Achillea millefolium*), and felwort (*Swertia perennis*). Southern meadow supports a tufted hairgrass herbaceous community. Occurrence may be seral based on hydrology and could be progressing from a more mesic water sedge dominated community to a dryer tufted hairgrass dominated community. Other graminoids present in the meadow include beaked sedge, bluejoint reedgrass (*Calamagrostis canadensis*), and silvery sedge (*Carex canescens*). Forb species include American bistort (*Polygonum bistortoides*), redpod stonecrop (*Rhodiola rhodantha*), and white-marsh marigold (*Caltha leptosepala*). The site appears to have been grazed in the past with some areas of grazing induced species including Kentucky bluegrass (*Poa pratensis*) and Virginia strawberry (*Fragaria virginiana*). Surrounding uplands are dominated by *Pinus contorta* forests.

Key Environmental Factors: Key environmental factors driving the biota of the site include perennial surface flows, groundwater discharge and recharge, slope degree and shape, and clay soils structure.

Climate Description: Climate likely follows patterns typical of this region of

Colorado, being generally xeric throughout the year, with wet spring seasons and late summer "monsoons".

Biodiversity Significance Rank Comments (B4): This site is drawn for an excellent (A-ranked) occurrence of the globally apparently secure (G4/S4) community, tufted hairgrass (*Deschampsia caespitosa*) herbaceous vegetation and a good (B-ranked) occurrence of the globally apparently secure (G4/S3) community *Salix wolfii* - *Carex aquatilis*.

Natural Heritage element occurrences at the South Supply Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Deschampsia caespitosa</i> Herbaceous Vegetation	Mesic Alpine Meadow	G4	S4				A	2005-07-30
Natural Communities	<i>Salix wolfii</i> / <i>Carex aquatilis</i> Shrubland	Subalpine Riparian Willow Carr	G4	S3				B	2005-07-30

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries includes approximately 0.75 mile along South Supply Creek and an adjacent tributary meadow. Boundaries include buffered uplands and are drawn to encompass those ecological processes necessary to maintain site hydrology, such as perennial surface flows, groundwater discharges, and seasonal flooding. However, boundaries do not include all ecological processes influencing the site. Activities upstream and along adjacent slopes such as improper grazing, water diversion, road maintenance, and development may impact site hydrology and biota.

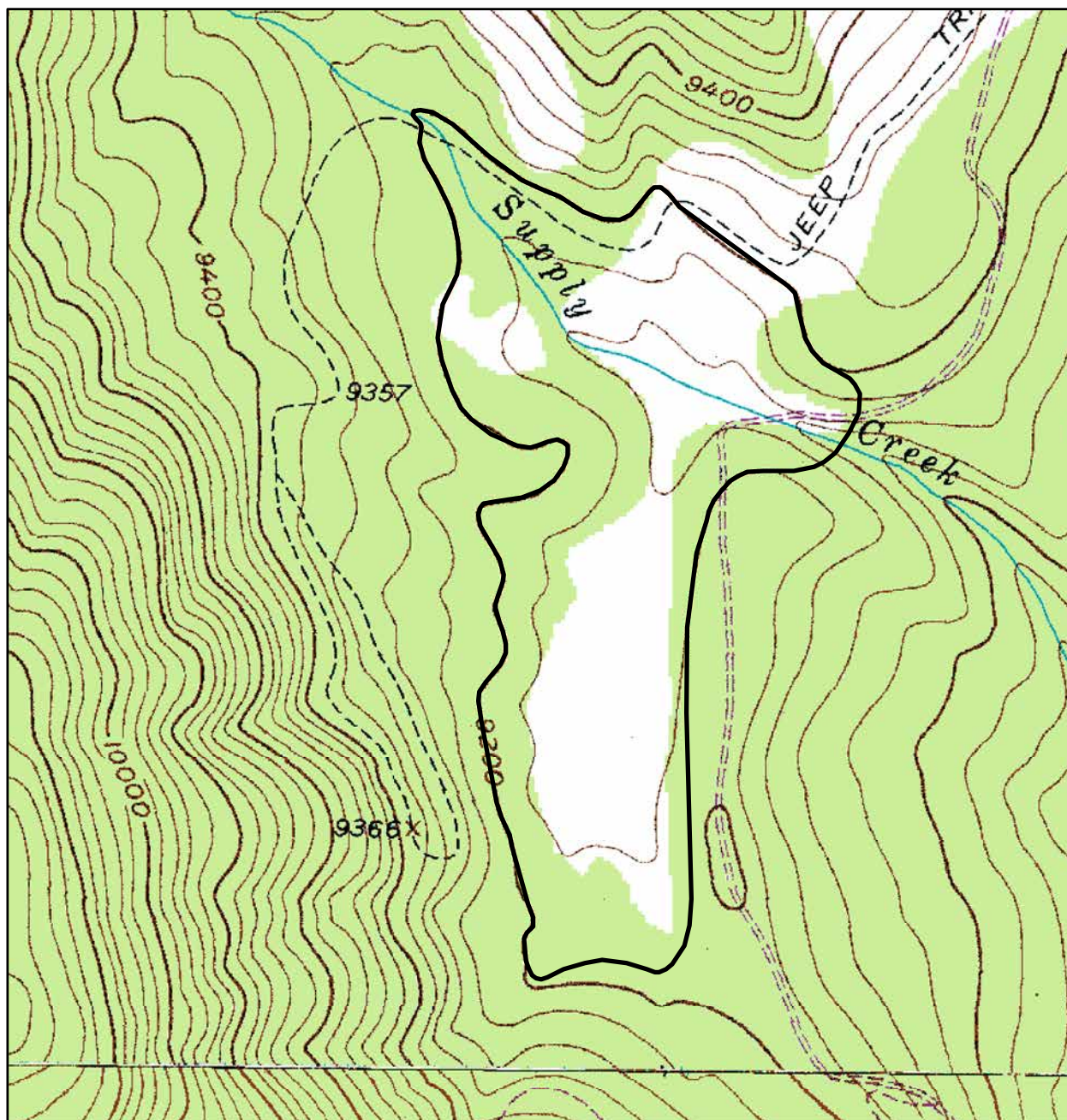
Protection Urgency Rank Comments (P3): Definable threats include use pressures from adjacent campsites and road.

Management Urgency Rank Comments (M4): Area does not currently need management, but may in the future if usage increases or changes.

Land Use Comments: Predominant land uses are recreational uses such as camping, hiking, fishing, hunting, and OHV use.

Exotic Species Comments: Kentucky bluegrass (*Poa pratensis*) is present along edges, but is not common or dominant in any areas. Increaser species such as Virginia strawberry (*Fragaria virginiana*) are common in some areas indicating past disturbances such as livestock grazing.

Off-Site Considerations: Road maintenance impacts.



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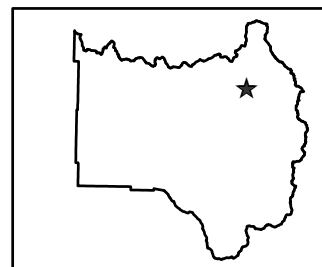
Legend

 PCA Boundary

Bowen Mountain, 40105-C8

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 52. South Supply Creek Potential Conservation Area, B4: Moderate Biodiversity Significance

St. Louis Creek at Fraser

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P1: Immediately Threatened/Outstanding Opportunity

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Fraser

Size: 61 acres (25 ha)

Elevation: 8,575 - 8,600 ft. (2,614 - 2,621 m)

General Description: Community inhabits open meadows along lower St. Louis Creek near the town of Fraser. Community is typical of Wolf's willow (*Salix wolfii*) associations forming a dense, consistent thicket of short shrubs interspersed with herbaceous meadows. Graminoid species are dispersed evenly throughout with water sedge (*Carex aquatilis*) being the most common. There are also patches of beaked sedge (*Carex utriculata*) and bluejoint reedgrass (*Calamagrostis canadensis*) present. Forbs are scattered throughout, but do not dominate. There is a tall shrub component encroaching from the surrounding community of Geyer's willow (*Salix geyeriana*). Surrounding uplands that are not developed are dominated by xeric lodgepole pine (*Pinus contorta*) forests. The main drainage of St. Louis Creek supports a large Geyer's willow carr upstream of this area. Soils are saturated to mesic throughout and highly variable. Some areas have very high organic content in the A horizon, while other areas have pockets of sandy soils and mineral mottling. General geology consists of unconsolidated surficial deposits and rocks of the Quaternary Age, specifically gravels and alluviums. Site is surrounded on two sides by local county roads that may impact hydrology and may in the future encourage weedy species invasion. Currently the occurrence appears to have intact hydrology dependent on rainfall and lateral groundwater flows with very few weedy species. There are very few anthropogenic disturbances within the community.

Key Environmental Factors: Key environmental factors contributing to the biota of the site include seasonal soil saturation, slope, and substrate.

Climate Description: Climate likely follows patterns typical of this region of Colorado, being generally xeric throughout the year, with wet spring seasons and late summer "monsoons".

Biodiversity Significance Rank Comments (B4): This site is drawn for a good (B-ranked) occurrence of the globally apparently secure (G4/S3) plant community, Wolf's willow (*Salix wolfii*) / water sedge (*Carex aquatilis*) riparian willow carr.

Natural Heritage element occurrences at the St. Louis Creek at Fraser PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Salix wolfii / Carex aquatilis Shrubland	Subalpine Riparian Willow Carr	G4	S3				B	2005-08-20

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries include shrublands along the northwestern edge of lower St. Louis Creek near the town of Fraser and are drawn to encompass those ecological processes necessary to maintain site hydrology including seasonal flooding and soil saturation, sediment deposition, and aquifer recharge and discharge. Boundaries do not include all ecological processes influencing the site. Activities upstream and along adjacent slopes such as improper grazing, water diversion, and development may impact site hydrology and biota.

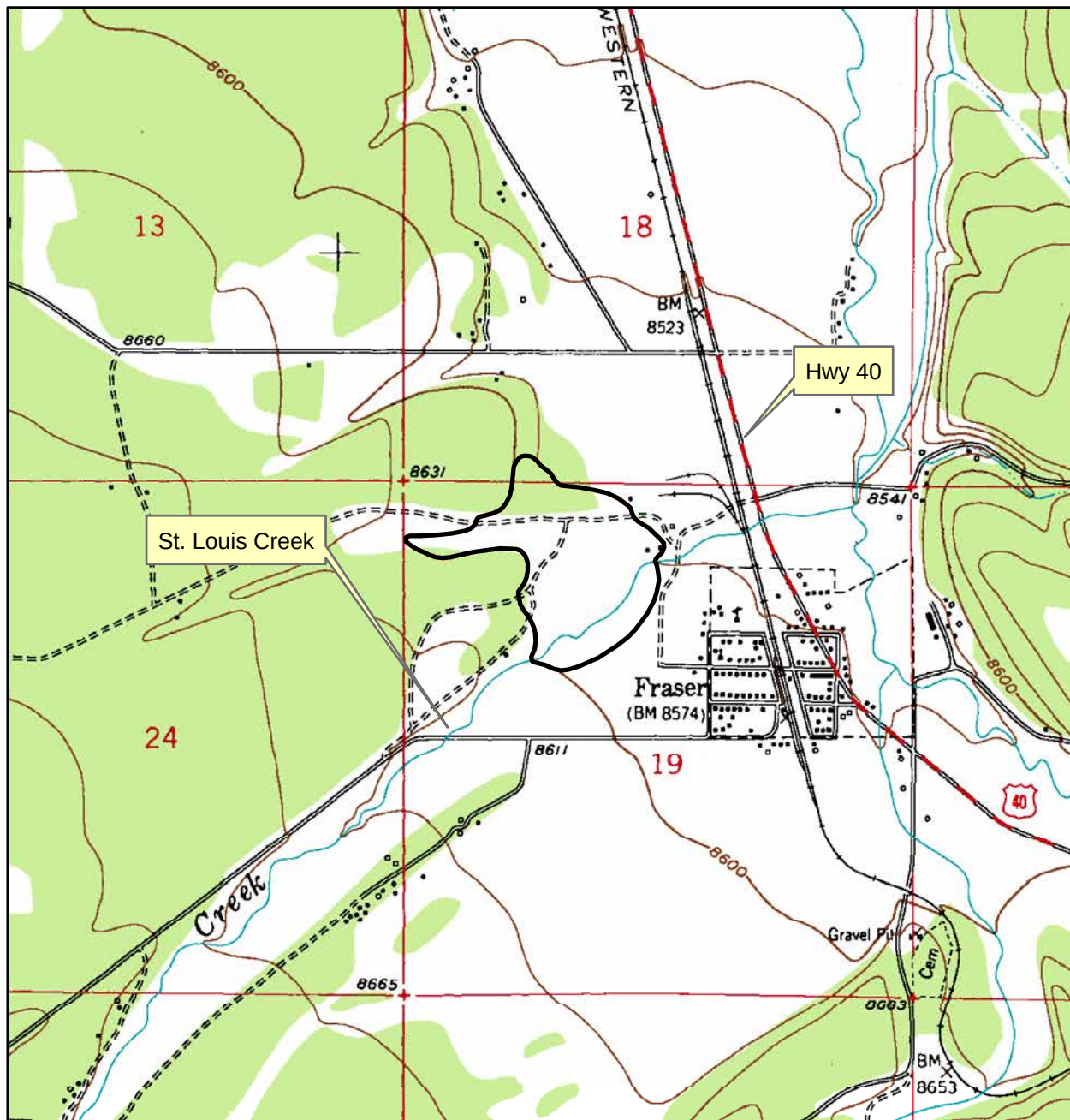
Protection Urgency Rank Comments (P1): Site is part of the proposed Fraser Valley Parkway. If plans are approved for the parkway, the wetland will be divided along its western edge. Hydrology will likely be extremely altered or may even be removed from the system due to draining for road stability.

Management Urgency Rank Comments (M3): Management needs are contingent upon development of the area. If developed, the site will likely need immediate management to maintain quality. Management needs may include exotic species removal and buffering construction to protect the occurrence from sediment deposition, nutrient and toxin additions, and dewatering.

Land Use Comments: Currently the land is open space and is not used by the owner.

Exotic Species Comments: Kentucky bluegrass (*Poa pratensis*), common dandelion (*Taraxacum officinale*), and curly dock (*Rumex crispus*) are all found, but are not dominant or common in many areas. Disturbed areas along edges and roads support many more weedy species than the occurrence. Virginia strawberry (*Fragaria virginiana*) is common and may be indicative of past land disturbance.

Off-Site Considerations: Off-site considerations include roads, development, and proximity to the town of Fraser.



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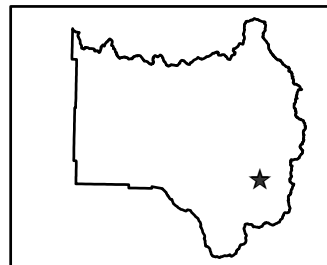
Legend

 PCA Boundary

Fraser, 39105-H7

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 53. St. Louis Creek at Fraser Potential Conservation Area, B4: Moderate Biodiversity Significance

Sulphur Spring

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Junction Butte

Size: 313 acres (127 ha)

Elevation: 7,380 - 7,760 ft. (2,249 - 2,365 m)

General Description: The community inhabits large, open salt flats and continues down Sulphur Gulch drainage for 2.25 miles near its former confluence with the Colorado River. The lowest reach of the drainage is now diverted and dispersed at its junction with Hwy 40. Site hydrology is dependent on multiple warm, mineral springs, just below Rd 2757. There are high salt accumulations present from sedimentary substrates carried to the surface by the spring. Site has a very strong sulfur smell and is considered saline due to its pH of 8.5 and conductivity of 3000 micromhos. General geology consists of sedimentary rocks of the Cretaceous and Jurassic Ages, specifically of the Dakota and Morrison Formations. Species composition is distinctly separated along the soil moisture gradient. Common threesquare (*Schoenoplectus pungens*) and seaside arrowgrass (*Triglochin maritimum*) are the dominant species along the areas of perennial hydrology. Common spikerush (*Eleocharis palustris*) is common in some areas, but throughout it only occurs at about 10% cover. Inland saltgrass (*Distichlis spicata*) occurs on seasonally inundated flats as large patches. Nuttall's alkaligrass (*Puccinellia airoides*) dominates many edges of inundated areas. Greasewood (*Sarcobatus vermiculatus*) and saltlover (*Halogeton glomeratus*), a listed noxious weed, are common in the uplands which are interspersed between mesic rivulets. Surrounding uplands are dominated by Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) / xeric graminoid communities and pockets of threetip sagebrush (*Artemisia tripartita*). Site is impacted by wildlife and past livestock use as a mineral source, with some areas showing evidence of poggings from use during the wet season. Road just above the site does not seem to heavily impact the area. Site is very unique due to its warm, perennial, mineral spring hydrology. Biota is also unique for the area which is mainly dominated by Wyoming big sagebrush and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) on clay substrate.

Key Environmental Factors: Key environmental factors influencing the biota of the site include perennial hydrology source, salt accumulations, and slope degree and shape.

Climate Description: Climate likely follows patterns typical of this region of Colorado being generally xeric throughout most of the year with wet spring seasons and late summer "monsoons".

Biodiversity Significance Rank Comments (B4): This site is drawn for an excellent (A-ranked) occurrence of the globally vulnerable to apparently secure (G3G4/S3) common threesquare (*Schoenoplectus pungens*) herbaceous vegetation plant community. This community type is probably more common than the global rank implies (most likely a G4 instead of a G3G4).

Natural Heritage element occurrences at the Sulphur Spring PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Schoenoplectus pungens</i> Herbaceous Vegetation	Bulrush	G3G4	S3				A	2005-06-22

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries include mineral spring and large open flat of mesic soils below the spring extending down a small drainage to its junction with Hwy 40 near the Colorado River. Boundaries are drawn to encompass buffered uplands and those ecological processes necessary to maintain site hydrology including groundwater discharge and perennial surface flows of the lower reaches of the site. Boundaries do not include all ecological processes influencing the site. Activities upstream and along adjacent slopes such as improper grazing, water diversion, and development may negatively impact hydrology and biota.

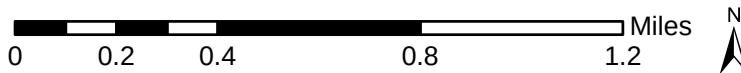
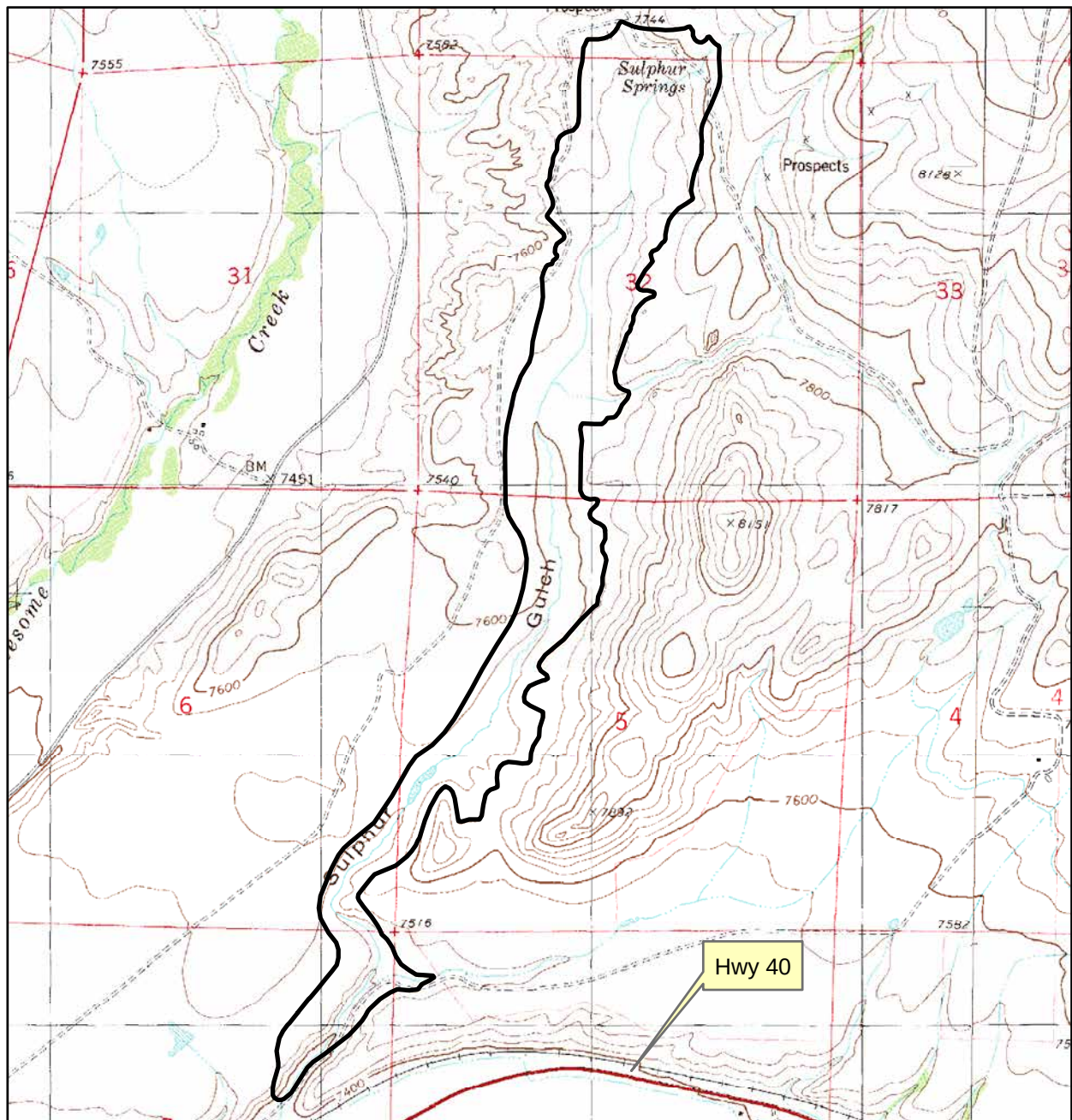
Protection Urgency Rank Comments (P4): There is no need for immediate action. The site occurs on BLM land and is protected generally for public land use.

Management Urgency Rank Comments (M3): New management actions could include monitoring of noxious weeds and grazing impacts from wildlife and livestock.

Land Use Comments: Actual wetland area is not heavily used except by livestock and wildlife as a mineral source. Surrounding uplands are used by the public for recreational purposes including hunting and OHV use.

Exotic Species Comments: Site harbors dense cover of saltlover (*Halogeton glomeratus*) along dry areas within the wetland.

Off-Site Considerations: Off-site considerations include OHV use, road maintenance, and other recreational uses.



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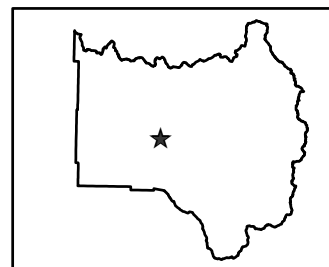
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 PCA Boundary

Junction Butte, 40106-A3

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 54. Sulphur Spring Potential Conservation Area, B4: Moderate Biodiversity Significance

Trail Mountain at Spirit Mountain Ranch

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M5: Not Needed; No Threats Anticipated

U.S.G.S. 7.5-minute quadrangles: Trail Mountain

Size: 96 acres (39 ha)

Elevation: 8,650 - 8,985 ft. (2,637 - 2,739 m)

General Description: Occurrence is an old growth quaking aspen (*Populus tremuloides*) forest on the west side of Trail Mountain. Dominant understory consists of russet buffaloberry (*Shepherdia canadensis*). *Populus* stand is said to be one of the oldest most continuous stands in the area. Other common shrubs include common juniper (*Juniperus communis*), Wood's rose (*Rosa woodsii*), and kinnikinnick (*Arctostaphylos uva-ursi*). The herbaceous layer is not dominated by any one species. Parry's goldenrod (*Oreochrysum parryi*), lupine (*Lupinus* sp.), and Geyer's sedge (*Carex geyeri*) are common. General geology consists of igneous rocks of the Tertiary Age, specifically upper Tertiary intrusive rocks and basalt flows. Soils are sandy loams with a thick organic layer and dense litter/duff from leaf fall. Lodgepole pine (*Pinus contorta*) and Douglas-fir (*Pseudotsuga menziesii*) are both present in the canopy layer, but do not dominate in any areas. Stand is mainly privately owned and the owners have no intention of impacting or developing the occurrence.

Key Environmental Factors: Key environmental factors influencing the biota of the site include elevation, natural disturbances, slope and aspect, and snow pack.

Climate Description: Climate likely follows patterns typical of this region of Colorado, being generally xeric throughout the year, with wet spring seasons and late summer "monsoons".

Biodiversity Significance Rank Comments (B4): This site is drawn for a good (B-ranked) occurrence of the state vulnerable (G3G4/S3?) community, quaking aspen (*Populus tremuloides*) / russet buffaloberry (*Shepherdia canadensis*) forest. This community type is probably more common than the global rank implies (most likely a G4 instead of a G3G4).

Natural Heritage element occurrences at the Trail Mountain at Spirit Mountain Ranch PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Populus tremuloides / Shepherdia canadensis Forest	Persistent Aspen Forests	G3G4	S3?				B	2005-09-10

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries include western portions of Trail Mountain and are drawn to encompass those environmental factors necessary to maintain species composition such as soil development, slope, and natural disturbances. Boundaries do not include all ecological processes influencing the site. Activities along adjacent slopes such as improper grazing, water diversion, clear-cutting, and development may impact site biota.

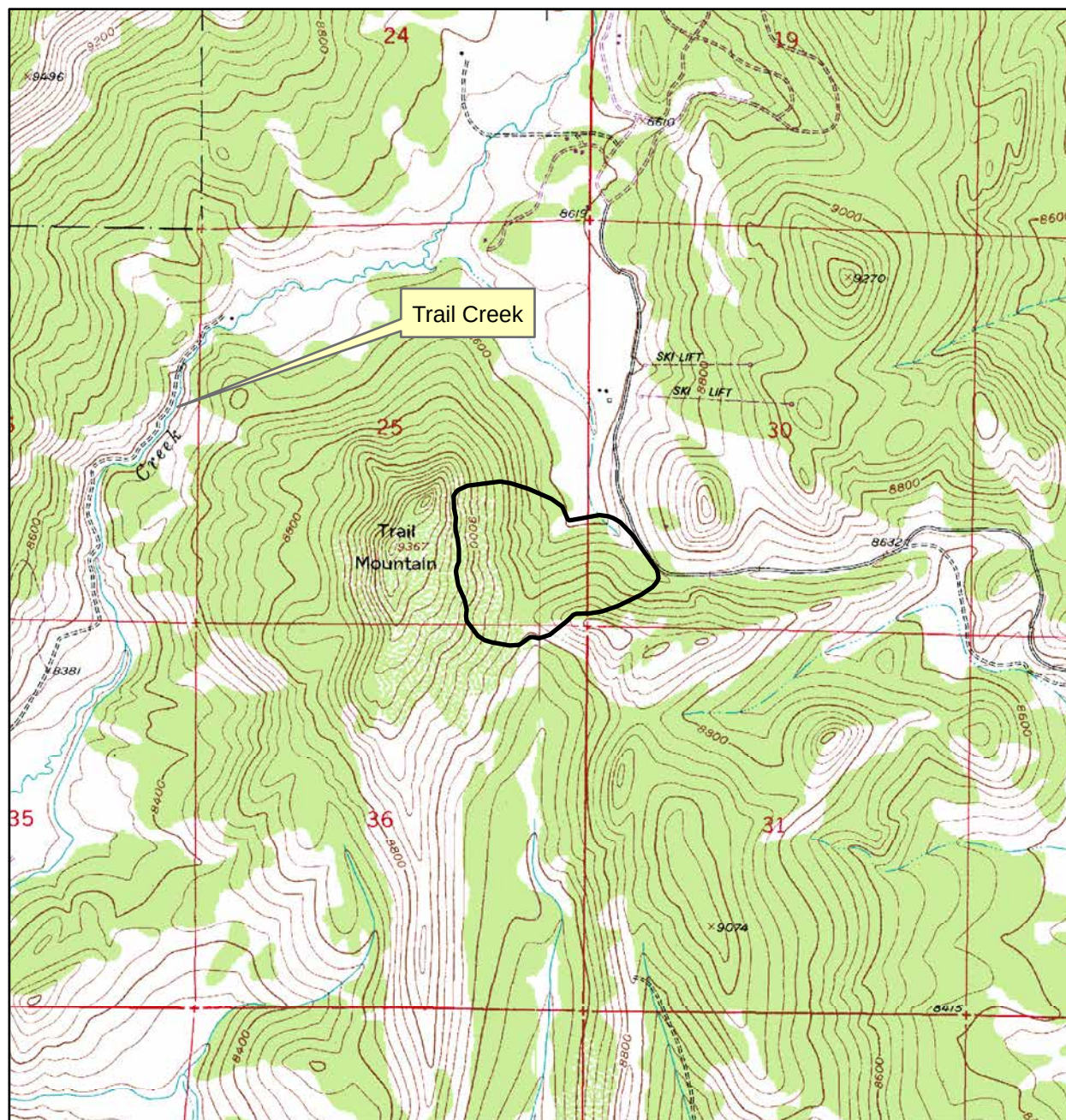
Protection Urgency Rank Comments (P4): There are no apparent or anticipated threats. Landowners have protected the land since its acquisition in the 70's and plan to maintain the forest as is with no alterations or further development.

Management Urgency Rank Comments (M5): The site currently needs no management. A few non-native species occur near the housing on the property and along edges, but they are not common within the forest.

Land Use Comments: Predominant land use is for open space and recreational use by property owners and guests.

Exotic Species Comments: Common dandelion (*Taraxacum officinale*) is present along edges of forest, but is not common within the forested areas.

Off-Site Considerations: Off-site considerations include logging of adjacent forests and beetle infestation of lodgepole pines.



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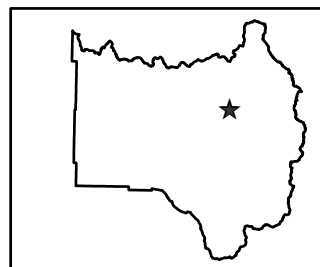


PCA Boundary

Trail Mountain, 40105-B8

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 55. Trail Mountain at Spirit Mountain Ranch Potential Conservation Area, B4:
Moderate Biodiversity Significance

West St. Louis Creek

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M5: Not Needed; No Threats Anticipated

U.S.G.S. 7.5-minute quadrangles: Bottle Pass

Size: 197 acres (80 ha)

Elevation: 9,200 - 9,275 ft. (2,804 - 2,827 m)

General Description: Site occurs along West St. Louis Creek, a second order, glaciated tributary of the Fraser River. General geology consists of unconsolidated surficial deposits and rocks of the Quaternary Age, specifically glacial drift of Pinedale and Bull lakes glaciation. Surrounding uplands are dominated by mixed lodgepole pine (*Pinus contorta*), Engelmann spruce (*Picea engelmannii*), and subalpine fir (*Abies lasiocarpa*) forests. The occurrence is confined to the creek, a small floodplain, and a few backwater sloughs. Surveyed areas are dominated by Engelmann spruce in the canopy and field horsetail (*Equisetum arvense*) in the understory. The tall shrub layer is dominated by Drummond's willow (*Salix drummondiana*) and thinleaf alder (*Alnus incana*) with a short shrub layer consisting of whortleberry (*Vaccinium* sp.). Common graminoids include bluejoint reedgrass (*Calamagrostis canadensis*) and water sedge (*Carex aquatilis*). Common forbs include sweet cicely (*Osmorhiza depauperata*), white panicle aster (*Symphyotrichum lanceolatum* ssp. *hesperium* var. *hesperium*), and subalpine fleabane (*Erigeron peregrinus*). Soils are rich loamy sands along creek edges and cobble along the creek bottom. There are no evident disturbances other than the road which appears to be stable. There is likely seasonal flooding along both drainages which helps to maintain soil moisture and species composition.

Key Environmental Factors: Key environmental factors driving element composition include snow pack and spring flooding, perennial surface flows, and gentle sloping providing perennial soil saturation.

Climate Description: Area likely follows climate patterns typical for Colorado being generally xeric, with wet spring seasons and late summer "monsoons".

Land Use History: Historical land uses include mining and removal of surface water for aqueducts for agricultural and municipal water supplies along Front Range sites.

Biodiversity Significance Rank Comments (B4): Site is drawn for a good (B-ranked) occurrence of a state rare (G4/S2) community, Engelmann spruce / field horsetail (*Picea engelmannii* / *Equisetum arvense*).

Natural Heritage element occurrences at the West St. Louis Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Picea engelmannii / Equisetum arvense Forest	Coniferous Wetland Forests	G4	S2				B	2005-09-13

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Boundaries are drawn to encompass portions of West St. Louis Creek and Deadhorse Creek. Boundaries include adjacent buffered uplands and ecological processes important to site hydrology, including seasonal flooding and backwater sloughs. However, not all ecological processes are included within the boundary. Activities upstream such as water diversion or logging could negatively impact the site.

Protection Urgency Rank Comments (P4): Site is contained within the Fraser Experimental Forest and is protected for USFS research purposes and some recreational activity.

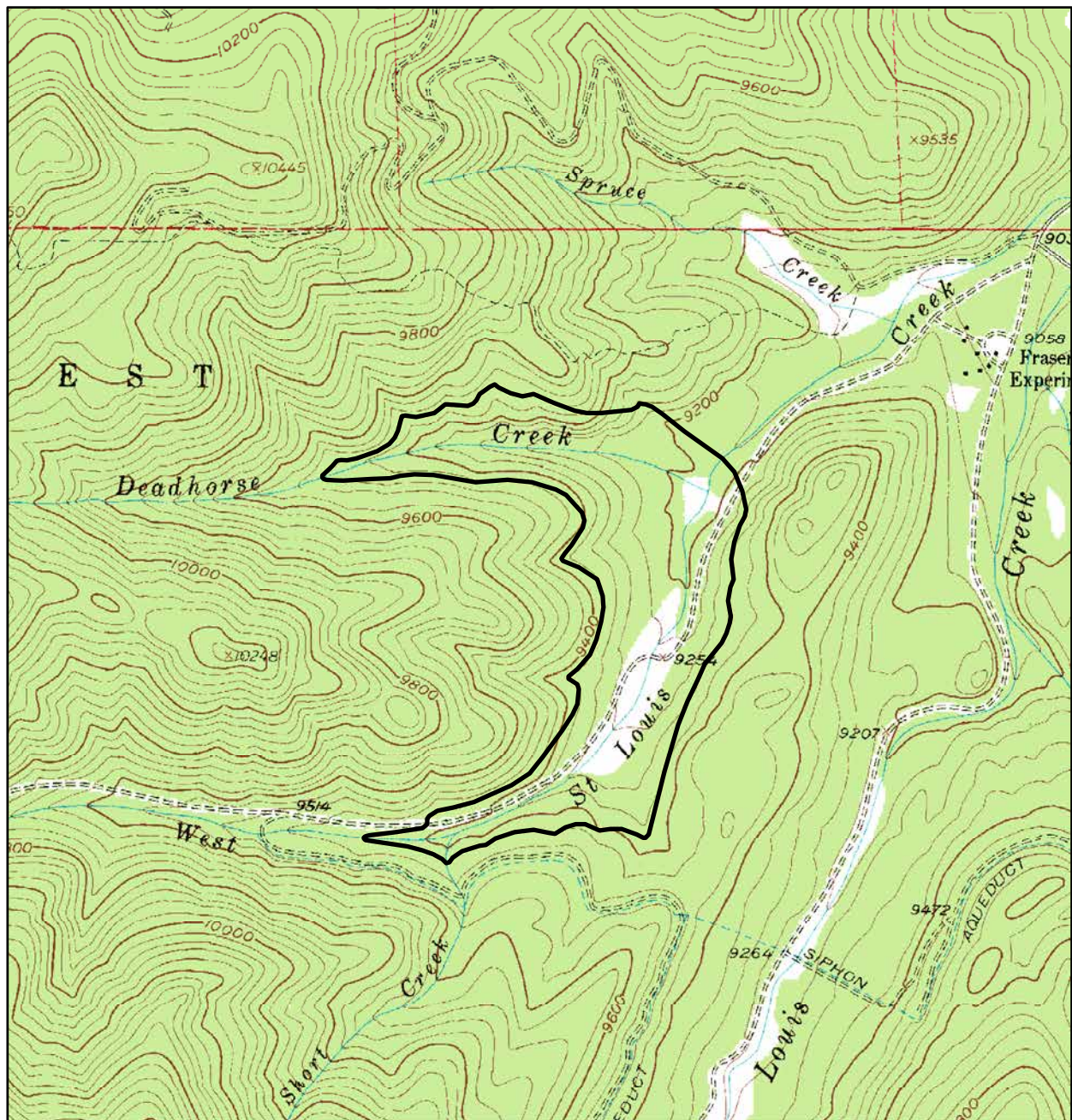
Management Urgency Rank Comments (M5): There is no management needed at this time. Due to its status within the Fraser Experimental Forest, the area sees little use from the public. There is the potential for weedy species invasion along the adjacent roadway.

Land Use Comments: Land use includes USFS research such as hydrologic monitoring and snow pack studies and recreation by bikers, hikers, and backpackers.

Natural Hazard Comments: Spring flooding may be hazardous to road travel along the drainage and adjacent slopes may be subject to avalanche danger.

Exotic Species Comments: Common dandelion (*Taraxacum officinale*) is present throughout, but does not seem to heavily impact native species distribution. Virginia strawberry (*Fragaria virginiana*) is sometimes considered an increaser species whose abundance is related to disturbance.

Off-Site Considerations: Off-site considerations include roads adjacent to both drainages which may add sediment and may act as a conduit for non-native species.



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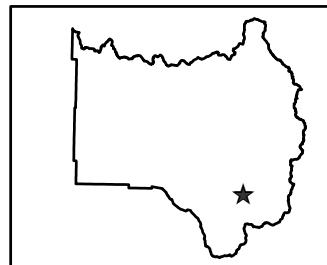
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 PCA Boundary

Bottle Pass, 39105-H8

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 56. West St. Louis Creek Potential Conservation Area, B4: Moderate Biodiversity Significance

Pioneer Park Site of Local Significance

Name: Pioneer Park

Location: Site is located along the Colorado River just northwest of the town of Hot Sulphur Springs before the river enters Byers Canyon.

USGS 7.5 minute quadrangle: Hot Sulphur Springs

Size: Approximately 5 acres

Elevation: 7,600 ft.

General Description: The Colorado River is the principal drainage of the southwestern US, impacting Colorado, Wyoming, Utah, New Mexico, Arizona, Nevada, California, and Mexico. The Colorado River is a very important resource of water for agriculture and municipal supplies throughout these areas. The river has been altered considerably from its natural state prior to the settlement of agricultural and sedentary cultures. Because of the importance of this river, the maintenance of its remaining natural areas and sites near the headwaters are very important to its overall health.

The Pioneer Park area has been used extensively since the site's first settlement by humans up to the present day. This use has brought about changes in habitat, species composition, and water movement. Natural areas along the Upper Colorado watershed are very important to habitat connectivity as a riparian corridor, maintenance of riparian areas for bank stability and energy dissipation, and general river health.

The Pioneer Park natural area has great potential as an outdoor learning and recreational center as well as an important wildlife and bird habitat for the area in light of recent restoration projects and current interest by managers and area locals. Past bank stabilization projects along upper reaches appear to be stable and revegetating with many native species. The current stream restoration project being managed by Grand Environmental is focusing on areas near the bridge that have been channelized by past development. The project is revitalizing this area of the river by stabilizing banks, rerouting the stream, revegetating with native species, and creating habitat for fish, wildlife, birds, and invertebrates.

The canopy of the site is dominated by a mature, healthy stand of narrowleaf cottonwood (*Populus angustifolia*) which is present along the entire reach of the river and its backwater areas. The understory is dominated by a mixed tall shrub strata of thinleaf alder (*Alnus incana* ssp. *tenuifolia*), whiplash willow (*Salix lucida* ssp. *caudata*), Booth's willow (*Salix boothii*), Bebb's willow (*Salix bebbiana*), and mountain willow (*Salix monticola*). The herbaceous strata is variable throughout with some areas being dominated entirely by invasive species such as orchardgrass (*Dactylis glomerata*), smooth brome (*Bromus inermis*), and Kentucky bluegrass (*Poa pratensis*). Other exotic species found include curly dock (*Rumex crispus*), Canada thistle (*Cirsium arvense*), and timothy (*Phleum pratense*). Native graminoid species present include beaked sedge

(*Carex utriculata*), bluejoint reedgrass (*Calamagrostis canadensis*), Baltic rush (*Juncus balticus*), and common spikerush (*Eleocharis palustris*). Other shrub and forb species present include Wood's rose (*Rosa woodsii*), meadowrue (*Thalictrum* sp.), Canada goldenrod (*Solidago canadensis*), and mountain goldenbanner (*Thermopsis montana*).

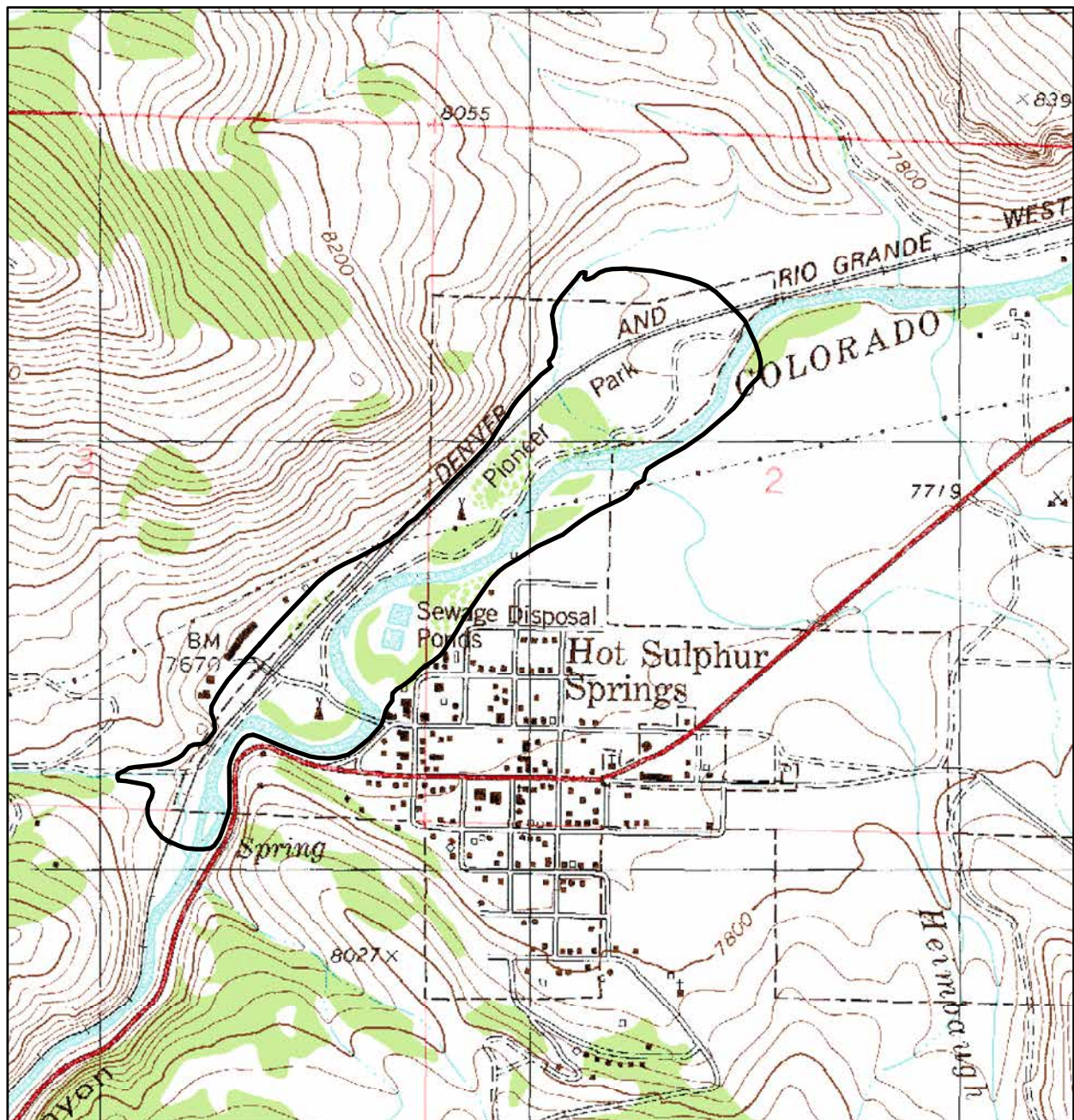
Protection Comments: Site is protected as a State Wildlife Area.

Management Comments: Site is managed by the Town of Hot Sulphur Springs and the Colorado Division of Wildlife as a State Wildlife Area. Predominant uses of the area are for recreation including fishing, camping, and hiking, as well the site contains a frisbee golf course at its eastern end. Past use has severely impacted species composition and bank stability along the river.

Soils Description: Soils along the banks of the river are composed of cobbles of small, medium, and large size over silts and sands. Backwater slough areas contain moderate amounts of accumulated organic matter.

Restoration Potential: Due to past use of the area, non-native species are prevalent throughout. Some exotic species control measures may be necessary if the site is to reach its potential natural community. Alteration of activities such as routing of foot traffic along banks and confining camping and parking to specified areas may significantly improve the site and allow for the natural succession of native species.

During the summer of 2004, a restoration project at Pioneer Park conducted by the Volunteers for Outdoor Colorado and Headwaters Trails Alliance focused on trail and bank restoration. During this past summer, 2005, Grand Environmental was hired for a large scale stream restoration project which focused on the restructuring of river flows near the bridge crossing back to more natural flows. The project also involved the construction of wildlife habitats such as log jams, planting of native species along denuded areas, and bank stabilization.



0 0.125 0.25 0.5 0.75 Miles



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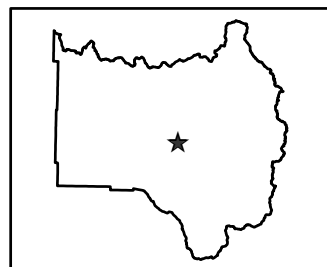
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 SLS Boundary

Hot Sulphur Springs, 40106-A1

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 57. Pioneer Park Site of Local Significance

East Inlet of Grand Lake Site of Local Significance

Location: Site is located along the eastern shore of Grand Lake at the mouth of the East Inlet drainage. Area is also the western portal of Rocky Mountain National Park.

USGS 7.5 minute quadrangle: Shadow Mountain

Size: Approximately 160 acres

Elevation: 8400 ft.

General Description: Grand Lake is Colorado's largest natural lake and a very important water source for agricultural and municipal water supplies along the Front Range. Water from the lake and adjacent reservoirs, Lake Granby and Shadow Mountain, is tunneled 13 miles through the continental divide in Rocky Mountain National Park to Front Range communities. This complex of lakes and reservoirs is an important part of the Big Thompson Project which diverts some 260,000 acre-feet of water from the Colorado River headwaters to the eastern slope (Bureau of Reclamation, 2005).

Grand Lake formed by the natural damming action of lateral and terminal moraines created by the recession of the Kawaneetchee Valley and Paradise Creek glaciers (Chronic, 2002). General geology of the area consists of metamorphic rocks of the Cambrian Age (Tweto, 1975). Water sources for the lake include the Echo Creek, East Inlet, North Inlet, and Paradise Creek drainages which are predominantly fed by snow pack draining from the eastern peaks of the continental divide.

The East Inlet site occurs as a large open wetland along the eastern shore of Grand Lake. Hydrology is variable throughout with areas of open water and inundated to mesic soils. Site was formerly protected by dunes formed by the oscillation of lake waters, which have been flattened for development, but can still be evidenced by the deposition of sands along the shore. Water table of wetland is perched approximately 6-10 feet above the level of the lake apparently due to beaver activities.

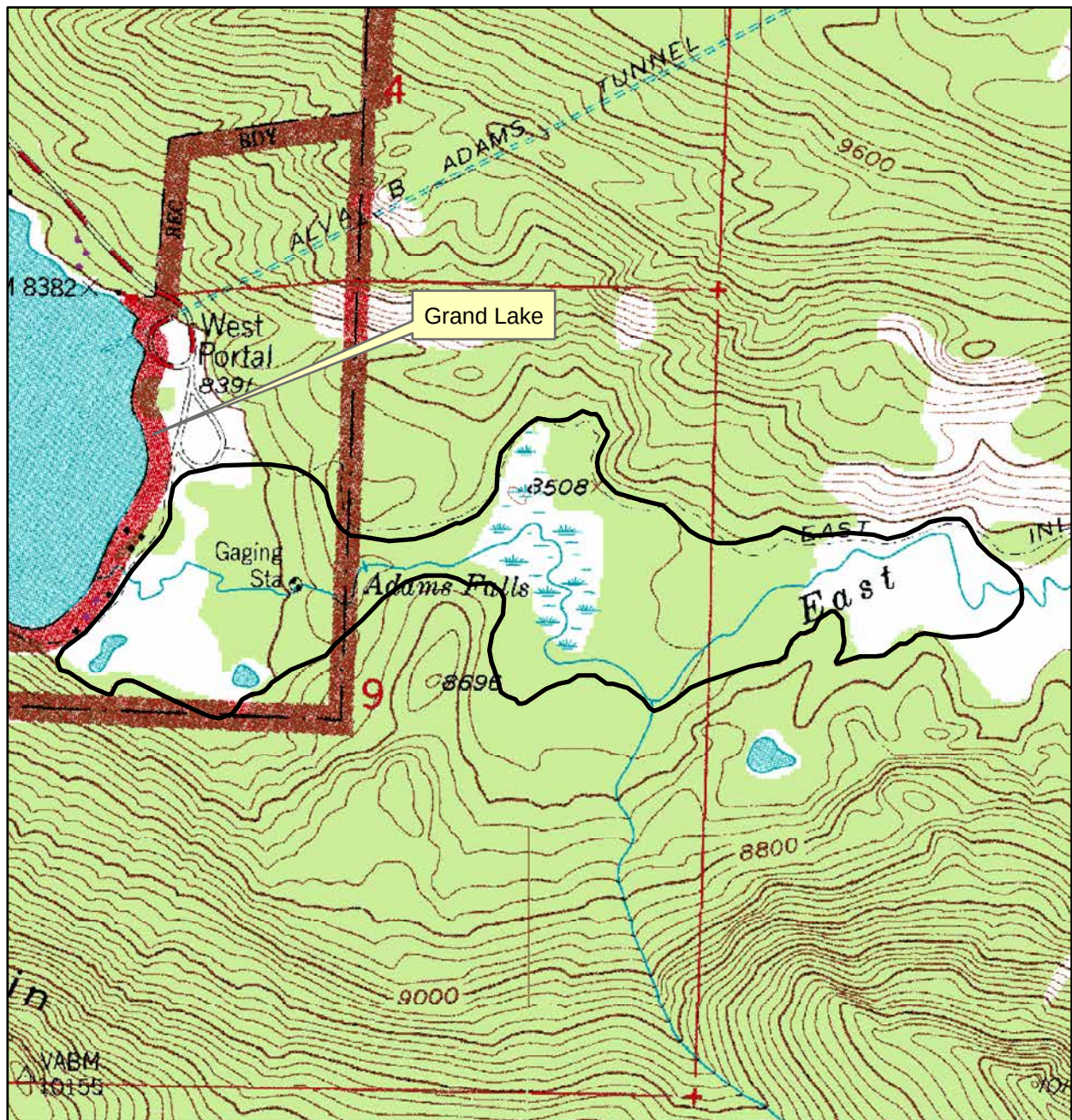
Site vegetation varies along the soil moisture gradient and along a soil organic content composition gradient. Yellow pond-lily (*Nuphar lutea*) and pondweed (*Potamogeton* sp.) occur in areas of open water. Inundated soils and pond edges are dominated by mesic graminoids such as beaked sedge (*Carex utriculata*), water sedge (*Carex aquatilis*), and small floating mannagrass (*Glyceria borealis*). Forbs present at this gradient include salt spring checkerbloom (*Sidalcea neomexicana*) and speedwell (*Veronica* sp.). Mesic and seasonally saturated soils support a mixed shrub layer of Geyer's willow (*Salix geyeriana*), diamondleaf willow (*Salix planifolia*), and dwarf birch (*Betula nana*) with an herbaceous understory of beaked sedge, water sedge, bluejoint reedgrass (*Calamagrostis canadensis*), largeleaf avens (*Geum macrophyllum*), fewflowered meadow-rue (*Thalictrum sparsiflorum*), and starwort (*Stellaria* sp.). Canopy species, Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) are dispersed throughout the wetland along higher ground. Kentucky bluegrass (*Poa pratensis*) is the only exotic

species found at the site, but there is a potential for invasion due to proximity to parking, roads, and trails leading into the park. Hydrology is unaltered and site is pristine. Wetland is an excellent habitat for cervids of our area, waterfowl, beaver, invertebrates, and amphibians.

Protection Comments: This area of the lake is restricted to boat access only with no roads leading into the area. Site is privately owned by multiple parties with one area of disputed ownership. Currently the site is under evaluation for a conservation easement and may be sold to the National Park Service in the future. Surrounding lands are protected as part of Rocky Mountain National Park.

Management Comments: Site does not see extensive use due to accessibility and ownership. As well, soils are mesic to saturated throughout and cannot be utilized for development. There are no current management needs.

Soils Description: Soil organic content varies throughout the site with areas of high fibric peat content and fen soils. Areas of mineral soils exhibit some mottling and oxidized root channels. Mineral soils have high clay content.



0 0.1 0.2 0.4 0.6 Miles



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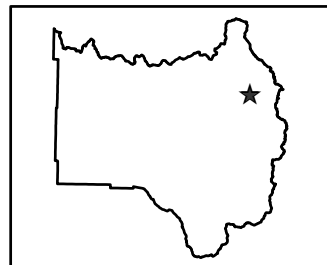
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 SLS Boundary

Shadow Mountain, 40105-B7

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 58. East Inlet Site of Local Significance

Tomlinson Park Site of Local Significance

Location: Tomlinson Park is located east of Highway 34 (Trail Ridge Road), 0.5 miles north of the intersection of Highway 34 and CO 278.

U.S.G.S. 7.5 minute quadrangle: Grand Lake

Size: Approximately 8 acres

Elevation: 8,600 ft.

General Description: Tomlinson Park is located along a stretch of Columbine Creek after it crosses Highway 34. The majority of the Park is dominated by riparian-shrub wetlands associated with Columbine Creek. The shrubs in the riparian area are dominated by Geyer willows (*Salix geyeriana*) and mountain willow (*Salix monticola*). Whiplash willow (*Salix lasiandra*) occurs infrequently in the wetter areas. The drier portions of the riparian area understory consists of blue joint reedgrass (*Calamagrostis canadensis*) and smooth brome (*Bromus inermis*), and beaked sedge (*Carex utriculata*) dominates the wetter portions. The steep hillside rises abruptly along the northern edge. The lodgepole pine (*Pinus contorta*) forest dominates with an understory of russet buffalo berry (*Shepherdia argentea*), common juniper (*Juniperus communis*), Geyer sedge (*Carex geyeri*), and bearberry (*Arctostaphylos uva-ursi*).

Protection Comments:

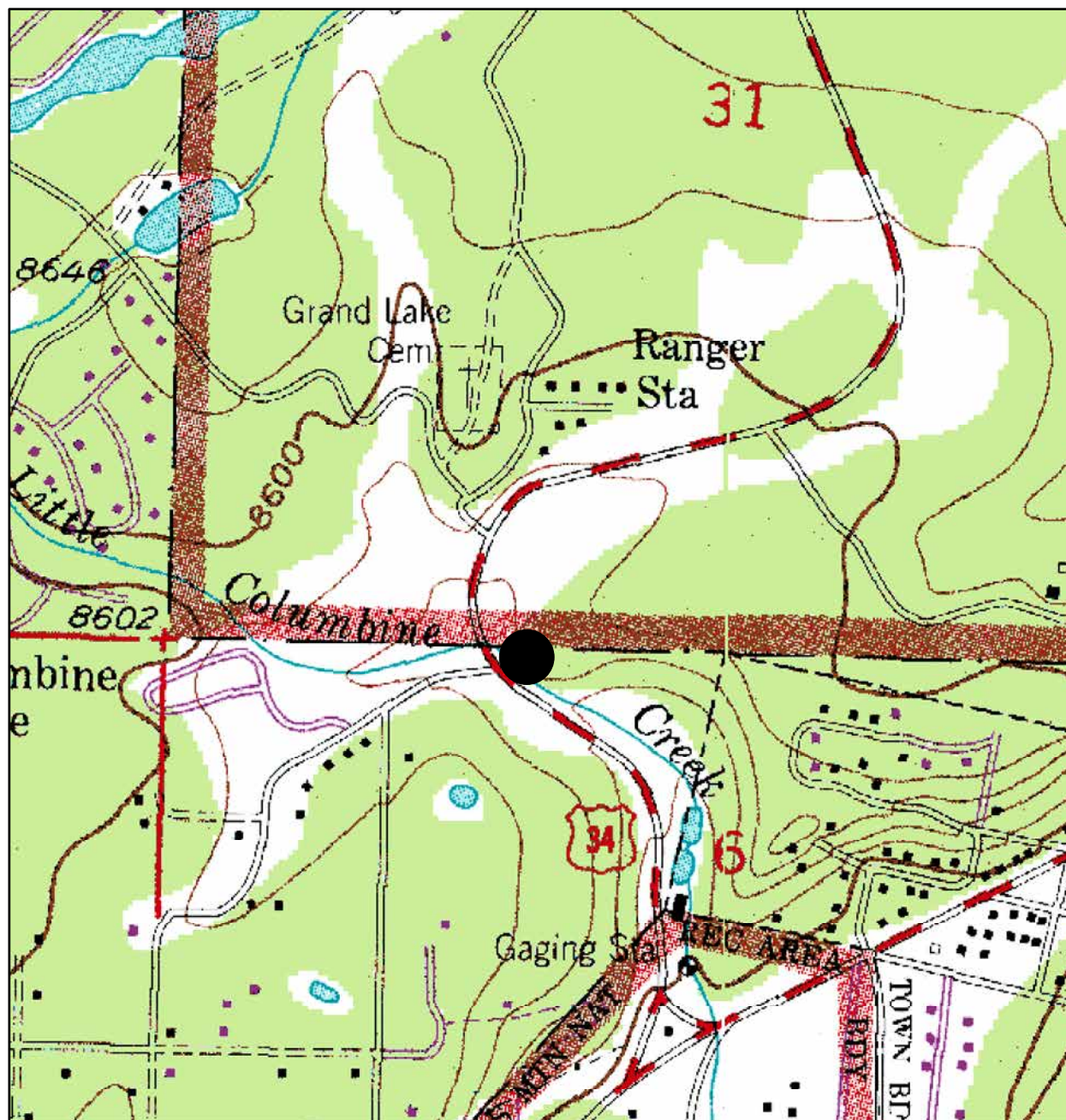
Tomlinson Park is owned by the Town of Grand Lake and is used primarily for open space and access path for pedestrians, horses, and snowmobiles. Separate private properties border the park.

Management Comments:

The Town has placed wood chips on the trail that has slowed erosion, however it is likely that more chips will be needed with increase traffic. Canada thistle (*Cirsium arvense*) was observed along the trail and creek in minor amounts. It is recommended to control this population before it spreads.

Restoration Potential:

The riparian section currently needs little restoration, however if traffic increases on the trail, steps will be needed to prevent sedimentation from erosion.



0 0.1 0.2 0.4 Miles



Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

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Map Date: 05/04/2006

Legend

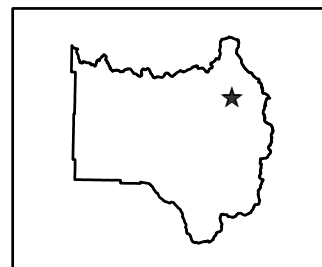


SLS Boundary

Grand Lake, 40105-C7

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Grand County



Map 59. Tomlinson Park Site of Local Significance

PLANT COMMUNITIES ABSTRACTS

(adapted from Carsey et al. 2003)

Alnus incana - *Salix drummondiana*



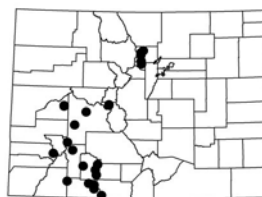
Global rank/State rank:

G3 / S3

HGM subclass: R2, R3/4

Colorado elevation range:

7,300-9,700 ft (2,200-
3,000m)



General Description

Alnus incana-*Salix drummondiana* (thinleaf alder-Drummond willow) is a relatively common plant association on the Western Slope. The association is generally found along steep-gradient streams with stable, shaded stream banks. This association occurs in the Gunnison, Arkansas, and St. Vrain River Basins and the San Juan and Rio Grande National Forests.

This association occurs along very steep, fast-moving streams in sheer-walled, confined canyons. It also occurs along or within the active channel of moderately to slightly entrenched channels in wider valleys. Stream channels are steep and rocky, less steep with limited floodplains and gravel and cobble bottoms, or wide and sinuous. Soils of this association are highly variable, but most are stratified alluvium with buried A horizons. Stands with a rich, herbaceous undergrowth have a thick layer, 5-10 inches (10-30 cm), of fine sandy loam and sandy clay loam over a coarse alluvial deposit. Stands with little shrub cover and herbaceous growth have coarse, skeletal soils without an accumulated fine layer at the surface.

Vegetation Description

This plant association is characterized by a dense, closed canopy of *Alnus incana* (thinleaf alder) and *Salix drummondiana* (Drummond willow) bordering the stream. Other willows that may be present include *Salix monticola* (mountain willow), *S. boothii* (Booth willow), *S. exigua* (sandbar willow), *S. lucida* (ssp. *caudata* or ssp. *lasiandra*) (shining willow), and *S. geyeriana* (Geyer willow). Other shrubs occasionally present include *Lonicera involucrata* (twinberry honeysuckle), *Ribes inerme* (whitestem gooseberry), *Cornus sericea* (red-osier dogwood), *Rosa woodsii* (Woods rose),

Amelanchier utahensis (Utah serviceberry), *Acer glabrum* (Rocky Mountain maple), *Symphoricarpos oreophilus* (mountain snowberry), and *Ribes montigenum* (gooseberry currant).

Some stands have a rich herbaceous understory that includes *Oxypolis fendleri* (Fendler cowbane), *Heracleum maximum* (common cowparsnip), *Equisetum pratense* (field horsetail), *Mertensia ciliata* (tall fringed bluebells) *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), and *Angelica ampla* (giant angelica). In some stands, the herbaceous undergrowth is sparse (less than 10% cover) due to shading and flood-scouring.

Ecological Processes

The *Alnus incana*-*Salix drummondiana* (thinleaf alder-Drummond willow) plant association is an early to midseral community restricted to stream margins, rarely forming large, extensive stands. Both species are prolific seed producers and are the first to colonize coarse-textured cobble bars and recently scoured alluvial surfaces. When young, these shrubs are flexible, can tolerate most flood events, and readily resprout. With time, *Salix drummondiana* may become more abundant by taking advantage of the nitrogen-rich soils associated with *Alnus incana*.

Avg. Cover %	(Range)	Species Name	# Plots (N=22)
46	(14-98%)	<i>Alnus incana</i>	22
27	(7-60%)	<i>Salix drummondiana</i>	22
13	(2-70%)	<i>Heracleum maximum</i>	13
11	(2-30%)	<i>Carex utriculata</i>	4
10	(1-43%)	<i>Salix monticola</i>	12
9	(1-30%)	<i>Calamagrostis canadensis</i>	13
8	(1-30%)	<i>Equisetum arvense</i>	10
7	(1-23%)	<i>Picea pungens</i>	7
6	(1-25%)	<i>Salix lucida</i> ssp. <i>caudata</i> , <i>lasiandra</i>	6
6	(1-20%)	<i>Lonicera involucrata</i>	11
6	(1-16%)	<i>Equisetum pratense</i>	5
6	(1-10%)	<i>Geranium richardsonii</i>	9
5	(1-15%)	<i>Mertensia ciliata</i>	14
5	(1-11%)	<i>Abies lasiocarpa</i>	4
5	(1-10%)	<i>Poa pratensis</i>	10

Other species with < 5% average cover present in at least 10% of plots:

Cardamine cordifolia (1-11%), *Rudbeckia laciniata* var. *ampla* (1-10%), *Taraxacum officinale* (1-13%), *Salix bebbiana* (3-7%), *Picea engelmannii* (0.1-10%), *Cornus sericea* (1-10%), *Ribes inerme* (1-6%), *Oxypolis fendleri* (0.1-14%), *Carex microptera* (1-9%), *Fragaria vesca* ssp. *bracteata* (1-8%), *Thalictrum fendleri* (1-5%), *Rubus idaeus* ssp. *strigosus* (1-5%), *Mertensia franciscana* (1-6%), *Achillea millefolium* var. *occidentalis* (1-8%), *Fragaria virginiana* ssp. *glauca* (1-10%), *Viola canadensis* var. *scopulorum* (1-4%), *Osmorhiza depauperata* (1-3%), *Galium triflorum* (1-3%), *Senecio triangularis* (1-5%), *Geum macrophyllum* var. *perincisum* (0.1-4%), *Galium boreale* (1-5%), *Conioselinum scopulorum* (0.1-4%), *Chamerion angustifolium* ssp. *circumvagum* (1-2%), *Luzula parviflora* (0.1-4%), *Maianthemum stellatum* (1-2%), *Rosa woodsii* (1%).

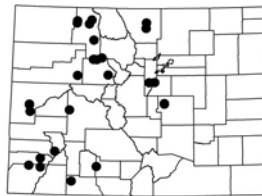
Alnus incana - *Cornus sericea*



Global rank/State rank:
G3G4/ S3

HGM subclass: R3/4

Colorado elevation range:
5600-9,000 ft (1,700-2,750 m)



General Description

The *Alnus incana*-*Cornus sericea* (thinleaf alder-red-osier dogwood) plant association is a narrow thicket of medium to tall shrubs lining the stream bank. Due to heavy shading, there is usually a limited herbaceous understory.

This plant association occurs on narrow, rocky banks and benches of small channels as well as narrow, constricted reaches of larger rivers. It can also occur along overflow channels and narrow tributaries. Stream channels are steep and narrow, wider and moderately sinuous, or wider and highly sinuous. Soils range from loamy sand to sandy clay loam. Mottling is evident at approximately 12 inches (30 cm) and gravel or cobble layers appear at 20-40 inches (50-100 cm) beneath the surface.

Vegetation Description

This plant association is characterized by a dense thicket of shrubs dominated by *Alnus incana* (thinleaf alder) and *Cornus sericea* (red-osier dogwood). *Salix exigua* (sandbar willow) is often present. A wide variety of other shrub species may be present, including *Salix bebbiana* (Bebb willow), *Salix ligulifolia* (strapleaf willow), *Salix lucida* (ssp. *caudata* or ssp. *lasianдра*) (shining willow), *Salix monticola* (mountain willow), *Lonicera involucrata* (twinberry honeysuckle), *Rosa woodsii* (Woods rose), *Betula occidentalis* (river birch), and *Rubus idaeus* (American red raspberry). Tree species are scattered and only occasionally present.

Forb cover is highly variable depending on the amount of light that penetrates the canopy. Forb species include *Rudbeckia laciniata* (cutleaf coneflower), *Heracleum maximum* (common cowparsnip), *Maianthemum stellatum* (starry false Solomon seal), *Osmorhiza depauperata* (bluntseed sweetroot) and *Ligusticum porteri* (Porter licoriceroot). Graminoid cover is usually low, but can include *Poa pratensis* (Kentucky bluegrass). *Equisetum arvense* (field horsetail) is sometimes present.

Ecological Processes

Alnus incana (thinleaf alder) is a long-lived, early-seral species. It is one of the first species to establish on fluvial or glacial deposits as well as the spoils of placer mining. After establishment, young stands of *Alnus* are continually flooded. As stands mature, the stems can slow flood waters and trap sediment. Fine-textured sediments accumulate on top of the coarser alluvial material and the land surface eventually rises above annual flood levels. Flooding is then less frequent and soils begin to develop. *Alnus incana* is shade-intolerant, and many mature stands in Colorado are restricted to stream bank edges, possibly because these are the only sites where light can penetrate the neighboring overstory canopy.

In Colorado, the *Alnus incana*-*Cornus sericea* (thinleaf alder-red-osier dogwood) plant association is tolerant of flooding and requires a high water table each spring. It appears to be a stable, long-lived association where succession to other types can be very slow.

Avg. Cover %	(Range)	Species Name	# Plots (N=25)
47	(1-100%)	<i>Alnus incana</i>	25
35	(5-83%)	<i>Cornus sericea</i> ssp. <i>sericea</i>	25
31	(8-70%)	<i>Salix bebbiana</i>	3
11	(3-20%)	<i>Betula occidentalis</i>	6
10	(1-20%)	<i>Salix drummondiana</i>	4
10	(1-33%)	<i>Juniperus scopulorum</i>	4
10	(3-30%)	<i>Salix ligulifolia</i>	7
9	(1-30%)	<i>Rudbeckia laciniata</i> var. <i>ampla</i>	14
8	(1-20%)	<i>Lonicera involucrata</i>	10
8	(0.1-30%)	<i>Heracleum maximum</i>	15
7	(1-20%)	<i>Salix monticola</i>	7
7	(1-45%)	<i>Poa pratensis</i>	11
6	(1-25%)	<i>Calamagrostis canadensis</i>	8
6	(1-20%)	<i>Rubus idaeus</i> ssp. <i>strigosus</i>	8
5	(1-20%)	<i>Rosa woodsii</i>	18

Other species with < 5% average cover present in at least 10% of plots:

Carex pellita (1-10%), *Ribes inerme* (1-10%), *Populus angustifolia* (1-13%), *Salix exigua* (1-10%), *Agrostis gigantea* (0.1-10%), *Equisetum pratense* (2-7%), *Osmorhiza depauperata* (1-10%), *Poa palustris* (1-5%), *Urtica dioica* ssp. *gracilis* (1-5%), *Equisetum arvense* (0.1-10%), *Solidago gigantea* (1-9%), *Symphoricarpos oreophilus* (1-5%), *Maianthemum stellatum* (1-10%), *Aconitum columbianum* (1-5%), *Actaea rubra* ssp. *arguta* (1-5%), *Streptopus amplexifolius* var. *chalcidatus* (1-3%), *Glyceria striata* (1-5%), *Rhus trilobata* var. *trilobata* (1-3%), *Geranium richardsonii* (1-3%), *Amelanchier alnifolia* (1-3%), *Ligusticum porteri* (1-3%), *Prunus virginiana* var. *melanocarpa* (1-3%), *Amelanchier utahensis* (1-3%), *Geum macrophyllum* var. *perincisum* (0.1-5%), *Elymus glaucus* (1-3%), *Mentha arvensis* (1-2%), *Mertensia ciliata* (1-2%), *Taraxacum officinale* (1-2%), *Achillea millefolium* var. *occidentalis* (1%), *Fragaria virginiana* ssp. *glaucula* (1%), *Cardamine cordifolia* (1%), *Chamerion angustifolium* ssp. *circumvagum* (1%), *Phleum pratense* (1%).

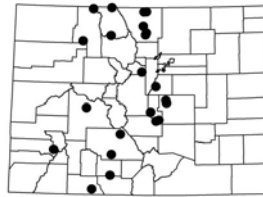
***Alnus incana* / Mesic forbs**



Global rank/State rank:
G3 / S3

HGM subclass: R2, R3/4

Colorado elevation range:
5,800-9,600 ft (1,750-2,930 m)



General Description

This association is characterized by stands of medium-tall, deciduous shrubs and a thick, herbaceous undergrowth of forbs and wetland grasses. A low canopy of shorter shrubs may also be present with *Ribes* (currant) and *Salix* (willow) species and *Cornus sericea* (red-osier dogwood). Undisturbed stands have abundant forbs and native grasses. Stands disturbed by season-long livestock grazing have reduced forb cover and an increase in non-native grasses including *Poa pratensis* (Kentucky bluegrass) and *Agrostis stolonifera* (creeping bentgrass). Large stands (>0.5 acre, 0.2 ha) with the native herbaceous undergrowth intact are uncommon.

This plant association occurs along narrow, 130-230 ft (40-70 m) wide, alluvial benches and terraces of canyons and valleys. It also occurs as narrow bands in wider valleys and occasionally forms a wide band on the floodplain. Stream channels are highly variable. They can be steep (3-12%) gradient and narrow or wider, rocky, and moderately sinuous. Occasionally, stream channels are low gradient and highly sinuous, narrow and highly sinuous, or braided. Soils are well drained silt loams, loams, sandy clay loams, sandy loams, or just sand. Some profiles have a high percentage of organic matter and are either skeletal or stratified with skeletal layers. Some profiles have significant silt fractions in the upper layers.

Vegetation Description

Alnus incana (thinleaf alder) creates a dense, tall shrub canopy. Other shrubs occasionally present include *Lonicera involucrata* (twinberry honeysuckle), *Ribes inerme* (whitestem gooseberry), *R. montigenum* (gooseberry currant) *Rosa woodsii* (Woods rose), *Salix bebbiana* (Bebb willow), *S. drummondiana* (Drummond willow), *S. geyeriana* (Geyer willow), *S. lucida* ssp. *caudata* (shining willow) and *S. monticola* (mountain willow). A few trees, including *Picea engelmannii* (Engelmann spruce), *Populus tremuloides* (quaking aspen), and *Populus angustifolia* (narrowleaf cottonwood) may be present along the edges of the stand.

The ground is generally very wet and covered with tall, 3-7 ft (1-2 m), forbs and graminoids. Forb cover is high in undisturbed stands, with total cover often exceeding 60%. Dominant forb species include *Heracleum maximum* (common cowparsnip), *Angelica ampla* (giant angelica), *Aconitum columbianum* (Columbian monkshood), *Mertensia ciliata* (tall fringed bluebells), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Viola canadensis* var. *scopulorum* (Canada white violet) and *Streptopus amplexifolius* (claspleaf twistedstalk). Graminoid species include *Glyceria striata* (fowl mannagrass), *Calamagrostis canadensis* (bluejoint reedgrass), *Carex microptera* (smallwing sedge), and *C. utriculata* (beaked sedge). A dense ground cover also includes *Equisetum arvense* (field horsetail), *Equisetum hyemale* (scouringrush horsetail) and *Equisetum pratense* (meadow horsetail).

Ecological Processes

Alnus incana (thinleaf alder) is a long-lived, early-seral species. It is one of the first species to establish on fluvial or glacial deposits as well as the spoils of placer mining. After establishment, young stands of *Alnus incana* are continually flooded. As stands mature, the stems can slow flood waters and trap sediment. Fine-textured sediments accumulate on top of the coarser alluvial material and the land surface eventually rises above annual flood levels. Flooding is then less frequent and soils begin to develop.

Avg. Cover %	(Range)	Species Name	# Plots (N=56)
56	(10-98%)	<i>Alnus incana</i>	56
14	(0.1-70%)	<i>Heracleum maximum</i>	42
12	(1-70%)	<i>Aconitum columbianum</i>	27
9	(0.1-18%)	<i>Picea engelmannii</i>	14
8	(1-62.5%)	<i>Senecio triangularis</i>	27
7	(1-40%)	<i>Mertensia ciliata</i>	40
7	(1-20%)	<i>Salix drummondiana</i>	15
7	(1-20%)	<i>Rudbeckia laciniata</i> var. <i>ampla</i>	13
7	(1-20%)	<i>Populus tremuloides</i>	14
7	(1-18%)	<i>Salix geyeriana</i>	8
7	(1-70%)	<i>Rosa woodsii</i>	14
6	(1-30%)	<i>Ribes inerme</i>	12
6	(1-32%)	<i>Salix lucida</i> ssp. <i>caudata</i> , <i>lasiandra</i>	11
6	(1-30%)	<i>Lonicera involucrata</i>	25
6	(1-16%)	<i>Salix monticola</i>	13
6	(1-30%)	<i>Equisetum arvense</i>	39
5	(1-25%)	<i>Cardamine cordifolia</i>	21
5	(1-13%)	<i>Urtica dioica</i> ssp. <i>gracilis</i>	13
5	(1-20%)	<i>Calamagrostis canadensis</i>	31
5	(1-11%)	<i>Salix bebbiana</i>	7

Other species with < 5% average cover present in at least 10% of plots:

Maianthemum stellatum (0.1-27%), *Glyceria striata* (0.1-15%), *Geranium richardsonii* (1-15%), *Elymus glaucus* (1-10%), *Mentha arvensis* (1-14%), *Oxypolis fendleri* (1-37.5%), *Rubus idaeus* ssp. *strigosus* (1-15%), *Carex utriculata* (1-6%), *Poa pratensis* (1-12%), *Streptopus amplexifolius* var. *chalazatus* (0.1-10%), *Saxifraga odontoloma* (1-5%), *Taraxacum officinale* (1-13%), *Conioselinum scopulorum* (1-10%), *Abies lasiocarpa* (1-6%), *Arnica cordifolia* (1-11%), *Mitella pentandra* (1-6%), *Galium boreale* (1-10%), *Carex aquatilis* (1-5%), *Galium triflorum* (1-5%), *Osmorhiza depauperata* (1-5%), *Thalictrum fendleri* (1-5%), *Achillea millefolium* var. *occidentalis* (1-8%), *Actaea rubra* ssp. *arguta* (1-5%), *Phleum pratense* (0.1-10%), *Bromus inermis* (1-5%), *Fragaria virginiana* ssp. *glauca* (1-3%), *Geum macrophyllum* var. *perincisum* (0.1-3%), *Carex microptera* (1-3%), *Chamerion angustifolium* ssp. *circumvagum* (1%).

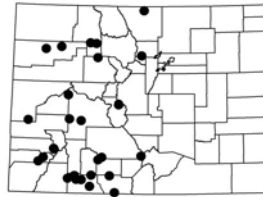
***Alnus incana* - *Salix* (*monticola*, *lucida*, *ligulifolia*)**



Global rank/State rank:
G3 / S3

HGM subclass: R3/4

Colorado elevation range:
5,600-9,600 ft (1,700-2,930
m)



General Description

The *Alnus incana*/*Salix* (*monticola*, *lucida*, *ligulifolia*) (thinleaf alder/mixed willow species) plant association is a more general type than other *Alnus incana* types. It has a high diversity of associated shrub species, unlike the nearly pure stands of alder found in other *Alnus incana* dominated plant associations. The abundance of other shrubs may represent a transition in the physical setting, for example, from a broad floodplain dominated by *Salix* to a narrow valley bottom and channel lined with only *Alnus incana* (thinleaf alder).

This association occurs along narrow, moderately steep streams (30-65 ft (10-20 m) wide with a gradient of 3-10%) and in moderately wide to wide river valleys on cobble point bars, islands, flat alluvial benches, and large alluvial floodplains. Stream channels are steep and narrow, moderately steep and wide, or wide and sinuous. Soils are poorly developed with loamy sands, sand, sandy loams, and silt loams over coarse alluvium.

Vegetation Description

This plant association is characterized by the dominance of *Alnus incana* (thinleaf alder). There is considerable variation of associated shrub species in the stands. Several willow species are often present, but no single willow species consistently occurred in all stands. Other shrubs frequently present include *Salix lucida* (ssp. *caudata* or ssp. *lasiandra*) (shining willow), *S. monticola* (mountain willow), *S. drummondiana* (Drummond willow), *S. bebbiana* (Bebb willow), *S. exigua* (sandbar willow), *S. geyeriana* (Geyer willow), *S. ligulifolia* (strapleaf willow), *Acer glabrum* (Rocky Mountain maple), and *Amelanchier utahensis* (Utah serviceberry). Tree cover is sparse, but can include *Picea pungens* (blue spruce), *Populus tremuloides* (quaking aspen), *P. angustifolia* (narrowleaf cottonwood) and *Picea engelmannii* (Engelmann spruce).

The herbaceous undergrowth is varied with 10-90% total cover. Native herbaceous species include *Equisetum arvense* (field horsetail), *Heracleum maximum* (common cowparsnip), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Mertensia ciliata* (tall fringed bluebells), *Calamagrostis canadensis* (bluejoint reedgrass) *Cardamine cordifolia*

(heartleaf bittercress) and *Carex utriculata* (beaked sedge). Introduced species include *Trifolium repens* (white clover), *Taraxacum officinale* (dandelion) and *Poa pratensis* (Kentucky bluegrass)

Ecological Processes

In Colorado, the *Alnus incana* -mixed *Salix* species plant association may represent response to recent changes in the environment. Several stands occur on abandoned beaver dams, for example. This shift in the physical environment may explain the diverse mix of shrub species in the canopy. If the water table lowers, this plant association may succeed to a more stable, drier community dominated by *Salix geyeriana* (Geyer willow) or *Populus tremuloides* (quaking aspen). Other stands appear to be disturbed by livestock grazing and may represent a grazing-induced stage of the *Alnus incana*/mesic forbs plant association.

Avg. Cover %	(Range)	Species Name	# Plots (N=28)
44	(5-100%)	<i>Alnus incana</i>	28
20	(3-50%)	<i>Salix lucida</i> ssp. <i>caudata</i> , <i>lasiandra</i>	17
19	(1-40%)	<i>Salix ligulifolia</i>	11
17	(1-57%)	<i>Salix monticola</i>	16
15	(3-39%)	<i>Salix bebbiana</i>	8
13	(1-70%)	<i>Poa pratensis</i>	20
12	(3-30%)	<i>Salix geyeriana</i>	6
12	(1-39%)	<i>Salix exigua</i>	13
10	(1-38%)	<i>Calamagrostis canadensis</i>	10
9	(1-27%)	<i>Ribes inerme</i>	11
9	(1-40%)	<i>Salix drummondiana</i>	10
8	(1-27%)	<i>Trifolium repens</i>	8
8	(1-30%)	<i>Equisetum arvense</i>	17
7	(3-13%)	<i>Populus angustifolia</i>	9
7	(1-21%)	<i>Heracleum maximum</i>	18
7	(1-15%)	<i>Aconitum columbianum</i>	5
7	(1-25%)	<i>Mertensia ciliata</i>	12
7	(1-22%)	<i>Rudbeckia laciniata</i> var. <i>ampla</i>	11
6	(1-30%)	<i>Rosa woodsii</i>	15
6	(1-20%)	<i>Phleum pratense</i>	10
6	(1-20%)	<i>Picea pungens</i>	6
6	(1-22%)	<i>Mertensia franciscana</i>	5
6	(1-18%)	<i>Poa palustris</i>	5
6	(1-15%)	<i>Agrostis gigantea</i>	5
5	(1-20%)	<i>Dactylis glomerata</i>	5
5	(1-20%)	<i>Taraxacum officinale</i>	21

Other species with < 5% average cover present in at least 10% of plots:
Glyceria striata (1-15%), *Rubus idaeus* ssp. *strigosus* (1-11%), *Geranium richardsonii* (1-17%),
Cardamine cordifolia (1-19%), *Lonicera involucrata* (1-15%), *Oxypolis fendleri* (1-15%), *Mentha*
arvensis (1-10%), *Carex utriculata* (1-10%), *Achillea millefolium* var. *occidentalis* (1-10%), *Geum*
macrophyllum var. *perincisum* (0.1-10%), *Juncus balticus* var. *montanus* (1-8%), *Urtica dioica* ssp.
gracilis (1-4%), *Carex microptera* (1-5%), *Maianthemum stellatum* (0.1-5%), *Vicia americana* (1-
3%), *Osmorhiza depauperata* (1-3%), *Galium boreale* (1-2%).

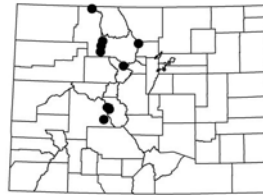
***Betula nana* (=glandulosa) / Mesic forbs - Mesic graminoids**



Global rank/State rank:
G3G4 / S3

HGM subclass: S1/2, R1,
R2

Colorado elevation range:
8,200-11,000 ft (2,500-
3,350 m)



General Description

The *Betula nana* (=glandulosa)/mesic forbs-mesic graminoids (bog birch/mesic forbs-mesic graminoids) plant association is a low stature (2-3 ft, 0.3-1 m) open shrubland of subalpine and lower alpine elevations. It occurs intermixed with *Salix* (willow) shrublands and *Carex* (sedge) meadows, forming complex wetland mosaics. It typically grows in very wet peat fens. This association is documented throughout high mountain ranges of Colorado, although typically occurring only in small stands.

Most stands of this association occur within a mosaic of subalpine meadows or willow communities. It grows in areas where soils are saturated from snowmelt runoff for a significant part of the growing season, often in fens, where the vegetation receives water from seeps and springs. Stream channels may be wide and slightly sinuous. Soils are deep peats and moderately deep (9-12 in, 23-30 cm) silty clay loams over gravels with a water table 10-48 inches (25-120 cm) deep.

Vegetation Description

Betula nana (=glandulosa) (bog birch) is the dominant shrub in the canopy. Several other shrubs may be present; however, none are as abundant as *Betula*. Shrub species occasionally present include *Dasiphora floribunda* (shrubby cinquefoil), *Salix wolfii* (Wolf willow), *S. planifolia* (planeleaf willow), *S. brachycarpa* (barrenground willow), *S. monticola* (mountain willow), and *Lonicera involucrata* (twinberry honeysuckle).

The herbaceous undergrowth grows on small hummocks and is usually dominated by a dense mixture of mesic forbs and graminoids. Mesic graminoids species include *Calamagrostis canadensis* (bluejoint reedgrass), *Carex aquatilis* (water sedge), *C. utriculata* (beaked sedge), *C. norvegica* (Norway sedge), *Deschampsia caespitosa* (tufted hairgrass), and *Phleum alpinum* (alpine timothy). Forb species include *Achillea millefolium* var. *occidentalis* (western yarrow), *Fragaria virginiana* (strawberry), *Galium boreale* (northern bedstraw), *Epilobium angustifolium* (fireweed), *Caltha leptosepala*

(marsh marigold), *Ligusticum tenuifolium* (Idaho licoriceroot), *Angelica pinnata* (small-leaf angelica), *Mertensia ciliata* (tall fringed bluebells), *Thalictrum alpinum* (alpine meadowrue), and *Conioselinum scopulorum* (Rocky Mountain hemlockparsley).

Due to their small size, *Betula nana* (= *glandulosa*) (bog birch) communities often inter-grade with surrounding communities.

Ecological Processes

This plant association appears to be a long-lived mid- to late-seral community. As peatland hummocks develop or become more pronounced, they may become more heavily dominated by *Salix* (willow) species. Due to cold temperatures and a short growing season, this process may take several decades to occur.

Avg. Cover %	(Range)	Species Name	# Plots (N=10)
44	(20-80%)	<i>Betula nana</i>	10
21	(3-80%)	<i>Carex aquatilis</i>	5
17	(3-50%)	<i>Picea engelmannii</i>	4
16	(10-25%)	<i>Salix planifolia</i>	5
13	(3-30%)	<i>Poa pratensis</i>	3
12	(3-20%)	<i>Salix monticola</i>	4
12	(3-30%)	<i>Salix brachycarpa</i>	5
11	(3-20%)	<i>Pinus contorta</i>	3
9	(1-30%)	<i>Calamagrostis canadensis</i>	4
9	(1-21%)	<i>Salix wolfii</i>	7
9	(1-20%)	<i>Dasiphora floribunda</i>	8
9	(3-11%)	<i>Ligusticum tenuifolium</i>	4
8	(1-10%)	<i>Chamerion angustifolium</i> ssp. <i>circumvagum</i>	4
6	(1-11%)	<i>Lonicera involucrata</i>	4
6	(1-25%)	<i>Fragaria virginiana</i> ssp. <i>glauca</i>	7
6	(1-10%)	<i>Caltha leptosepala</i>	4
6	(1-20%)	<i>Trisetum wolfii</i>	4
6	(1-10%)	<i>Carex utriculata</i>	2
5	(1-10%)	<i>Deschampsia caespitosa</i>	5

Other species with < 5% average cover present in at least 10% of plots:

Bromus ciliatus var. *ciliatus* (1-8%), *Galium boreale* (1-13%), *Poa reflexa* (1-10%), *Taraxacum officinale* (1-12%), *Conioselinum scopulorum* (1-10%), *Salix boothii* (3-3%), *Mertensia ciliata* (1-10%), *Geum macrophyllum* var. *perincisum* (1-4%), *Polygonum bistortoides* (1-7%), *Geum triflorum* var. *triflorum* (1-4%), *Thalictrum alpinum* (2-3%), *Arnica cordifolia* (1-3%), *Geranium richardsonii* (1-3%), *Juncus drummondii* (1-3%), *Trollius laxus* ssp. *albiflorus* (1-3%), *Symphyotrichum foliaceum* (1-3%), *Maianthemum stellatum* (1-3%), *Castilleja sulphurea* (1-3%), *Valeriana edulis* (1-2%), *Phleum alpinum* (1-3%), *Achillea millefolium* var. *occidentalis* (1-3%), *Luzula parviflora* (1-2%), *Polygonum viviparum* (1%), *Aconitum columbianum* (1%), *Veronica worms kjoldii* (1%), *Stellaria umbellata* (1%), *Pedicularis groenlandica* (1%), *Luzula comosa* (1%), *Trisetum spicatum* (1%), *Carex norvegica* (1%), *Equisetum arvense* (1%), *Rhodiola rhodantha* (0.1%).

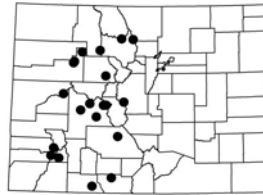
Carex aquatilis* - *Carex utriculata



Global rank/State rank:
G4 / S4

HGM subclass: D1, S1/2,
S3/4

Colorado elevation range:
8,200-11,100 ft (2,500-
3,400 m)



General Description

This plant association is recognized by the presence of both *Carex aquatilis* (water sedge) and *Carex utriculata* (beaked sedge) in roughly equal proportions. This is a common association that generally occurs in small to moderate size patches in very shallow, slow-moving to still water or on saturated soils near low-order streams, lakes, and backwater areas of larger rivers.

This plant association occurs in broad, glaciated, subalpine meadows that remain saturated with snowmelt runoff for most of the growing season. It is also often associated with beaver activity. Stream channels are narrow, deep, and sinuous, or wide and shallow. Soils are often organic, thick peat or sandy clays and sandy clay loams originating from glacial till.

Vegetation Description

This plant association has relatively low species diversity due to saturated soil conditions. *Carex aquatilis* (water sedge) and *Carex utriculata* (beaked sedge) co-dominate the association. Both species are present in equal or near equal amounts. For example, a stand with 10% cover of each *Carex* (sedge) species would classify as this type, however a stand with 10% *Carex aquatilis* (water sedge) and 80% *Carex utriculata* (beaked sedge) would classify as a *Carex utriculata* (beaked sedge) plant association. Other graminoid and forb species may also be present. Graminoid species include *Carex microptera* (smallwing sedge), *Deschampsia caespitosa* (tufted hairgrass), *Poa pratensis* (Kentucky bluegrass), *Juncus balticus* var. *montanus* (mountain rush), *Carex nebrascensis* (Nebraska sedge), and *Carex canescens* (pale sedge). Forb species include *Caltha leptosepala* (marsh marigold), *Rhodiola rhodantha* (redpod stonecrop), *Cardamine cordifolia* (heartleaf bittercress), *Senecio triangularis* (arrowleaf ragwort), *Pedicularis groenlandica* (elephanthead lousewort), and *Epilobium* spp. (willowweed).

Ecological Processes

The difficulty in classifying mixed stands of *Carex aquatilis* (water sedge) and *Carex utriculata* (beaked sedge) has been discussed in the literature and attempts have been made to differentiate the types based on soil characteristics. In some cases a dominance of *Carex utriculata* on organic soils and *Carex aquatilis* on mineral soils has been noted, while in other cases the opposite trend where *Carex aquatilis* appears to occur more often on rich organic soils, while *Carex utriculata* occurs on less nutrient rich soils is observed.

In stands observed for this study, water availability appears to be a stronger factor in determining relative dominance of these two sedge species. *Carex utriculata* appears to tolerate standing water and may be a pioneering species since it readily establishes on exposed, saturated mineral soil. In Colorado, *Carex utriculata* occurs more often in standing water and often grades into a mesic terrestrial habitat where *Carex aquatilis* is commonly dominant. The *Carex aquatilis*-*Carex utriculata* plant association may, therefore, represent a spatial transition between a wet *Carex utriculata* association and a mesic *Carex aquatilis* association.

Avg. Cover %	(Range)	Species Name	# Plots (N=20)
32	(9-65%)	<i>Carex utriculata</i>	19*
30	(6-90%)	<i>Carex aquatilis</i>	20
18	(1-40%)	<i>Deschampsia caespitosa</i>	6
10	(3-20%)	<i>Caltha leptosepala</i>	4
7	(2-10%)	<i>Carex canescens</i>	3

Other species with < 5% average cover present in at least 10% of plots:
Carex microptera (1-10%), *Poa pratensis* (1-11%), *Calamagrostis canadensis* (1-13%), *Juncus balticus* var. *montanus* (1-7%), *Pedicularis groenlandica* (1-5%), *Cardamine cordifolia* (1-5%), *Senecio triangularis* (1-5%), *Taraxacum officinale* (1-3%), *Achillea millefolium* var. *occidentalis* (1-3%), *Dasiphora floribunda* (1-3%), *Equisetum arvense* (1-3%), *Salix wolfii* (1-3%).

**Carex utriculata* occurred in all stands, but was not captured in every sample plot.

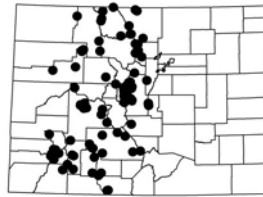
Carex aquatilis



Global rank/State rank:
G5 / S4

HGM subclass: S1/2

Colorado elevation range:
7,600-11,800 ft (2,300-
3,600 m)



General Description

Carex aquatilis (water sedge) is a common, widespread plant association that can occur as large meadows in high montane valleys or as narrow strips bordering ponds and streams at lower elevations. It occurs in a variety of environmental settings in the montane and subalpine zones. A clear dominance by *Carex aquatilis* and low cover of *C. utriculata* (beaked sedge) or *Pedicularis groenlandica* (elephanthead lousewort) set this plant association apart from closely related types.

This plant association occurs in a variety of valley types, but the largest expanses occur in broad, low-gradient valleys where large snow-melt fed swales and slopes dominate the landscape. It can also grow in fine sediments at the margins of lakes and beaver ponds. The largest occurrences are found adjacent to narrow, deep, sinuous streams. Some stands occur along steep streams, others along wide, shallow streams, as well as where beaver dams and ponds have altered the channel morphology. Soils are mostly deep, dark colored heavy clays, silts or organic layers over more skeletal layers. Soils are often saturated to the surface, and if not, mottling is commonly present within 10 cm of the surface.

Vegetation Description

This plant association is characterized by a dense rhizomatous meadow of *Carex aquatilis* (water sedge), usually accompanied by a few other graminoids species such as *Calamagrostis canadensis* (bluejoint reedgrass) or *Deschampsia caespitosa* (tufted hairgrass). *Eleocharis quinqueflora* (fewflower spikerush) can be abundant on organic substrates. *Carex utriculata* (beaked sedge) may be present. When present, *Carex utriculata* (beaked sedge) is usually not more than one third the cover of *C. aquatilis* (water sedge) cover. If it is more than that, the stand may be a *Carex aquatilis* - *Carex utriculata* (water sedge- beaked sedge) or *Carex utriculata* (beaked sedge) plant association. Forbs are often present, although sometimes inconspicuously. Species include *Epilobium* spp. (willowweed), *Pedicularis groenlandica* (elephanthead

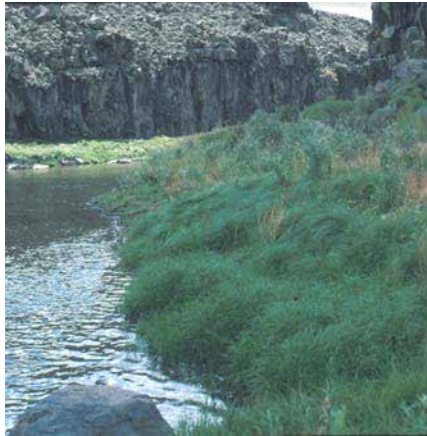
lousewort), *Caltha leptosepala* (marsh marigold), *Cardamine cordifolia* (heartleaf bittercress), and *Mertensia ciliata* (tall fringed bluebells).

Ecological Processes

Presence of *Carex utriculata* (beaked sedge) may indicate the site has progressed from the more wet *Carex utriculata* community to the current less mesic conditions, and may become dominated by *Salix planifolia* (planeleaf willow) or *Salix wolfii* (Wolf willow). *Carex aquatilis* (water sedge) associations trap sediment from overbank flows which forms a clay pan, eventually raising the water table. This process drives retrogressive succession and a plant association dominated by *Carex utriculata* takes over on these sites.

Avg. Cover %	(Range)	Species Name	# Plots (N=133)
60	(5-95%)	<i>Carex aquatilis</i>	133
13	(0.1-48%)	<i>Caltha leptosepala</i>	30
10	(1-30%)	<i>Carex utriculata</i>	35
9	(1-40%)	<i>Calamagrostis canadensis</i>	27
6	(0.1-31%)	<i>Deschampsia caespitosa</i>	40
6	(1-30%)	<i>Juncus balticus</i> var. <i>montanus</i>	19
5	(0.1-30%)	<i>Salix planifolia</i>	32
Other species with < 5% average cover present in at least 10% of plots:			
Taraxacum officinale (0.1-20%), Cardamine cordifolia (1-15%), Achillea millefolium var. occidentalis (1-36%), Poa pratensis (1-7%), Geum macrophyllum var. perincisum (0.1-5%), Pedicularis groenlandica (0.1-10%), Rhodiola rhodantha (0.1-5%).			

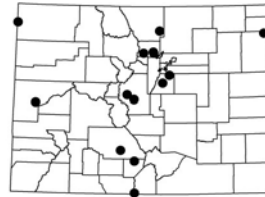
***Carex pellita* (=lanuginosa)**



Global rank/State rank:
G3 / S3

HGM subclass: D2/3,
S3/4, R5

Colorado elevation range:
4,600-9,300 ft (1,400-2,830
m)



General Description

Carex pellita is the name currently used by the USDA Plants Database for both *Carex lanuginosa* and *Carex lasiocarpa*. These species are recognized separately in Colorado, where *C. lasiocarpa* is much less common than *C. lanuginosa*. The *Carex lasiocarpa* association is ranked as S1 in Colorado and is currently known only from the subalpine fens on the east side of the Park Range.

Carex pellita (= *C. lanuginosa*) (woolly sedge) is a distinctive wetland-indicator sedge that forms small- to medium sized meadows. It occurs in depressions and swales at the saturated edge of stream channels or in standing water. On the eastern plains of Colorado, it can occur under the canopy of cottonwood trees, forming the *Populus deltoides*/*Carex pellita* (plains cottonwood/wooly sedge) plant association.

This plant association occurs in very wet conditions, generally at the saturated edge of the stream channel or in standing water. Stream channels are sinuous with a moderate gradient. Soils are deep silt loams to clays. Mottling often occurs throughout the profile.

Vegetation Description

This plant association is characterized by a nearly monotypic stand of *Carex lanuginosa* (woolly sedge). Other graminoid cover is minor, but includes *Phalaris arundinacea* (reed canarygrass), *Carex nebrascensis* (Nebraska sedge), *Schoenoplectus pungens* (threesquare bulrush), and *Poa pratensis* (Kentucky bluegrass). Scattered forbs include *Mentha arvensis* (wild mint), and *Cirsium arvense* (Canada thistle). *Equisetum arvense* (field horsetail) and *Equisetum hyemale* (scouringrush horsetail) may also be present.

Ecological Processes

The *Carex pellita* (woolly sedge) plant association appears to be a fairly stable community because of its strongly rhizomatous roots and well developed soils. In

Montana, the *Carex pellita* plant association can be associated with large amounts of *Carex lasiocarpa* (slender sedge). With season-long grazing, *Carex pellita* decreases in abundance, shifting dominance towards *Poa pratensis* (Kentucky bluegrass). In Colorado, stands of *Carex pellita* that occur on stream banks with a consistent water table depth and heavy, cohesive clay soils, appear stable and long-lived as long as the water table level remains consistent.

Avg. Cover %	(Range)	Species Name	# Plots (N=22)
73	(20 -98%)	<i>Carex pellita</i>	22
25	(10-40%)	<i>Phalaris arundinacea</i>	2
12	(3-20%)	<i>Polygonum amphibium</i> var. <i>emersum</i>	2
11	(0.1-40%)	<i>Mentha arvensis</i>	6
10	(0.1-20%)	<i>Muhlenbergia asperifolia</i>	2
10	(0.1-30%)	<i>Poa pratensis</i>	7
10	(1-20%)	<i>Argentina anserina</i>	7
9	(1-40%)	<i>Eleocharis palustris</i>	7
8	(5-10%)	<i>Calamagrostis stricta</i>	2
6	(5-7%)	<i>Lycopus asper</i>	2
Other species with < 5% average cover present in at least 10% of plots:			
Deschampsia caespitosa (1-10%), Carex praegracilis (2-5%), Hordeum jubatum ssp. jubatum (0.1-10%), Carex nebrascensis (0.1-5%), Agrostis gigantea (2.5-3%), Schoenoplectus pungens (1-5%), Cirsium arvense (1-4%), Juncus balticus var. montanus (0.1-5%), Polygonum lapathifolium (0.1-2%), Rumex crispus (0.1-1%), Equisetum arvense (0.1-1%), Juncus torreyi (0.1-1%).			

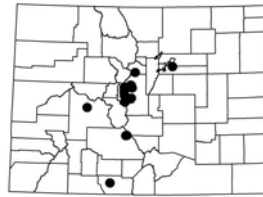
Carex simulata



Global rank/State rank:
G4 / S3

HGM subclass: S1/2

Colorado elevation range:
5,600-11,700 ft (1,700-
3,560 m)



General Description

Carex simulata (analogue sedge) is found only on quaking fens in Colorado (occasionally may persist on drying fens). It is commonly found with many other sedge species, but its presence is associated with deep organic soils and a perennially high water table. *Carex simulata* (analogue sedge) fens are known from Larimer County south to the San Luis Valley, and are more or less restricted to the high mountain valleys in the central part of the state.

This community is located on saturated organic soils in moderate to wide valleys. The surface of the ground is hummocky, and “quakes” when walked or jumped on. Streams are low gradient and highly sinuous to broader and slightly steeper. Soils are deep, dark brown to black, 100% peat, saturated to the surface.

Vegetation Description

Graminoids dominate this meadow association with 90-100% vegetative cover. *Carex simulata* (analogue sedge) may not be the most abundant species, but it is always present, and serves as the indicator species for this association. A variety of other *Carex* (sedge) species may be present, and even more abundant, including *Carex aquatilis* (water sedge), *Carex utriculata* (beaked sedge), and *Carex nebrascensis* (Nebraska sedge). *Juncus balticus* var. *montanus* (mountain rush) and other graminoids may also be present. A variety of forbs may be inconspicuously present (total cover <10%). A few scattered shrubs, usually in stunted form, contribute little cover when present. They may include *Salix geyeriana* (Geyer willow), *Salix monticola* (mountain willow), and *Dasiphora floribunda* (shrubby cinquefoil).

Concentric rings or a mosaic of patches of other herbaceous wetland types can be adjacent and intermixed with *Carex simulata* (analogue sedge) fens. Herbaceous wetland plants include *Carex nebrascensis* (Nebraska sedge), *Carex utriculata* (beaked sedge) and *Juncus balticus* var. *montanus* (mountain rush).

Ecological Processes

Little is known about the successional processes of this plant association. Deep accumulations of peat suggest long-term stability. Changes in the natural hydrological regime have the potential to greatly affect the composition of this association.

Avg. Cover %	(Range)	Species Name	# Plots (N=33)
67	(5-90%)	Carex simulata	33
21	(1-45%)	Carex utriculata	4
16	(1-47%)	Carex aquatilis	10
11	(1-30%)	Carex nebrascensis	5
11	(1-28%)	Juncus balticus var. montanus	9

Other species with < 5% average cover present in at least 10% of plots:
Deschampsia caespitosa (1-10%), Triglochin maritimum (1-10%), Eleocharis palustris (1-7%),
Ranunculus cymbalaria (1-5%), Poa pratensis (1-5%), Pedicularis groenlandica (1-2%),
Calamagrostis stricta (1-3%), Dodecatheon pulchellum (0.1-1%), Epilobium lactiflorum (0.1-1%).

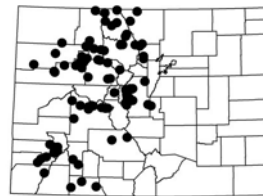
Carex utriculata



Global rank/State rank:
G5 / S4

HGM subclass: D1, D2/3,
R2, S1/2?, S3/4

Colorado elevation range:
5,600-11,000 ft (1,700-
3,350 m)



General Description

The *Carex utriculata* (beaked sedge) plant association is a common wet meadow community that occurs around the edges of montane lakes and beaver ponds, along the margins of slow-moving reaches of streams and rivers, and in marshy swales and overflow channels on broad floodplains. The water table is usually near the surface for most of the growing season. This association is well documented throughout the western states. A clear dominance of *Carex utriculata* over other *Carex* species including *C. aquatilis* (water sedge), sets this association apart from closely related types.

Carex utriculata (beaked sedge) grows in standing water or saturated soils. It also occurs along the margins of lakes and beaver ponds. Stream channels are wide and slightly sinuous, to wide and more sinuous. Soils are saturated organics or fine silty clays to clays over cobbles and alluvium. Mottling often occurs within a few centimeters of the surface.

Vegetation Description

This plant association is characterized by stands dominated by *Carex utriculata* (beaked sedge). Stands often appear to be nearly pure *Carex utriculata* (beaked sedge), but a variety of other graminoid species may be present as well. *Carex aquatilis* can be abundant, but if equal in cover to *C. utriculata*, see the *Carex aquatilis*-*Carex utriculata* association on page. Other *Carex* (sedge) species present include *Carex lenticularis* (shore sedge) and *C. microptera* (small-wing sedge), but usually with low cover relative to the amount of *C. utriculata* (beaked sedge) present. Other graminoid species that may be present include *Glyceria striata* (fowl mannagrass), *Calamagrostis canadensis* (bluejoint reedgrass), and *Juncus balticus* var. *montanus* (mountain rush). Forb cover is very inconspicuous and can include *Mentha arvensis* (wild mint), *Mimulus guttatus* (seep monkeyflower), and *Geum macrophyllum* (largeleaf avens). Willow carrs (i.e., shrubland thickets) are often adjacent and a few scattered willows will occur within the *Carex utriculata* (beaked sedge) stand. Individual willows tend to be very short if present, either from limiting growth conditions (extremely cold and/or extremely wet), or because

of heavy browsing by wildlife or livestock. The elevation of the site determines which willow species are in and adjacent to *Carex utriculata* (beaked sedge) stands. Willow species that are present may include *Salix monticola* (mountain willow), *S. drummondiana* (Drummond willow), *S. geyeriana* (Geyer willow), *S. planifolia* (planeleaf willow), and *S. exigua* (sandbar willow).

Ecological Processes

The *Carex utriculata* (beaked sedge) plant association occurs on the wettest sites of the riparian or wetland area, such as low-lying swales, and shallow margins of lakes and ponds, often in standing water. It is an early-seral community and is known to invade margins of newly formed beaver ponds, as well as the freshly exposed silt beds of drained beaver ponds. With time, the *Carex utriculata* plant association will grade into *Carex aquatilis* (water sedge) and *Calamagrostis canadensis* (bluejoint reedgrass) associations.

Successional shifts in species composition can be initiated by a change in the physical environment of the riparian area. Flooding events can result in sediments deposited on the floodplain, raising the surface higher above the water table. As aggradation, or build up, of the floodplain proceeds, the site can become drier and the dominant graminoid cover changes.

Abandoned beaver ponds also go through a similar succession. With time, ponds become silted-in and *Carex utriculata* establishes on the new, saturated substrate. As the site becomes firm and raised above the old pond level, *Carex aquatilis* and willows may become established. With further aggradation and time *Calamagrostis canadensis* may become established in the undergrowth. Depending on site characteristics, various willow species may become established in the overstory as well, creating the *Salix monticola*/*Carex utriculata* (mountain willow/beaked sedge) plant association or the *Salix geyeriana*/*Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) plant association, for example.

Distance from the stream channel can also differentiate the graminoid dominance spatially within the riparian mosaic. *Carex utriculata* commonly occurs at the stream channel or pond edge where the water table is close to or at the ground surface. As the floodplain surface becomes higher with increased distance from the channel edge, the ground becomes slightly less saturated and shifts to mesic meadows of *Carex aquatilis*, or on higher surfaces, to slightly drier meadows of *Calamagrostis canadensis*.

Avg. Cover %	(Range)	Species Name	# Plots (N=143)
72	(7-100%)	<i>Carex utriculata</i>	143
9	(0.1-50%)	<i>Carex aquatilis</i>	40
7	(1-20%)	<i>Carex microptera</i>	15
7	(0.1-30%)	<i>Calamagrostis canadensis</i>	20
7	(1-20%)	<i>Juncus balticus</i> var. <i>montanus</i>	16
6	(1-10%)	<i>Salix monticola</i>	15
5	(0.1-15%)	<i>Mentha arvensis</i>	15
Other species with < 5% average cover present in at least 10% of plots:			
<i>Equisetum arvense</i> (0.1-20%), <i>Glyceria striata</i> (0.1-10%), <i>Deschampsia caespitosa</i> (1-10%), <i>Geum macrophyllum</i> var. <i>perincisum</i> (0.1-15%), <i>Poa pratensis</i> (1-10%).			

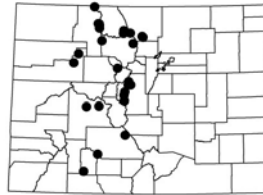
Deschampsia caespitosa



Global rank/State rank:
G4 / S4

HGM subclass: S1/2,
S3/4

Colorado elevation range:
7,900-12,300 ft (2,400-
3,750 m)



General Description

This dense, bunch-grass meadow occurs in broad, nearly flat, valley bottoms in openings of willow carrs (i.e., shrubland thickets) and coniferous forests in subalpine regions across Colorado. It is characterized by uniform to patchy cover of *Deschampsia caespitosa* (tufted hairgrass) with minor cover of other graminoids and forbs. Drier phases of this association grow on gentle slopes above the valley floor.

This meadow plant association generally occurs in broad, glaciated valleys on well-drained ridges and hummocks adjacent to low to moderate gradient streams. It occurs on sites with a moderately high water table, indicated by the presence of mottles or gleying in the soil at a depth of 8 in (20 cm). Stream channels are wide and moderately sinuous or narrow and highly sinuous. Soils are a shallow to deep organic layer over stratified sandy or silty loams and loamy sands.

Vegetation Description

This plant association is a meadow dominated by *Deschampsia caespitosa* (tufted hairgrass). Other graminoids may be abundant depending on local conditions, but no other species are consistently present. These include *Carex aquatilis* (water sedge), *Carex utriculata* (beaked sedge), and *Calamagrostis canadensis* (bluejoint reedgrass). Forb cover is highly variable, *Caltha leptosepala* (marsh marigold) is present in about half of all stands. Other forbs often, but not always, present include *Ranunculus alismifolius* (plantainleaf buttercup), *Rhodiola rhodantha* (redpod stonecrop), *Veronica wormskjoldii* (American alpine speedwell), and *Pedicularis groenlandica* (elephanthead lousewort). Occasionally, a few shrub stems from adjacent stands occur within this association, including *Dasiphora floribunda* (shrubby cinquefoil), *Salix planifolia* (planeleaf willow), and *Salix brachycarpa* (barrenground willow).

Ecological Processes

The *Deschampsia caespitosa* (tufted hairgrass) plant association can continue to occupy sites indefinitely under relatively stable conditions. *Deschampsia caespitosa* occurs along a broad moisture gradient from mesic and dry-mesic environments to those that are very wet. As sites become drier, *Deschampsia caespitosa* cover gradually decreases and *Dasiphora floribunda* (shrubby cinquefoil) cover may increase on sites with well-drained soils. In contrast, if a site becomes wetter, *Carex* (sedge) species may become dominant.

The presence of native increaser species such as *Juncus balticus* var. *montanus* (mountain rush) and exotic species such as *Poa pratensis* (Kentucky bluegrass) and *Taraxacum officinale* (dandelion) may indicate disturbed conditions. As disturbance levels increase, *Poa pratensis* may replace *Deschampsia caespitosa*. Many subalpine areas now dominated by *Poa pratensis* may have supported *Deschampsia caespitosa* communities in the past.

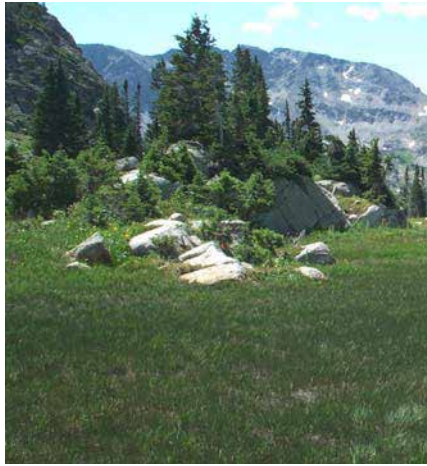
This is a common association in Colorado, however few pristine stands have been documented. It is highly threatened by heavy livestock grazing, invasion by non-native species, and reduced fire frequency.

Avg. Cover %	(Range)	Species Name	# Plots (N=31)
39	(10-80%)	<i>Deschampsia caespitosa</i>	31
16	(1-38%)	<i>Ligusticum tenuifolium</i>	6
16	(2-30%)	<i>Juncus balticus</i> var. <i>montanus</i>	6
13	(1-90%)	<i>Poa pratensis</i>	9
13	(1-50%)	<i>Carex aquatilis</i>	19
12	(6-20%)	<i>Calamagrostis canadensis</i>	3
11	(1-40%)	<i>Carex microptera</i>	7
11	(5-26%)	<i>Argentina anserina</i>	5
10	(1-20%)	<i>Carex utriculata</i>	3
10	(3-20%)	<i>Arnica mollis</i>	4
10	(1-45%)	<i>Caltha leptosepala</i>	16
9	(3-15%)	<i>Hordeum jubatum</i> ssp. <i>jubatum</i>	3
9	(1-15%)	<i>Hordeum brachyantherum</i> ssp. <i>brachyantherum</i>	3
8	(5-12%)	<i>Carex illota</i>	5
7	(2-11%)	<i>Erigeron peregrinus</i> ssp. <i>callianthemus</i>	4
6	(1-11%)	<i>Trollius laxus</i> ssp. <i>albiflorus</i>	4

Other species with < 5% average cover present in at least 10% of plots:

Carex scopulorum (3-4%), *Trisetum wolfii* (1-7%), *Juncus drummondii* (1-11%), *Phleum alpinum* (1-12%), *Senecio triangularis* (1-8%), *Taraxacum officinale* (1-9%), *Salix planifolia* (1-7%), *Packera dimorphophylla* (1-5%), *Carex nigricans* (1-8%), *Symphyotrichum foliaceum* (1-5%), *Potentilla diversifolia* (2-3%), *Pedicularis groenlandica* (0.1-5%), *Achillea millefolium* var. *occidentalis* (1-5%), *Cardamine cordifolia* (1-3%), *Viola macloskeyi* ssp. *pallens* (1-3%), *Agrostis humilis* (1-4%), *Veronica wormsjoldii* (1-4%), *Polygonum bistortoides* (0.1-5%), *Plantago tweedyi* (1-2%), *Carex ebenea* (1-2%), *Ranunculus alismifolius* var. *montanus* (1-3%), *Juncus mertensianus* (1-2%), *Rhodiola rhodantha* (0.1-3%), *Fragaria virginiana* ssp. *glauca* (1%), *Castilleja sulphurea* (1%), *Antennaria corymbosa* (1%), *Stellaria umbellata* (1%).

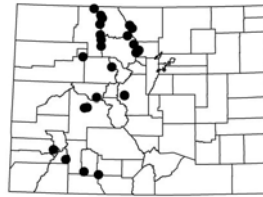
Eleocharis quinqueflora



Global rank/State rank:
G4 / S3S4

HGM subclass: S1/2

Colorado elevation range:
8,700-12,300 ft (2,650-3,800 m)



General Description

The *Eleocharis quinqueflora* (fewflower spikerush) plant association is a uniform peatland community found in upper subalpine and lower alpine wetlands. It is easily recognized by its homogeneity, the presence of usually little more than *Eleocharis quinqueflora* and *Carex aquatilis* (water sedge), and the sparse nature of the vegetation growth. This is a common association of upper subalpine elevations. It is widespread and is well documented throughout the western states.

The *Eleocharis quinqueflora* (fewflower spikerush) plant association occurs in high elevation, marshy meadows associated with seeps where the water table is at the soil surface. Valley bottoms are moderately wide to wide and usually have a gentle to moderate gradient (0.4-6%). Adjacent stream channels are narrow and sinuous headwater rivulets with lateral seepage from surrounding toeslopes. This association occurs on peat occasionally as deep as 7 ft (2 m). The soils remain saturated throughout the growing season and may not be very rich in nutrients.

Vegetation Description

This plant association is characterized by widely-spaced *Eleocharis quinqueflora* (fewflower spikerush) with *Pedicularis groenlandica* (elephanthead lousewort) often present. *Carex aquatilis* (water sedge) is present in 85% of stands. Other forb and graminoid species present are variable. Some of the more frequently encountered species include *Caltha leptosepala* (marsh marigold), *Carex scopulorum* (mountain sedge), *Carex utriculata* (beaked sedge), *Carex illota* (small-headed sedge), and *Carex jonesii* (Jones sedge).

Ecological Processes

Eleocharis quinqueflora (fewflower spikerush) is an early colonizer and persists under wet conditions. *Carex aquatilis* (water sedge) can be a co-dominant in this plant association. Grazing can increase the cover of increaser and invader species such as

Agrostis stolonifera (creeping bentgrass) and *Juncus balticus* var. *montanus* (mountain rush), and will damage the wet soils.

Avg. Cover %	(Range)	Species Name	# Plots (N=41)
56	(7-90%)	Eleocharis quinqueflora	41
11	(0.1-31%)	Carex aquatilis	30
9	(1-30%)	Carex utriculata	5
8	(1-20%)	Triglochin palustre	5
8	(0.1-30%)	Carex scopulorum	5
5	(0.1-16%)	Carex illota	4
Other species with < 5% average cover present in at least 10% of plots:			
Caltha leptosepala (0.1-20%), Salix planifolia (0.1-10%), Carex canescens (1-5%), Deschampsia caespitosa (1-8%), Pedicularis groenlandica (0.1-10%), Ligusticum tenuifolium (0.1-3%), Rhodiola rhodantha (0.1-1%), Juncus mertensianus (0.1-1%).			

Glyceria grandis



Global rank/State rank:

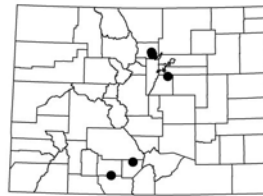
G2? / S2

HGM subclass: D2/3,

D4/5

Colorado elevation range:

5,200-8,900 ft (1,580-
2,700 m)



General Description

This tall grass plant association occurs in small depressions along the edges of ditches, small streams, or sloughs. It may develop where a gentle current occurs, or in the wet sands on the edge of the active channel. Stands are seasonally or permanently flooded (Depressional 2/3) or occasionally flooded (Depressional 4/5).

This association occurs in wet areas along the Front Range in the transition zone between the foothills and the plains and in valleys in the mountains at low to moderate elevations, often associated with beaver ponds. Soils are generally coarse, but may be fine, usually sedimentary and alluvial. Soils vary from mineral to organic; mineral soils may have a thick layer of muck-like organic material.

Vegetation Description

Glyceria grandis (American mannagrass) is generally the most abundant species, with cover values up to 90%. Occasionally it may be the only species present. More often a variety of forbs and graminoids, usually with fairly low cover and constancy occur with the *Glyceria grandis*. Forbs that may occur include *Bidens cernua* (nodding beggartick), *Mentha arvensis* (wild mint), *Solidago* spp. (goldenrod), and *Persicaria* spp. (smartweed). Graminoid species typically provide greater cover than forbs and may include *Eleocharis palustris* (common spikerush), *Phalaris arundinacea* (reed canarygrass), *Agrostis gigantea* (redtop), *Beckmannia syzigachne* (American sloughgrass) and *Leersia oryzoides* (rice cutgrass). *Carex nebrascensis* (Nebraska sedge) was present in one stand in the San Luis Valley.

Ecological Processes

This plant association is usually an indicator of stable water table levels. A drop in water table will eliminate this association. Saturated soils are highly susceptible to damage by livestock.

Avg. Cover %	(Range)	Species Name	# Plots (N=13)
57	(15-90%)	Glyceria grandis	13
37	(10-85%)	Lemna minor	3
29	(15-62%)	Eleocharis palustris	5
26	(2-37%)	Leersia oryzoides	3
19	(0.1-37%)	Juncus nodosus	2
18	(2-37%)	Bidens cernua	4
16	(1-30%)	Carex nebrascensis	2
15	(15-15%)	Carex emoryi	2
9	(2-15%)	Salix exigua	2
9	(2-15%)	Polygonum lapathifolium	2
8	(2-15%)	Agrostis gigantea	3
7	(2-15%)	Beckmannia syzigachne	3
7	(2-15%)	Schoenoplectus acutus/tabernaemontani	3
6	(2-15%)	Epilobium ciliatum ssp. glandulosum	4
6	(1-15%)	Salix amygdaloides	3
5	(0.1-15%)	Phalaris arundinacea	4

Other species with < 5% average cover present in at least 10% of plots:
 Polygonum persicaria (0.1-15%), Schoenoplectus pungens (2-5%), Conyza canadensis (2%),
 Solidago canadensis (2%), Lycopus americanus (2%), Bidens frondosa (2%), Rorippa
 nasturtium-aquaticum (2%), Mentha arvensis (0.1-5%), Veronica anagallis-aquatica (0.1-2.5%),
 Juncus balticus var. montanus (1-2%), Alopecurus aequalis (0.1-2%), Hordeum jubatum ssp.
 jubatum (0.1-2%), Juncus dudleyi (0.1-1%), Xanthium strumarium (0.1%).

Picea engelmannii / *Equisetum arvense*



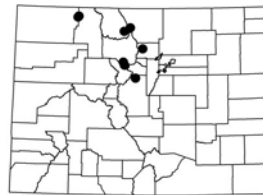
Global rank/State rank:

G4 / S2

HGM subclass: R2,
R3/4

Colorado elevation range:

8,400-9,500 ft (2,600-
2,900 m)



General Description

The *Picea engelmannii*/*Equisetum arvense* (subalpine fir-Engelmann spruce/field horsetail) plant association is a shaded, moist forest with few to almost no shrubs present and an open carpet of *Equisetum arvense* (field horsetail) along the stream bank. It occurs below 10,000 ft (3,000 m) and is often a disturbance (flooding) dependent community. However, in some situations this association may persist for long periods in the absence of disturbance.

Although this is a widespread community extending from British Columbia through the U.S. to northern Colorado, it is relatively rare in Colorado, where it occurs in the northern and central mountains. In the Routt National Forest, this plant association occurs on low terraces along low to moderate gradient streams. Soils are sandy with a gravel layer near the surface.

Vegetation Description

Picea engelmannii (Engelmann spruce) is the dominant overstory species and is present in all stands. *Abies lasiocarpa* (subalpine fir) is often present with a lower average cover. Total shrub canopy is low, and includes species such as *Alnus incana* (thinleaf alder), *Salix geyeriana* (Geyer willow) and *Lonicera involucrata* (twinberry honeysuckle). *Equisetum arvense* (field horsetail) is the characteristic and always dominant herbaceous species. Other herbaceous species typically present include *Calamagrostis canadensis* (Bluejoint reedgrass), *Senecio triangularis* (arrowleaf ragwort), *Oxypolis fendleri* (Fendler cowbane), *Mertensia ciliata* (tall fringed bluebells), *Saxifraga odontoloma* (brook saxifrage), *Geranium richardsonii* (Richardson geranium), and *Carex aquatilis* (water sedge).

Adjacent riparian areas include *Abies lasiocarpa*-*Picea engelmannii* (subalpine fir-Engelmann spruce) forests and *Salix drummondiana* (Drummond willow) shrublands.

Ecological processes

In Utah, Idaho, and western Wyoming, the *Abies lasiocarpa*-*Picea engelmannii*/*Equisetum arvense* (subalpine fir-Engelmann spruce/field horsetail) plant association is considered a late-seral to climax stage community. In Colorado, this association is considered an early-seral type. The association is dependent on flood disturbance (deposition of sand and silt) to maintain the understory dominance of *Equisetum arvense* (field horsetail). With larger disturbances, *Populus tremuloides* (quaking aspen) and *Populus angustifolia* (narrowleaf cottonwood) will become established. Without flood disturbance, the site will remain dominated by *Abies lasiocarpa* and *Picea engelmannii*.

Avg. Cover %	(Range)	Species Name	# Plots (N=8)
39	(19-70%)	<i>Equisetum arvense</i>	8
28	(9-50%)	<i>Picea engelmannii</i>	8
11	(1-20%)	<i>Vaccinium scoparium</i>	2
10	(3-27%)	<i>Abies lasiocarpa</i>	6
10	(5-16%)	<i>Geranium richardsonii</i>	3
10	(1-30%)	<i>Heracleum maximum</i>	6
9	(1-15%)	<i>Alnus incana</i>	6
8	(1-20%)	<i>Calamagrostis canadensis</i>	7
8	(3-13%)	<i>Salix drummondiana</i>	2
6	(1-10%)	<i>Carex aquatilis</i>	2
5	(3-10%)	<i>Chamerion angustifolium</i> ssp. <i>circumvagum</i>	3
5	(1-15%)	<i>Cardamine cordifolia</i>	4
5	(1-10%)	<i>Senecio triangularis</i>	6

Other species with < 5% average cover present in at least 10% of plots:

Oxypolis fendleri (1-11%), *Mertensia ciliata* (1-11%), *Salix monticola* (1-7%), *Orthilia secunda* (2-6%), *Saxifraga odontoloma* (1-10%), *Aconitum columbianum* (1-10%), *Lonicera involucrata* (1-8%), *Ribes lacustre* (1-5%), *Osmorhiza depauperata* (1-4%), *Caltha leptosepala* (1-5%), *Streptopus amplexifolius* var. *chalcidatus* (0.1-5%), *Mitella pentandra* (1-5%), *Carex microptera* (1-2%), *Salix planifolia* (1-2%), *Fragaria virginiana* ssp. *glauca* (1-3%), *Taraxacum officinale* (1-2%), *Geum macrophyllum* var. *perincisum* (0.1-2%), *Arnica cordifolia* (1-1%), *Moneses uniflora* (1%), *Juncus balticus* var. *montanus* (1%), *Juncus drummondii* (1%), *Conioselinum scopulorum* (1%), *Viola canadensis* var. *scopulorum* (1%), *Galium triflorum* (1%), *Pyrola minor* (1%), *Platanthera hyperborea* var. *hyperborea* (1%), *Luzula parviflora* (0.1-1%), *Rosa woodsii* (0.1-1%), *Glyceria striata* (0.1-1%), *Fragaria vesca* ssp. *bracteata* (0.1%).

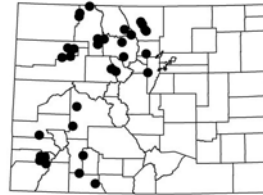
Picea pungens* / *Alnus incana



Global rank/State rank:
G3 / S3

HGM subclass:
R2, R3/4

Colorado elevation range:
6,100-10,650 ft (1,900-3,200 m)



General Description

The *Picea pungens*/*Alnus incana* (blue spruce/thinleaf alder) plant association occurs in montane riparian areas in Colorado. It occurs in deep, shaded canyons and narrow valleys along relatively straight stream reaches. It generally forms small patches, but can be continuous for several river miles.

This plant association occurs along narrow to moderately wide floodplains and stream benches in canyons subject to cold air drainage and limited sunlight. Stream channels are steep and narrow, moderately broad and slightly sinuous, or broad and highly sinuous. Soils are generally shallow and range from loamy sand to silty clay loams with heavy organic matter content over gravel, cobbles, and boulders.

Vegetation Description

Picea pungens (blue spruce) dominates the overstory with 1-70% cover. There are typically many seedling and saplings as well as mature trees. *Abies lasiocarpa* (subalpine fir) is usually present with up to 50% cover. Other tree species that occurred in half or fewer of the stands sampled include *Picea engelmannii* (Engelmann spruce), *Populus tremuloides* (quaking aspen), *Pinus contorta* (lodgepole pine) and *Pinus ponderosa* (ponderosa pine).

The thick shrub understory is confined to a narrow band lining the stream channel. *Alnus incana* (thinleaf alder) was present in all stands sampled, and ranged in cover from 1 to 80%. Other shrub species present were highly variable, with constancy of less than 40%, but often appearing with abundant cover when present. These shrubs include *Salix drummondiana* (Drummond willow), *Cornus sericea* (red-osier dogwood), *Ribes lacustre*

(current), *Acer glabrum* (Rocky Mountain maple), *Vaccinium* spp. (whortleberry), *Salix boothii* (Booth willow), and *Salix wolfii* (Wolf willow).

The forb canopy layer is thick, up to 50% total cover and species-rich, often with more than 40 species represented in one stand. Species include *Actaea rubra* (red baneberry), *Conioselinum scopulorum* (Rocky Mountain hemlockparsley), *Oxypolis fendleri* (cowbane), *Geranium richardsonii* (Richardson geranium), *Heracleum maximum* (common cowparsnip), *Maianthemum stellatum* (starry false Solomon seal), *Mertensia ciliata* (tall fringed bluebells), *Rudbeckia laciniata* var. *ampla* (cutleaf cornflower), and *Equisetum arvense* (field horsetail).

Ecological Processes

In deep, narrow canyons with swift-moving streams and narrow floodplains and benches, *Picea pungens* (blue spruce) appears to be a climax riparian species, and will remain until removed or damaged by a catastrophic flood. In Colorado, the closely related *Picea pungens/Equisetum arvense* (blue spruce/field horsetail) plant association is considered an indicator of frequent flooding. With less frequent flooding, this association may gradually change to a *Picea pungens/Alnus incana* (blue spruce/thinleaf alder) plant association.

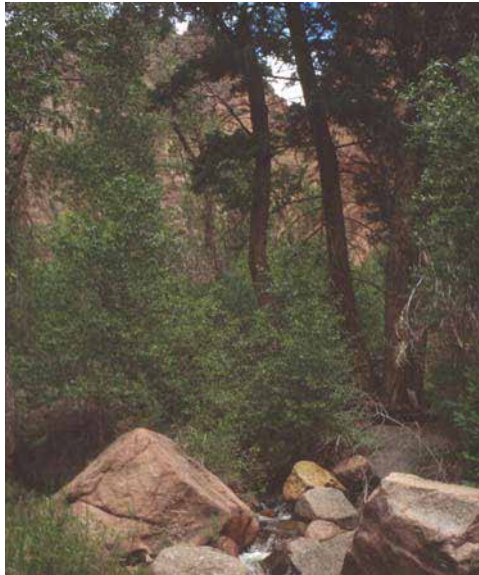
Avg. Cover %	(Range)	Species Name	# Plots (N=35)
32	(1-70%)	<i>Picea pungens</i>	35
28	(1-80%)	<i>Alnus incana</i>	34*
12	(1-85%)	<i>Calamagrostis canadensis</i>	13
12	(1-55%)	<i>Salix exigua</i>	5
12	(1-50%)	<i>Abies lasiocarpa</i>	15
9	(1-28%)	<i>Acer glabrum</i>	6
9	(1-32%)	<i>Salix bebbiana</i>	7
9	(1-28%)	<i>Salix monticola</i>	7
9	(1-18%)	<i>Populus tremuloides</i>	8
8	(1-45%)	<i>Equisetum arvense</i>	27
8	(1-40%)	<i>Salix drummondiana</i>	16
8	(1-20%)	<i>Ribes lacustre</i>	7
7	(1-32%)	<i>Ribes inerme</i>	10
7	(1-18%)	<i>Pinus contorta</i>	6
5	(1-25%)	<i>Poa pratensis</i>	20
5	(1-30%)	<i>Lonicera involucrata</i>	26
5	(0.1-20%)	<i>Rudbeckia laciniata</i> var. <i>ampla</i>	14
5	(1-10%)	<i>Cornus sericea</i>	8
5	(0.1-20%)	<i>Trifolium repens</i>	8

Other species with < 5% average cover present in at least 10% of plots:

Saxifraga odontoloma (1-10%), *Symphoricarpos oreophilus* (1-20%), *Heracleum maximum* (1-15%), *Rubus idaeus* ssp. *strigosus* (0.1-20%), *Mertensia ciliata* (1-10%), *Thalictrum fendleri* (1-10%), *Streptopus amplexifolius* var. *chalazatus* (1-10%), *Senecio triangularis* (1-10%), *Erigeron speciosus* var. *speciosus* (1-9%), *Maianthemum stellatum* (0.1-13%), *Geranium richardsonii* (0.1-10%), *Bromus ciliatus* var. *ciliatus* (1-11%), *Actaea rubra* ssp. *arguta* (1-10%), *Salix ligulifolia* (1-5%), *Rosa woodsii* (1-10%), *Aconitum columbianum* (1-10%), *Taraxacum officinale* (0.1-15%), *Poa palustris* (1-5%), *Amelanchier alnifolia* (1-10%), *Phleum pratense* (1-10%), *Cardamine cordifolia* (1-10%), *Urtica dioica* ssp. *gracilis* (1-10%), *Elymus glaucus* (1-10%), *Galium triflorum* (1-10%), *Luzula parviflora* (0.1-8%), *Conioselinum scopulorum* (0.1-5%), *Dasiphora floribunda* (1-7%), *Chamerion angustifolium* ssp. *circumvagum* (1-10%), *Osmorhiza depauperata* (0.1-10%), *Fragaria virginiana* ssp. *glaucula* (1-5%), *Glyceria striata* (0.1-5%), *Achillea millefolium* var. *occidentalis* (1-5%), *Galium boreale* (1-5%), *Orthilia secunda* (1-3%), *Viola canadensis* var. *scopulorum* (0.1-3%), *Carex microptera* (1-3%), *Vicia americana* (1-5%), *Oxypolis fendleri* (1-3%), *Osmorhiza berteroi* (1-3%), *Geum macrophyllum* var. *perincisum* (0.1-5%), *Prunella vulgaris* (1%), *Ranunculus macounii* (1%).

**Alnus incana* occurred in all stands, but was not captured in every sample plot.

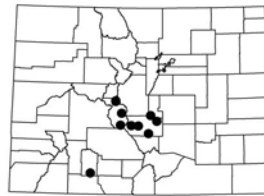
Populus angustifolia* - *Pseudotsuga menziesii



**Global rank/State
rank:**
G3 / S2

HGM subclass: R3/4

**Colorado elevation
range:**
7,100-8,700 ft (2,150-
2,700 m)



General Description

This plant association occurs in the San Juan National Forest and in parts of the upper Arkansas River Basin. It is also expected to occur in narrow foothill canyons of the Colorado Front Range. The *Populus angustifolia*-*Pseudotsuga menziesii* (narrowleaf cottonwood-Douglas-fir) plant association is limited to narrow canyon bottoms and V-shaped valleys where a northern or protected aspect creates cool micro-environments. This association represents a transition from lower montane to upper montane habitats. Nearly all stands observed have an adjacent north-facing slope with *Pseudotsuga menziesii* (Douglas-fir) forests.

The association grows in wash bottoms and on immediate stream banks, cobble bars, and terraces. Stream channels are steep and narrow with streambeds of bedrock, sand, or silt. This association also occurs on slightly meandering floodplains of broad reaches with coarse channel bed material. The soils are derived from alluvial and colluvial deposits and are fairly shallow, 10-30 inches (25-75 cm) thick. The soils become skeletal with depth. Surface layers are sandy loams, clay loams, and loams. Subsurface layers are sandy loams with 10-30% cobbles and gravels. Organic matter from accumulated litter is concentrated in the upper layers.

Vegetation Description

The upper canopy of this plant association is dominated by *Pseudotsuga menziesii* (Douglas-fir) and *Populus angustifolia* (narrowleaf cottonwood). The mix of these two species as mature trees in the overstory canopy is the diagnostic characteristic for this plant association. *Juniperus scopulorum* (Rocky Mountain juniper) or *Abies concolor* (white fir) may also be present. Several other conifer tree species may be present, but with less than 1% cover. Shrub cover is typically low, but is highly variable and diverse. No single species was present in all stands sampled. Shrub species include *Acer glabrum*

(Rocky Mountain maple), *Salix exigua* (sandbar willow), *Betula occidentalis* (river birch), *Alnus incana* (thinleaf alder), *Quercus gambelii* (Gambel oak), *Salix lucida* ssp. *caudata* (shining willow), *Clematis ligusticifolia* (western white clematis), and *Ribes cereum* (wax currant).

The herbaceous undergrowth can be sparse and is usually limited by heavy shade and dry soil conditions. Herbaceous species include *Poa pratensis* (Kentucky bluegrass), *Taraxacum officinale* (dandelion), *Achillea millefolium* var. *occidentalis* (western yarrow), *Trifolium repens* (white clover), and *Agrostis stolonifera* (creeping bentgrass).

Ecological Processes

Pseudotsuga menziesii (Douglas-fir) is a non-obligate riparian species and in Colorado riparian communities dominated by this species are uncommon. Observed stands of the *Populus angustifolia*-*Pseudotsuga menziesii* plant association were composed of mature trees, appear to be late-seral, and were limited to narrow canyon bottoms where upland *Pseudotsuga menziesii* forests grade into the riparian corridor or invade late successional terraces. Narrow canyons with steep slopes create pockets of moist, cool air by funneling cold-air downwards and providing a microsite for *Pseudotsuga menziesii*. Well-drained colluvial soils favor *Pseudotsuga menziesii* establishment.

Along broader, meandering rivers, *Pseudotsuga menziesii* can occur on upper terraces with stands of *Populus angustifolia*. These stands likely represent a drier occurrence of a *Populus angustifolia* community where *Pseudotsuga menziesii* is not an indicator of riparian condition. However, at lower elevations and in narrow valleys with cold air drainage, *Pseudotsuga menziesii*, co-dominating with *Populus angustifolia* on stream banks and floodplains, represents a perpetual riparian community.

Avg. Cover %	(Range)	Species Name	# Plots (N=9)
39	(26-59%)	<i>Populus angustifolia</i>	9
24	(8-45%)	<i>Pseudotsuga menziesii</i>	9
11	(5-17%)	<i>Clematis ligusticifolia</i>	2
10	(5-15%)	<i>Trifolium repens</i>	3
8	(1-18%)	<i>Acer glabrum</i>	5
7	(4-13%)	<i>Alnus incana</i>	3
6	(1-14%)	<i>Ribes cereum</i>	3
6	(2-8%)	<i>Juniperus scopulorum</i>	6
6	(1-10%)	<i>Melilotus officinalis</i>	2
5	(2-11%)	<i>Salix exigua</i>	3
4	(1-13%)	<i>Poa pratensis</i>	8
Other species with < 5% average cover present in at least 10% of plots:			
Geranium richardsonii (1-15%), Abies concolor (2-5%), Achnatherum hymenoides (1-6%), Agrostis stolonifera (1-6%), Elymus repens (2-3%), Bromus inermis (2-3%), Taraxacum officinale (1-4%), Holodiscus dumosus (1-2%), Rosa woodsii (1-2%), Thalictrum fendleri (1-2%), Symphoricarpos oreophilus (1-2%), Achillea millefolium var. occidentalis (1%), Bromus tectorum (1%), Medicago lupulina (1%), Heterotheca villosa (1%), Heracleum maximum (1%), Elymus trachycaulus ssp. trachycaulus (1%), Ribes inerme (1%).			

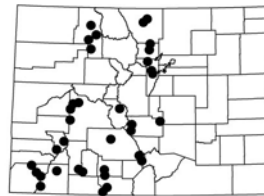
Populus angustifolia* / *Alnus incana



**Global rank/State
rank:**
G3 / S3

HGM subclass: R3/4

**Colorado elevation
range:**
6,000-9,600 ft (1,830-
2,930 m)



General Description

The *Populus angustifolia*/*Alnus incana* (narrowleaf cottonwood/thinleaf alder) plant association is characterized by a dense stand of *Alnus incana* lining the stream bank and an open to nearly closed canopy of *Populus angustifolia*. Other shrubs may occur but *Alnus incana* (thinleaf alder) usually has at least 10-20% cover and is the most abundant of all other shrubs within the stand. It occurs along narrow, fast-moving stream reaches in montane areas.

This plant association occurs on active floodplains in narrow to broad valleys. It forms a narrow, dense band along stream banks and benches. Some of the stands have signs of recent flooding. Stream gradient and channel width are highly variable. Some sites occur along steep, narrow reaches with little sinuosity. Other sites occur along low gradient, moderately sinuous, broad channel reaches, low gradient, highly sinuous reaches, or very narrow and highly sinuous stream sections. Soils are mostly coarse textured ranging from deep sands to shallow sandy loams. Some profiles show stratification with loams to clay loams alternating with sands. Most profiles become skeletal at an average depth of 12 inches (30 cm).

Vegetation Description

The dominance of *Populus angustifolia* (narrowleaf cottonwood) and *Alnus incana* (thinleaf alder) are the key diagnostic characteristics of this association. Several other tree and shrub species may be present, but they rarely equal the abundance of the diagnostic species. The overstory is an open to dense canopy of *Populus angustifolia*, which is always present, if sometimes only as sapling-sized individuals. Other tree species that may be present include *Pseudotsuga menziesii* (Douglas-fir), *Juniperus scopulorum* (Rocky Mountain juniper), *Populus tremuloides* (quaking aspen), *Pinus ponderosa* (ponderosa pine), *Populus x acuminata* (lanceleaf cottonwood), *Abies concolor* (white fir), or *Picea pungens* (blue spruce). The shrub understory is dominated

by a dense band of *Alnus incana* (thinleaf alder) lining the stream bank. A variety of other shrubs may be present, intermingling with the alder but usually providing less than the total alder cover. Other shrub species include *Salix bebbiana* (Bebb willow), *Salix monticola* (mountain willow), *Salix drummondiana* (Drummond willow), *Salix ligulifolia* (strapleaf willow), *Salix lucida* ssp. *caudata* (shining willow), *Salix exigua* (sandbar willow), *Cornus sericea* (red-osier dogwood), *Rosa woodsii* (Woods rose), *Acer glabrum* (Rocky Mountain maple), and *Betula occidentalis* (river birch).

The herbaceous undergrowth is generally sparse. Herbaceous species include *Poa pratensis* (Kentucky bluegrass), *Taraxacum officinale* (dandelion), *Equisetum arvense* (field horsetail), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Heracleum maximum* (common cowparsnip), *Maianthemum stellatum* (starry false Solomon seal), *Trifolium repens* (white clover), *Calamagrostis canadensis* (bluejoint reedgrass), *Oxypolis fendleri* (Fendler cowbane), and *Cardamine cordifolia* (heartleaf bittercress).

Ecological Processes

The *Populus angustifolia*/*Alnus incana* (narrowleaf cottonwood/thinleaf alder) plant association is considered a mid-seral community (not the youngest and not the oldest stands of cottonwoods within a reach). With time and without flooding disturbance, stands may become dominated by invading conifers from adjacent upland communities such as *Pseudotsuga menziesii* (Douglas-fir), *Juniperus* spp. (juniper), or *Picea engelmannii* (Engelmann spruce).

Avg. Cover %	(Range)	Species Name	# Plots (N=37)
37	(3-84%)	<i>Populus angustifolia</i>	37
35	(1-80%)	<i>Alnus incana</i>	37
18	(1-40%)	<i>Agrostis gigantea</i>	5
13	(1-30%)	<i>Salix lucida</i> ssp. <i>caudata</i> , <i>lasianдра</i>	14
13	(3-28%)	<i>Betula occidentalis</i>	5
12	(1-48%)	<i>Trifolium repens</i>	7
11	(3-35%)	<i>Salix drummondiana</i>	10
10	(1-30%)	<i>Poa pratensis</i>	26
10	(1-30%)	<i>Cornus sericea</i> ssp. <i>sericea</i>	12
10	(1-34%)	<i>Populus tremuloides</i>	5
8	(1-32%)	<i>Salix exigua</i>	8
7	(1-15%)	<i>Agrostis stolonifera</i>	6
7	(1-14%)	<i>Salix monticola</i>	9
6	(1-22%)	<i>Cardamine cordifolia</i>	5
6	(0.1-40%)	<i>Dactylis glomerata</i>	9
6	(1-20%)	<i>Rubus idaeus</i> ssp. <i>strigosus</i>	6
6	(1-17%)	<i>Calamagrostis canadensis</i>	8
6	(1-14%)	<i>Pseudotsuga menziesii</i>	7
5	(1-14%)	<i>Salix bebbiana</i>	8
5	(1-11%)	<i>Ribes inerme</i>	5
5	(1-20%)	<i>Rudbeckia laciniata</i> var. <i>ampla</i>	12

Other species with < 5% average cover present in at least 10% of plots:

Acer glabrum (1-10%), *Rosa woodsii* (1-30%), *Heracleum maximum* (0.1-15%), *Pyrola asarifolia* ssp. *asarifolia* (1-10%), *Poa palustris* (1-10%), *Taraxacum officinale* (1-20%), *Juniperus scopulorum* (1-11%), *Salix ligulifolia* (1-10%), *Lonicera involucrata* (0.1-10%), *Equisetum arvense* (0.1-18%), *Oxypolis fendleri* (1-11%), *Urtica dioica* ssp. *gracilis* (1-10%), *Prunus virginiana* var. *melanocarpa* (1-7%), *Maianthemum stellatum* (0.1-10%), *Osmorhiza depauperata* (1-4%), *Achillea millefolium* var. *occidentalis* (0.1-12%), *Clematis ligusticifolia* (1-3%), *Juncus balticus* var. *montanus* (1-6%), *Vicia americana* (1-5%), *Mertensia ciliata* (1-5%), *Galium triflorum* (1-4%), *Thalictrum fendleri* (1-5%), *Geum macrophyllum* var. *perincisum* (1-6%), *Geranium richardsonii* (1-5%), *Fragaria virginiana* ssp. *glauca* (1-5%), *Chamerion angustifolium* ssp. *circumvagum* (1-3%), *Galium boreale* (1-3%), *Mentha arvensis* (1-4%), *Symphoricarpos oreophilus* (1-3%), *Galium trifidum* ssp. *subbiflorum* (1-3%), *Actaea rubra* ssp. *arguta* (0.1-3%), *Phleum pratense* (1%), *Equisetum laevigatum* (0.1-1%).

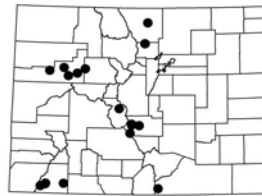
Populus angustifolia* / *Betula occidentalis



**Global rank/State
rank:**
G3 / S2

HGM subclass: R3/4

**Colorado elevation
range:**
6,000-8,400 ft (1,830-
2,600 m)



General Description

This plant association is a lush deciduous community of *Populus angustifolia* (narrowleaf cottonwood) and *Betula occidentalis* (river birch) growing in a thick band along the stream banks. The community is one of the wetter *Populus angustifolia* plant associations, which indicates a perennial source of water and possibly lateral seepage to the channel. Some stands occur on hillside seeps.

This plant association occurs on stream banks and benches along narrow, somewhat steep streams with little to moderate floodplain development. It also occurs on immediate stream banks or steep-sided overflow channel areas along larger streams with well-developed floodplains. Stream channels are steep and narrow with rocky beds or broad and meandering. Soils have a surface layer of partially decomposed organic matter 2-4 inches (5-10 cm) thick. Subsurface layers are very coarse with 10-60% gravel or cobbles. Subsurface textures range from clay loams to loamy sands.

Vegetation Description

This plant association is characterized by an overstory of 5-80% cover of *Populus angustifolia* (narrowleaf cottonwood) and a thick shrub understory of *Betula occidentalis* (river birch). Other tree species that can be present include *Pseudotsuga menziesii* (Douglas-fir) and *Juniperus scopulorum* (Rocky Mountain juniper). Other shrubs that can be abundant, but never more than birch include *Alnus incana* (thinleaf alder), *Acer glabrum* (mountain maple), *Cornus sericea* (red-osier dogwood), *Salix bebbiana* (Bebb willow), *Crataegus rivularis* (river hawthorn), *Ribes inerme* (whitestem gooseberry), *Salix ligulifolia* (strapleaf willow), *Rhus trilobata* (skunkbush sumac), *Salix irrorata* (bluestem willow), *Rubus parviflorus* (thimbleberry), and *Prunus virginiana* (chokecherry).

Graminoid and forb cover is minor, except in degraded stands, where introduced, non-native species can be abundant. These include *Poa pratensis* (Kentucky bluegrass), *Taraxacum officinale* (dandelion), *Melilotus* spp. (sweetclover). Native herbaceous species include *Maianthemum stellatum* (starry false Solomon seal), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Carex utriculata* (beaked sedge), and *Angelica ampla* (giant angelica).

Ecological Processes

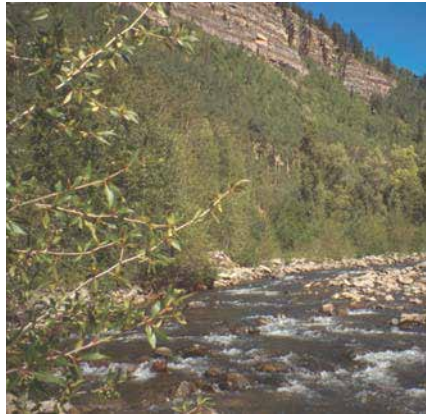
The *Populus angustifolia*/*Betula occidentalis* (narrowleaf cottonwood/river birch) plant association is considered to be early- to mid-seral. *Betula occidentalis* becomes abundant along stream banks with perennial stream flow and well-aerated soils. With continued aggradation of the alluvial surface and shading from a thick shrub canopy, successful *Populus angustifolia* reproduction may cease and the stand may become a *Betula occidentalis* dominated shrubland with a graminoid understory. *Populus angustifolia* appears to be reproducing in two of the stands sampled, however, the individuals may be sprouting from roots rather than developing from seeds.

Avg. Cover %	(Range)	Species Name	# Plots (N=24)
41	(4-80%)	<i>Populus angustifolia</i>	24
35	(8-67%)	<i>Betula occidentalis</i>	24
19	(1-59%)	<i>Alnus incana</i>	10
16	(1-63%)	<i>Agrostis gigantea</i>	5
11	(1-20%)	<i>Cornus sericea</i>	7
10	(2-18%)	<i>Poa compressa</i>	5
9	(1-24%)	<i>Pseudotsuga menziesii</i>	8
9	(1-22%)	<i>Acer glabrum</i>	5
8	(0.1-23%)	<i>Salix lucida</i> ssp. <i>caudata</i> , <i>lasianдра</i>	3
8	(0.1-28%)	<i>Melilotus officinalis</i>	5
8	(1-20%)	<i>Poa pratensis</i>	12
7	(1-20%)	<i>Glyceria striata</i>	3
6	(1-14%)	<i>Trifolium repens</i>	8
6	(0.1-20%)	<i>Dactylis glomerata</i>	4
6	(0.1-30%)	<i>Rudbeckia laciniata</i> var. <i>ampla</i>	8
6	(1-10%)	<i>Clematis ligusticifolia</i>	5
6	(1-18%)	<i>Salix bebbiana</i>	7

Other species with < 5% average cover present in at least 10% of plots:

Calamagrostis canadensis (1-10%), *Salix exigua* (1-7%), *Salix ligulifolia* (1-10%), *Geranium richardsonii* (1-7%), *Juniperus scopulorum* (1-15%), *Equisetum arvense* (0.1-15%), *Medicago lupulina* (1-5%), *Ribes inerme* (0.1-10%), *Prunus virginiana* var. *melanocarpa* (1-11%), *Carex microptera* (1-5%), *Taraxacum officinale* (1-11%), *Conioselinum scopulorum* (1-7%), *Heracleum maximum* (1-5%), *Cirsium arvense* (1-5%), *Rosa woodsii* (1-7%), *Populus tremuloides* (1-5%), *Urtica dioica* ssp. *gracilis* (1-4%), *Deschampsia caespitosa* (1-3%), *Quercus gambelii* (0.1-5%), *Bromus inermis* (0.1-5%), *Osmorhiza depauperata* (1-3%), *Maianthemum stellatum* (0.1-5%), *Amelanchier utahensis* (1-3%), *Thalictrum fendleri* (0.1-5%), *Achillea millefolium* var. *occidentalis* (0.1-2%), *Oxypolis fendleri* (1%), *Bromus ciliatus* var. *ciliatus* (1%), *Equisetum hyemale* var. *affine* (1%), *Senecio triangularis* (1%), *Cynoglossum officinale* (0.1-1%), *Veronica americana* (0.1-1%), *Equisetum laevigatum* (0.1-1%).

***Populus angustifolia* / *Salix* (*monticola*, *drummondiana*, *lucida*)**



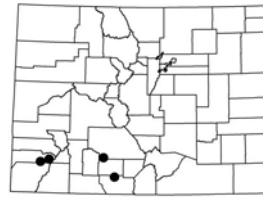
Global rank/State rank:

G3 / S3

HGM subclass: R3/4

Colorado elevation range:

7,900-8,900 ft (2,400-2,700 m)



General Description

The *Populus angustifolia*/*Salix* (*monticola*, *drummondiana*, *lucida*) (narrowleaf cottonwood/mixed willow) plant association is an early to mid-seral stage of more mature *Populus angustifolia* dominated plant associations. The cottonwoods are fairly young trees (5-15 in, 12-38 cm dbh), with a diverse mix of willows and other shrubs in the understory canopy.

This community occurs on active floodplains, stream benches and low terraces, generally within 1-4.5 ft (0.3-1.4 m) of the active channel elevation. Stream channels range from steep and narrow to broad, moderate gradient and more sinuous. Sites show signs of active flooding. One stand occurs on an overflow or back channel. Soils are somewhat deep (about 3 ft, 1 m), loamy to clay sands over very coarse alluvial layers with at least 25% gravel and other coarse fragments present in all layers.

Vegetation Description

The upper canopy is dominated by young (sapling, pole and medium-sized 5-15 in, 12-35 cm in diameter) *Populus angustifolia* (narrowleaf cottonwood) trees with 25-90% cover. The understory has a consistent mixture of two or more willow species, which can include *Salix exigua* (sandbar willow), *S. ligulifolia* (strapleaf willow), *S. monticola* (mountain willow), *S. lucida* ssp. *caudata* (shining willow), *S. drummondiana* (Drummond willow), and *S. geyeriana* (Geyer willow). Total cover of the shrub layer is between 15-70%. Other, non-willow shrubs are usually present as well, and include *Rosa woodsii* (Woods rose), *Ribes* spp. (gooseberry), *Alnus incana* (thinleaf alder), *Crataegus rivularis* (river hawthorn), *Dasiphora floribunda* (shrubby cinquefoil), and *Symphoricarpos* spp. (snowberry).

The herbaceous undergrowth is generally low in total cover, with 10-40% forbs and 5-15% graminoids. Common species include *Maianthemum stellatum* (starry false Solomon seal), *Trifolium* spp. (clover), *Erigeron* spp. (fleabane), *Poa pratensis* (Kentucky bluegrass), and *Bromus inermis* (smooth brome).

Ecological Processes

As with all cottonwood woodlands, this association is found within a continually changing alluvial environment where riparian vegetation is constantly being “re-set” by flooding disturbance. Mature cottonwood stands do not regenerate in place, but regenerate by “moving” up and down a river reach. Over time, a healthy riparian area supports all stages of cottonwood communities. The process of cottonwood regeneration is dependent on flooding disturbance. Periodic flooding allows cottonwood seedlings to germinate and become established on newly deposited, moist sandbars. Natural river processes of bank erosion, deposition and channel migration result in a dynamic patchwork of different age classes, plant associations and habitats.

Avg. Cover %	(Range)	Species Name	# Plots (N=4)
57	(23-89%)	<i>Populus angustifolia</i>	4
17	(6-36%)	<i>Salix monticola</i>	3
13	(10-16%)	<i>Alnus incana</i>	2
12	—	<i>Salix drummondiana</i>	1
11	—	<i>Juniperus monosperma</i>	1
7	—	<i>Ribes cereum</i>	1
6	(1-13%)	<i>Poa pratensis</i>	4
5	(1-9%)	<i>Ribes inerme</i>	2
5	(4-6%)	<i>Salix exigua</i>	2
5	(3-7%)	<i>Salix lucida</i> ssp. <i>caudata</i> , <i>lasiandra</i>	2
5	—	<i>Maianthemum stellatum</i>	1

Other species with < 5% average cover present in at least 10% of plots:

Symphyotrichum foliaceum (4%), *Symphoricarpos albus* (4%), *Rosa woodsii* (1-8%), *Lonicera involucrata* (3%), *Equisetum arvense* (3%), *Heracleum maximum* (3%), *Bromus ciliatus* var. *ciliatus* (3%), *Galium triflorum* (3%), *Equisetum pratense* (3%), *Crataegus rivularis* (3%), *Cornus sericea* ssp. *sericea* (3%), *Trifolium pratense* (3%), *Thermopsis montana* (3%), *Symphoricarpos oreophilus* (3%), *Salix geyeriana* (3%), *Rudbeckia laciniata* var. *ampla* (3%), *Pseudocymopterus montanus* (3%), *Phleum pratense* (3%), *Pedicularis procera* (3%), *Medicago lupulina* (3%), *Salix ligulifolia* (2-3%), *Taraxacum officinale* (2-3%), *Achillea millefolium* var. *occidentalis* (1-2%), *Juncus balticus* var. *montanus* (1%), *Glyceria striata* (1%), *Fragaria virginiana* ssp. *glauca* (1%), *Dasiphora floribunda* (1%), *Iris missouriensis* (1%), *Thalictrum fendleri* (1%), *Dactylis glomerata* (1%), *Amelanchier alnifolia* (1%), *Angelica pinnata* (1%), *Geranium richardsonii* (1%), *Bromus inermis* (1%), *Chamerion angustifolium* ssp. *circumvagum* (1%), *Calamagrostis canadensis* (1%), *Carex pellita* (1%), *Cardamine cordifolia* (1%), *Carex microptera* (1%), *Mertensia ciliata* (1%), *Castilleja sulphurea* (1%), *Castilleja miniata* (1%), *Carex utriculata* (1%), *Elymus glaucus* (1%), *Vicia americana* (1%), *Trifolium repens* (1%), *Solidago canadensis* (1%), *Ribes lacustre* (1%), *Heterotheca villosa* (1%), *Platanthera sparsiflora* var. *ensifolia* (1%), *Pinus ponderosa* var. *scopulorum* (1%), *Oxypolis fendleri* (1%), *Mimulus guttatus* (1%), *Zigadenus elegans* ssp. *elegans* (1%), *Maianthemum racemosum* ssp. *amplexicaule* (1%), *Rubus idaeus* ssp. *strigosus* (1%).

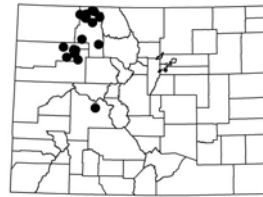
***Salix boothii* / Mesic forbs**



Global rank/State rank:
G3 / S3

HGM subclass: S1/2, R2

Colorado elevation range:
7,000-9,500 ft (2,130-2,900
m)



General Description

The *Salix boothii*/mesic forbs (Booth willow/mesic forbs) plant association is a tall (4-5 ft, 1-2 m) shrubland that often forms extensive thickets (willow carrs) on broad montane floodplains. This association is common in the northern half of Colorado.

This association occurs on wetter sites within the floodplain environment. It is usually found within 2.5 ft (0.75 m) of the water table, but is occasionally located above the channel on low terraces of straighter sections of river. The ground surface is often uneven and hummocky due to past flooding and beaver activity. A narrow to broad, low-gradient floodplain is common along all of the river reaches. Stream channels are steep and narrow, broad and sinuous, narrow and meandering, or recently eroding. Soils are highly stratified with alternating layers of sandy loams and clay loams and mottled within the top 4 inches (10 cm). Others are finely textured, dark-colored, highly organic soils with silty clay loam mottling. Lower profiles contain a gravel or cobble layer which may indicate that the soil section is a silted-in beaver pond.

Vegetation Description

Salix boothii (Booth willow) forms large stands with a canopy ranging from 20-80% cover. Other shrub species can be as abundant but do not exceed that of *Salix boothii* nor are they consistently present. Other shrub species include *Salix drummondiana* (Drummond willow), *Salix geyeriana* (Geyer willow), *Salix monticola* (mountain willow), *Dasiphora floribunda* (shrubby cinquefoil), *Betula nana* (= *glandulosa*) (bog birch), and *Alnus incana* (thinleaf alder).

The undergrowth is characterized by a sparse to lush forb layer growing on raised hummocks. No one forb species is dominant, instead several abundant species have a combined cover of 40-60%. Forb species include *Swertia perennis* (star gentian), *Pedicularis groenlandica* (elephanthead lousewort), *Polygonum bistortoides* (American bistort), *Heracleum maximum* (common cowparsnip), and *Achillea millefolium* var. *occidentalis* (western yarrow). Graminoid cover is typically low (< 20%), but it can be as

high as 80%. Graminoid species include *Carex aquatilis* (water sedge), *Carex utriculata* (beaked sedge), and *Calamagrostis canadensis* (bluejoint reedgrass).

Ecological Processes

The *Salix boothii* (Booth willow)/mesic forbs plant association appears to be a stable and long-lived community on sites that are neither completely saturated nor dry throughout the growing season. The undergrowth of *Salix boothii* dominated associations varies according to the substrate and water regime. Wetter stands have an understory of *Carex utriculata* (beaked sedge), while drier stands may have *Calamagrostis canadensis* (bluejoint reedgrass) and various forb species. It is unclear whether grazing increases the dominance of either mesic forbs or graminoids or if there are subtle environmental differences between sites that contribute to this. With excessive grazing, this community may be replaced by a *Salix boothii*/*Poa pratensis* (Booth willow/Kentucky bluegrass) type with native forbs once dominant in the *Salix boothii*/mesic forbs plant association growing under the protection of shrub bases.

Avg. Cover %	(Range)	Species Name	# Plots (N=20)
58	(20-80%)	<i>Salix boothii</i>	20
31	(1-80%)	<i>Salix drummondiana</i>	7
13	(1-34%)	<i>Salix geyeriana</i>	8
11	(1-80%)	<i>Calamagrostis canadensis</i>	11
10	(1-20%)	<i>Salix wolfii</i>	6
9	(1-40%)	<i>Heracleum maximum</i>	13
9	(1-40%)	<i>Poa pratensis</i>	11
9	(1-20%)	<i>Agrostis gigantea</i>	4
9	(1-50%)	<i>Fragaria virginiana</i> ssp. <i>glauca</i>	16
7	(1-30%)	<i>Alnus incana</i>	6
6	(1-20%)	<i>Rudbeckia laciniata</i> var. <i>ampla</i>	8
5	(1-30%)	<i>Sidalcea candida</i>	7
5	(1-20%)	<i>Phleum pratense</i>	11
5	(1-20%)	<i>Carex utriculata</i>	8

Other species with < 5% average cover present in at least 10% of plots:

Urtica dioica ssp. *gracilis* (1-10%), *Taraxacum officinale* (1-50%), *Maianthemum stellatum* (1-30%), *Elymus repens* (1-10%), *Symphyotrichum foliaceum* (1-10%), *Lonicera involucrata* (1-5%), *Galium boreale* (1-20%), *Poa palustris* (1-10%), *Elymus glaucus* (1-7%), *Cardamine cordifolia* (1-10%), *Geranium richardsonii* (1-10%), *Ribes inerme* (1-10%), *Mertensia ciliata* (1-5%), *Equisetum arvense* (1-6%), *Achillea millefolium* var. *occidentalis* (1-10%), *Thalictrum fendleri* (1-5%), *Solidago canadensis* (1-5%), *Symphyotrichum lanceolatum* ssp. *hesperium* var. *hesperium* (1-5%), *Rubus idaeus* ssp. *strigosus* (1-5%), *Dactylis glomerata* (1-5%), *Geum macrophyllum* var. *perincisum* (1-5%), *Hymenoxys hoopesii* (1-5%), *Senecio bigelovii* var. *hallii* (1-4%), *Vicia americana* (1-5%), *Aconitum columbianum* (1-2%), *Carex microptera* (1%), *Conioselinum scopulorum* (1%), *Senecio triangularis* (1%), *Glyceria striata* (1%), *Chamerion angustifolium* ssp. *circumvagum* (1%).

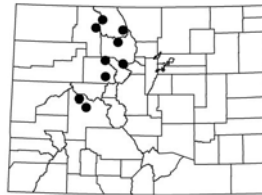
Salix drummondiana* / *Calamagrostis canadensis



Global rank/State rank:
G3 / S3

HGM subclass: S1/2,
R2

Colorado elevation range:
8,000-9,800 ft (2,400-3,000 m)



General Description

The *Salix drummondiana*/*Calamagrostis canadensis* (Drummond willow/bluejoint reedgrass) plant association is characterized by a dense canopy of *Salix drummondiana* and a thick undergrowth of *Calamagrostis canadensis*. This association is often associated with beaver activity along streams and can also occur within the riparian mosaic with *Abies lasiocarpa*-*Picea engelmannii* (subalpine fir-Engelmann spruce) forests. This plant association occurs in scattered locations on the West Slope in the Yampa, Colorado and Gunnison River Basins and in the Routt National Forest.

This plant association occurs as small, isolated patches in forest and shrubland openings along channels in narrow valley bottoms. *Salix drummondiana* (Drummond willow) usually occurs along steep, narrow stream margins. It is often associated with beaver activity and can occasionally occur along low-gradient streams.

Vegetation Description

Salix drummondiana (Drummond willow) dominates the shrub overstory. Other shrubs can be present and abundant, such as *Salix planifolia* (planeleaf willow) and *Alnus incana* (thinleaf alder). The graminoid layer is dominated by *Calamagrostis canadensis* (bluejoint reedgrass). Other abundant graminoids include *Carex aquatilis* (water sedge), *Carex utriculata* (beaked sedge), and *Glyceria striata* (fowl mannagrass). Forb cover is typically low and includes *Galium boreale* (northern bedstraw), *Geranium richardsonii* (Richardson geranium), and *Mertensia ciliata* (tall fringed bluebells).

Ecological Processes

The *Salix drummondiana*/*Calamagrostis canadensis* (Drummond willow/bluejoint reedgrass) plant association is often an early colonizer of first-order, boulder-strewn,

steep streams. Only a few stands representing the *Salix drummondiana*/*Calamagrostis canadensis* (Drummond willow/bluejoint reedgrass) plant association have been found in Colorado, and livestock grazing has probably altered the species composition of these stands. This association appears to be limited to saturated wetland environments and therefore may be dependent on beaver populations that maintain a high water table. In addition, near beaver activity, this association may be a mid-successional community that will eventually become a *Salix planifolia* (planeleaf willow) or *Salix monticola* (mountain willow) type as the area dries slightly and accumulates sediment.

Avg. Cover %	(Range)	Species Name	# Plots (N=12)
54	(20-95%)	<i>Salix drummondiana</i>	12
34	(3-80%)	<i>Calamagrostis canadensis</i>	11
15	(5-30%)	<i>Carex utriculata</i>	3
14	(5-30%)	<i>Carex aquatilis</i>	4
13	(5-20%)	<i>Salix geeyariana</i>	2
11	(1-20%)	<i>Salix planifolia</i>	2
10	(1-20%)	<i>Salix monticola</i>	3
9	(5-11%)	<i>Glyceria striata</i>	3
8	(0.1-30%)	<i>Heracleum maximum</i>	8
4	(1-7%)	<i>Equisetum arvense</i>	6

Other species with < 5% average cover present in at least 10% of plots:
Chamerion angustifolium ssp. *circumvagum* (1-5%), *Galium triflorum* (1-5%), *Veronica americana* (1-4%), *Deschampsia caespitosa* (2-3%), *Geranium richardsonii* (1-5%), *Alnus incana* (2-3%), *Mertensia ciliata* (1-5%), *Taraxacum officinale* (1-3%), *Poa pratensis* (1-3%), *Fragaria virginiana* ssp. *glauca* (1-3%), *Cardamine cordifolia* (1-3%), *Veratrum tenuipetalum* (1-2%), *Thalictrum sparsiflorum* (1-2%), *Geum macrophyllum* var. *perincisum* (1-3%), *Senecio triangularis* (1-3%), *Conioselinum scopulorum* (0.1-2%), *Achillea millefolium* var. *occidentalis* (1%), *Galium boreale* (1%), *Rubus idaeus* ssp. *strigosus* (1%), *Lonicera involucrata* (1%), *Bromus ciliatus* var. *ciliatus* (1%), *Epilobium lactiflorum* (0.1-1%).

Salix drummondiana* / *Carex aquatilis



Global rank/State rank:
G2G3 / S2S3

HGM subclass: S1/2?, R2

Colorado elevation range:
8,430-10,460 ft (2,570-
3,190 m)



General Description

The *Salix drummondiana*/*Carex aquatilis* (Drummond willow/water sedge) plant association forms a narrow band of tall (5-8 ft, 1.5-2.5 m) willows lining steep to moderately steep streams in the montane zone of the Rocky Mountains. The dominance of *Carex aquatilis* (water sedge) in the undergrowth is an indication of a wet, stable site. This association represents one of the wettest types within the *Salix drummondiana* Alliance.

Salix drummondiana (Drummond willow) typically becomes the dominant willow on floodplains of high-gradient streams in narrow, V-shaped valleys. Stream channels are steep and incised. Soils are deep sandy clays with high organic content in the top layers. Mottling is infrequent (10%) 6-20 inches (15-50 cm) below the surface and the soil profile becomes skeletal at a depth of 13 inches (33 cm).

Vegetation Description

Salix drummondiana (Drummond willow) forms a thick band of tall, 5-8 ft (1.5-2.5 m), shrubs overhanging the stream channel. Other shrubs that may be present include *Salix monticola* (mountain willow), *Dasiphora floribunda* (shrubby cinquefoil), and *Cornus sericea* (red-osier dogwood). The undergrowth is a thick carpet of grasses, grass-like plants and forbs including *Carex aquatilis* (water sedge), *Carex utriculata* (beaked sedge), *Carex microptera* (smallwing sedge), *Conioselinum scopulorum* (Rocky Mountain hemlockparsley), *Equisetum arvense* (field horsetail), *Fragaria virginiana* (strawberry), and *Senecio triangularis* (arrowleaf ragwort).

Ecological Processes

The *Salix drummondiana*/*Carex aquatilis* (Drummond willow/water sedge) plant association is early- to mid-seral. *Salix drummondiana* is a prolific seed producer and one of the first to colonize coarse-textured cobble bars and recently scoured alluvial surfaces. *Salix drummondiana* is flexible and can tolerate most flood events. With time,

fine-textured particles are deposited on the alluvial surface, raising the ground level above the annual flood stage. These fine-textured particles along with litter develop into more nutrient-rich soils. If the site remains close to the water table, but is not heavily disturbed by flooding (no scouring), grasses and grass-like plants will become established. The presence of *Carex aquatilis* and other sedge species is a good indication of a wet-mesic and stable site. With time, this association may become dominated by conifer trees.

Avg. Cover %	(Range)	Species Name	# Plots (N=3)
36	(30-42%)	<i>Salix drummondiana</i>	3
28	(20-45%)	<i>Carex aquatilis</i>	3
21	(11-30%)	<i>Calamagrostis canadensis</i>	2
15	—	<i>Juncus tracyi</i>	1
11	(5-16%)	<i>Salix monticola</i>	3
10	—	<i>Equisetum pratense</i>	1
10	—	<i>Dodecatheon pulchellum</i>	1
10	—	<i>Dasiphora floribunda</i>	1
9	(3-15%)	<i>Picea engelmannii</i>	2
9	—	<i>Pinus contorta</i>	1
6	—	<i>Fragaria virginiana</i> ssp. <i>glauca</i>	1
6	—	<i>Juncus compressus</i>	1
6	(1-10%)	<i>Conioselinum scopulorum</i>	2
5	—	<i>Cornus sericea</i>	1
5	—	<i>Alnus incana</i>	1
5	—	<i>Carex simulata</i>	1
5	—	<i>Erigeron eximius</i>	1
5	—	<i>Caltha leptosepala</i>	1
5	—	<i>Salix lucida</i> ssp. <i>caudata</i> , <i>lasiandra</i>	1
5	—	<i>Ribes montigenum</i>	1

Other species with < 5% average cover present in at least 10% of plots:

Arnica cordifolia (4%), *Fragaria vesca* ssp. *bracteata* (4%), *Salix planifolia* (2-5%), *Arnica mollis* (3%), *Vaccinium scoparium* (3%), *Senecio triangularis* (3%), *Saxifraga odontoloma* (3%), *Festuca thurberi* (3%), *Pinus aristata* (3%), *Pedicularis groenlandica* (3%), *Oxypolis fendleri* (0.1-5%), *Taraxacum officinale* (0.1-6%), *Poa compressa* (1-3%), *Carex utriculata* (2%), *Equisetum arvense* (2%), *Aconitum columbianum* (2%), *Carex interior* (2%), *Carex occidentalis* (2%), *Chamerion angustifolium* ssp. *circumvagum* (1%), *Carex microptera* (1%), *Epilobium hornemannii* (1%), *Clematis ligusticifolia* (1%), *Angelica grayi* (1%), *Carex albonigra* (1%), *Cardamine cordifolia* (1%), *Cerastium arvense* ssp. *strictum* (1%), *Streptopus amplexifolius* var. *chalazatus* (1%), *Salix brachycarpa* (1%), *Pyrola asarifolia* ssp. *asarifolia* (1%), *Potentilla pulcherrima* (1%), *Polygonum viviparum* (1%), *Orthilia secunda* (1%), *Mitella pentandra* (1%), *Maianthemum stellatum* (1%), *Lupinus argenteus* (1%), *Vahlodea atropurpurea* (1%), *Juncus balticus* var. *montanus* (1%), *Abies lasiocarpa* (1%), *Poa pratensis* (1%), *Geum macrophyllum* var. *perincisum* (0.1%), *Achillea millefolium* var. *occidentalis* (0.1%), *Trifolium pratense* (0.1%), *Platanthera hyperborea* var. *hyperborea* (0.1%).

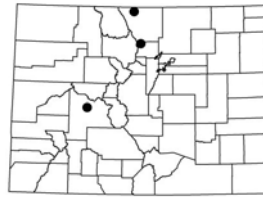
Salix geyeriana* - *Salix monticola* / *Calamagrostis canadensis



Global rank/State rank:
G3 /S3

HGM subclass: R2

Colorado elevation range:
8,200-9,200 ft (2,500-2,800
m)



General Description

The *Salix geyeriana*-*Salix monticola*/*Calamagrostis canadensis* (Geyer willow-mountain willow/bluejoint reedgrass) plant association is a tall (4-8 ft, 1.5-2.5 m), deciduous shrubland that occurs in small and large stands interspersed with wet meadows, open stream channels, and beaver ponds. The willow canopy is nearly a homogeneous mix of the two willow species.

This plant association occurs on wide floodplains that are flat or hummocky and occurs within 2 ft (0.5 m) of the channel high water mark. Stream channels are narrow and highly sinuous or braided by beaver activity. Soil textures range from sandy loam to silty clay, with up to 50% organic matter in the upper layers. Water table depths range from 8-25 inches (20-60 cm).

Vegetation Description

The shrub canopy is dominated by 22-40% cover of *Salix geyeriana* (Geyer willow) and 15-50% cover of *Salix monticola* (mountain willow). Other shrubs that may be present include *Salix planifolia* (planeleaf willow), *Salix drummondiana* (Drummond willow), *Lonicera involucrata* (twinberry honeysuckle), and *Ribes inerme* (whitestem gooseberry). The undergrowth can be patchy, but generally dominated by *Calamagrostis canadensis* (bluejoint reedgrass). Other herbaceous species that may be present include *Carex aquatilis* (water sedge), *Geum macrophyllum* (largeleaf avens), and *Heracleum maximum* (common cowparsnip).

Ecological Processes

Stands dominated by *Salix geyeriana* (Geyer willow) appear to be stable, long-lived communities. *Salix geyeriana* is most stable where the water table does not drop below 3 ft (1 m) of the surface. It appears to be limited to cold, wet environments of broad valley bottoms at high elevations. Due to the colder environments, organic matter builds up in the soils and succession to other associations is likely to be slow. Beaver activity is also

important in maintaining this association since it may be the last successional community to establish on naturally silted-in beaver ponds.

Avg. Cover %	(Range)	Species Name	# Plots (N=3)
31	(16-50%)	Salix monticola	3
31	(20-47%)	Calamagrostis canadensis	3
28	(22-40%)	Salix geeyeriana	3
21	—	Heracleum maximum	1
15	—	Carex disperma	1
15	—	Urtica dioica ssp. gracilis	1
13	—	Carex aquatilis	1
11	—	Lonicera involucrata	1
9	(4-13%)	Salix planifolia	2
7	—	Rubus idaeus ssp. strigosus	1
7	(1-12%)	Geum macrophyllum var. perincisum	2
5	—	Cardamine cordifolia	1
5	—	Fragaria virginiana ssp. glauca	1
5	—	Rudbeckia laciniata var. ampla	1
5	—	Salix drummondiana	1
Other species with < 5% average cover present in at least 10% of plots:			
Carex utriculata (4%), Viola canadensis var. scopulorum (4%), Rosa woodsii (4%), Cicuta douglasii (3%), Rhodiola rhodantha (2%), Cirsium arvense (2%), Pinus ponderosa var. scopulorum (2%), Trifolium repens (2%), Chamerion angustifolium ssp. circumvagum (1-2%), Equisetum arvense (1%), Ribes inerme (1%), Stellaria crassifolia (1%), Taraxacum officinale (1%), Thalictrum alpinum (1%), Mertensia ciliata (1%).			

Salix geyeriana / *Calamagrostis canadensis*



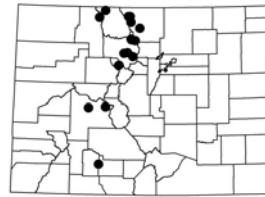
Global rank/State rank:

G5 / S3

HGM subclass: R2

Colorado elevation range:

7,700-10,000 ft (2,350-3,050 m)



General Description

The *Salix geyeriana*/*Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) plant association is a tall (6-10 ft, 2-3 m), deciduous shrubland, often forming large expanses of willows on broad montane valley floors. The ground is usually hummocky with a thick carpet of grasses and grass-like plants. These shrublands are often associated with beaver-created wetlands. Although this association has been reported from several states, it is relatively uncommon in Colorado where it occurs in the Colorado River Basin, the upper South Platte River Basin, and on the Routt, Arapaho, Roosevelt, Rio Grande, and Gunnison National Forests.

This plant association occurs along sinuous, moderate to low gradient (0.1-8%) rivers and adjacent to beaver ponds on hummocky land surfaces. Stream channels are wide and strongly meandering. Soil textures are fine silty clay loams with high organic content.

Vegetation Description

Salix geyeriana (Geyer willow) dominates the tall-shrub overstory. Other shrubs that may be present include *Salix monticola* (mountain willow), *Salix planifolia* (planeleaf willow), *Salix drummondiana* (Drummond willow), and *Alnus incana* (thinleaf alder). The undergrowth is always dominated by *Calamagrostis canadensis* (bluejoint reedgrass). Other graminoids that may be present include *Carex aquatilis* (water sedge) and *Carex utriculata* (beaked sedge). Forb cover is relatively low.

Ecological Processes

The *Salix geyeriana* (Geyer willow) dominated associations appear to be long-lived and late-seral, remaining in areas where a shallow water table saturates soils, not dropping below 3 ft (1 m) for much of the growing season. Stands are limited to cold, wet environments of broad valley bottoms at high elevations. Due to the colder environments, organic matter builds up in the soils and succession to other associations is

likely to be slow. Beaver activity is also important in maintaining this association since it may be the last successional community to establish on naturally silted-in beaver ponds.

Carex utriculata (beaked sedge), *Carex aquatilis* (water sedge), and *Calamagrostis canadensis* (bluejoint reedgrass) are common dominant undergrowth of several *Salix* plant associations. These three graminoids indicate different micro-environments, generally separating out along a moisture gradient related to the depth of the water table, and can represent different stages of succession of the floodplain.

Carex utriculata (beaked sedge) occurs on the wettest sites, such as shallow pond margins, low-lying swales, and overflow channels with the shallowest water tables. *Carex aquatilis* (water sedge) occurs on intermediate sites that have saturated but not inundated soils. *Calamagrostis canadensis* (bluejoint reedgrass) dominates the drier sites with lower water tables.

Avg. Cover %	(Range)	Species Name	# Plots (N=21)
53	(20-100%)	<i>Salix geyeriana</i>	21
33	(1-80%)	<i>Calamagrostis canadensis</i>	21
15	(5-25%)	<i>Thalictrum fendleri</i>	2
13	(1-20%)	<i>Salix boothii</i>	3
13	(3-25%)	<i>Ribes lacustre</i>	3
11	(3-20%)	<i>Salix planifolia</i>	3
10	(1-16%)	<i>Alnus incana</i>	3
9	(3-16%)	<i>Salix wolfii</i>	5
9	(1-15%)	<i>Fragaria virginiana</i> ssp. <i>glauca</i>	6
9	(1-30%)	<i>Carex aquatilis</i>	6
8	(1-30%)	<i>Poa pratensis</i>	13
8	(0.1-20%)	<i>Salix monticola</i>	10
7	(1-15%)	<i>Phleum pratense</i>	4
7	(1-20%)	<i>Carex utriculata</i>	10
6	(1-10%)	<i>Carex microptera</i>	2
5	(1-10%)	<i>Ribes inerme</i>	4
5	(1-30%)	<i>Heracleum maximum</i>	8

Other species with < 5% average cover present in at least 10% of plots:

Lonicera involucrata (1-15%), *Agrostis scabra* (1-20%), *Geum macrophyllum* var. *perincisum* (1-10%), *Dasiphora floribunda* (1-10%), *Taraxacum officinale* (1-10%), *Juncus balticus* var. *montanus* (1-5%), *Mertensia ciliata* (1-7%), *Achillea millefolium* var. *occidentalis* (1-5%), *Deschampsia caespitosa* (1-3%), *Trisetum wolfii* (1-3%), *Scirpus microcarpus* (1-3%), *Conioselinum scopulorum* (1-5%), *Galium boreale* (0.1-3%), *Equisetum arvense* (0.1-4%), *Glyceria striata* (1-2%), *Betula nana* (1-2%), *Cardamine cordifolia* (1-2%), *Polemonium occidentale* ssp. *occidentale* (0.1-2%), *Geranium richardsonii* (1%), *Pedicularis groenlandica* (1%), *Oxypolis fendleri* (1%), *Aconitum columbianum* (1%), *Solidago canadensis* (1%), *Senecio triangularis* (1%), *Castilleja sulphurea* (1%), *Eleocharis palustris* (1%), *Caltha leptosepala* (1%), *Symphyotrichum foliaceum* (0.1-1%).

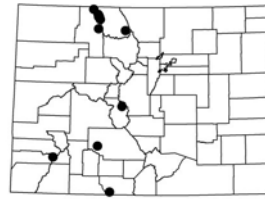
***Salix geyeriana* / Mesic forbs**



Global rank/State rank:
G3 / S3

HGM subclass: R2, R3/4

Colorado elevation range:
8,100-9,900 ft (2,460-3,000 m)



General Description

The *Salix geyeriana*/mesic forbs (Geyer willow/mesic forbs) plant association is a tall (5-15 ft, 1.5-2.5 m), deciduous shrubland confined to a narrow band along stream banks. The herbaceous undergrowth is dominated by mosses and forbs. This association is well documented in several western states. However, large, pristine stands without introduced species in the undergrowth are extremely rare.

This plant association generally occurs along moderately wide, low-gradient valley bottoms with sinuous stream channels. It can also occur in narrow valley bottoms (65-165 ft, 20-50 m), and on flood benches of moderately sinuous stream channels. Soils are coarse skeletal sandy loams and sandy clay loams overlying gravel and cobble horizons. Soils of this plant association tend to have more coarse fragments than other more moist *Salix geyeriana* associations.

Vegetation Description

Salix geyeriana (Geyer willow) dominates the tall shrub canopy. Other willow species that may be present include *Salix monticola* (mountain willow), *Salix drummondiana* (Drummond willow), *Salix planifolia* (planeleaf willow), *Salix wolfii* (Wolf willow), and *Salix brachycarpa* (barrenground willow). *Alnus incana* (thinleaf alder) can also be present. Forb cover is low to fairly dense and includes *Mertensia ciliata* (tall fringed bluebells), *Heracleum maximum* (common cowparsnip), *Senecio triangularis* (arrowleaf ragwort), *Oxypolis fendleri* (Fendler cowbane), and *Fragaria virginiana* (strawberry). Graminoid cover is sparse.

Ecological Processes

The *Salix geyeriana*/mesic forbs (Geyer willow/mesic forbs) plant association appears to be a long-lived, late-seral community that will remain dominant where a high water table saturates soils for much of the growing season. However, if the stand has predominantly non-native species in the undergrowth, such as *Trifolium repens* (white clover) and

Taraxacum officinale (dandelion), it is likely a grazing-induced community. With appropriate grazing management, the stand can revert back to the *Salix geyeriana*/mesic forbs (Geyer willow/mesic forbs) or the *Salix geyeriana* /mesic graminoids (Geyer willow/mesic graminoids) plant association.

Avg. Cover %	(Range)	Species Name	# Plots (N=10)
54	(30-75%)	<i>Salix geyeriana</i>	10
28	(15-50%)	<i>Alnus incana</i>	4
20	(6-32%)	<i>Salix monticola</i>	4
14	(7-20%)	<i>Salix boothii</i>	2
12	(3-20%)	<i>Salix wolfii</i>	2
11	(1-28%)	<i>Heracleum maximum</i>	6
9	(1-17%)	<i>Juncus balticus</i> var. <i>montanus</i>	2
9	(1-34%)	<i>Mertensia ciliata</i>	6
8	(6-10%)	<i>Trifolium repens</i>	2
8	(1-16%)	<i>Picea engelmannii</i>	3
7	(1-18%)	<i>Cardamine cordifolia</i>	4
7	(3-11%)	<i>Carex utriculata</i>	2
6	(1-20%)	<i>Poa pratensis</i>	4
6	(1-11%)	<i>Trifolium longipes</i>	2
6	(2-9%)	<i>Senecio triangularis</i>	5
6	(1-10%)	<i>Castilleja sulphurea</i>	2
5	(1-13%)	<i>Taraxacum officinale</i>	7
5	(2-8%)	<i>Erigeron speciosus</i> var. <i>speciosus</i>	2
5	(1-9%)	<i>Pinus contorta</i>	2
5	(1-18%)	<i>Carex aquatilis</i>	5

Other species with < 5% average cover present in at least 10% of plots:
Prunella vulgaris (4-5%), *Veratrum tenuipetalum* (3-7%), *Geranium richardsonii* (2-10%),
Aconitum columbianum (1-9%), *Thalictrum fendleri* (1-6%), *Carex microptera* (1-10%), *Achillea*
millefolium var. *occidentalis* (1-23%), *Dasiphora floribunda* (1-9%), *Calamagrostis canadensis* (2-
6%), *Salix planifolia* (1-10%), *Ligusticum tenuifolium* (2-5%), *Viola macloskeyi* ssp. *pallens* (1-6%),
Oxypolis fendleri (1-10%), *Conioselinum scopulorum* (1-5%), *Erigeron peregrinus* ssp.
callianthemus (3-3%), *Galium boreale* (1-5%), *Fragaria virginiana* ssp. *glauca* (1-5%), *Lonicera*
involuta (2-3%), *Equisetum arvense* (1-5%), *Aster alpinus* var. *vierhapperi* (1-3%), *Osmorhiza*
depauperata (1-3%), *Carex foenea* (1-3%), *Carex norvegica* (1-3%), *Trisetum spicatum* (1-3%),
Vicia americana (1-4%), *Pedicularis groenlandica* (1-3%), *Luzula parviflora* (1-3%), *Phleum*
alpinum (1-3%), *Maianthemum stellatum* (1-2%), *Galium triflorum* (1-2%), *Castilleja miniata* (1-
2%), *Ribes montigenum* (1-2%), *Mitella pentandra* (1-2%), *Saxifraga odontoloma* (1-2%), *Geum*
macrophyllum var. *perincisum* (1%), *Deschampsia caespitosa* (1%), *Caltha leptosepala* (1%),
Bromus ciliatus var. *ciliatus* (1%), *Bromus lanatipes* (1%), *Chamerion angustifolium* ssp.
circumvagum (1%), *Elymus glaucus* (1%), *Stellaria longifolia* (1%), *Streptopus amplexifolius* var.
chalazatus (1%).

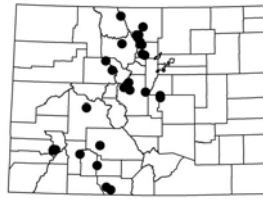
Salix monticola* / *Calamagrostis canadensis



Global rank/State rank:
G3 / S3

HGM subclass: R2

Colorado elevation range:
7,500-10,000 ft (2,280-
3,050 m)



General Description

The *Salix monticola*/*Calamagrostis canadensis* (mountain willow/bluejoint reedgrass) plant association is a tall (4-5 ft, 1.5-2 m) shrubland with an open to closed canopy of willows and a lush carpet of grasses. It occurs along broad floodplains and narrow streams in the montane and upper montane elevations.

This plant association occurs on narrow to wide, (100-1,000 ft; 30-300 m), low-gradient (2-3.5%) valley bottoms and floodplains. In wider valleys, large stands of this association occur between meanders and at the edges of beaver ponds. Stream channels are steep and narrow, moderately steep and wide, wide and sinuous, or braided from beaver activity. Soils are finely textured sandy clays to silty clay loams, often saturated to within 10 inches (30 cm) of the surface. Soils can also be silty loams over sand and coarse sand. Mottling often occurs at 5-15 inches (20-40 cm) depth.

Vegetation Description

This plant association has a closed, mixed canopy of willows with *Salix monticola* (mountain willow) being the dominant or matrix willow. The matrix species is the willow with the highest abundance, even though other willow species combined may have greater canopy cover. Other willows that may be present include *Salix drummondiana* (Drummond willow), *S. boothii* (Booth willow), *S. geyeriana* (Geyer willow), and *S. wolfii* (Wolf willow).

Calamagrostis canadensis (bluejoint reedgrass) forms an open to dense graminoid layer. Other graminoids that may be present include *Carex aquatilis* (water sedge), *C. utriculata* (beaked sedge), *C. microptera* (small-wing sedge), *Deschampsia caespitosa* (tufted hairgrass), and *Glyceria grandis* (American mannagrass). Total forb cover ranges from 20-50% cover and may include *Cardamine cordifolia* (heartleaf bittercress), *Geranium richardsonii* (Richardson geranium), *Mertensia ciliata* (tall fringed bluebells), *Oxypolis fendleri* (Fendler cowbane), *Geum macrophyllum* (largeleaf avens), *Solidago canadensis*

(Canada goldenrod), *Senecio bigelovii* var. *hallii* (Hall ragwort), and *Galium boreale* (northern bedstraw).

Ecological Processes

Salix monticola (mountain willow) dominated plant associations appear to be long-lived and stable. They occur on mesic sites that support a diversity of graminoids and forbs. *Salix monticola* appears to grow only where the water table does not drop below 3 ft (1 m) of the surface. It appears to be limited to cold, wet environments in broad valley bottoms at high elevations. The presence of dying conifer trees in these associations may indicate a rise in the water table. A higher water table allows for the increase in cover of *Calamagrostis canadensis* (bluejoint reedgrass) and the conversion from a conifer/*Calamagrostis canadensis* type to a *Salix* spp./ *Calamagrostis canadensis* type.

Carex utriculata (beaked sedge), *Carex aquatilis* (water sedge), and *Calamagrostis canadensis* (bluejoint reedgrass) are common dominant undergrowth of several *Salix* plant associations. These three graminoids indicate different micro-environments, generally separating out along a moisture gradient related to the depth of the water table, and can represent different stages of succession of the floodplain. *Carex utriculata* (beaked sedge) occurs on the wettest sites, such as shallow pond margins, low-lying swales, and overflow channels with the shallowest water tables. *Carex aquatilis* (water sedge) occurs on intermediate sites that have saturated but not inundated soils. *Calamagrostis canadensis* (bluejoint reedgrass) dominates the drier sites with lower water tables.

Avg. Cover %	(Range)	Species Name	# Plots (N=37)
57	(17-99%)	<i>Salix monticola</i>	37
39	(1-95%)	<i>Calamagrostis canadensis</i>	37
12	(2-40%)	<i>Salix drummondiana</i>	15
12	(1-25%)	<i>Salix geeyeriana</i>	10
11	(1-18%)	<i>Alnus incana</i>	8
10	(0.1-33%)	<i>Angelica ampla</i>	5
10	(3-15%)	<i>Ribes lacustre</i>	5
8	(1-20%)	<i>Carex aquatilis</i>	6
7	(1-19%)	<i>Carex microptera</i>	5
7	(0.1-30%)	<i>Heracleum maximum</i>	19
7	(1-25%)	<i>Salix planifolia</i>	10
6	(1-17%)	<i>Salix bebbiana</i>	10
6	(0.1-20%)	<i>Equisetum arvense</i>	18
6	(3-10%)	<i>Salix ligulifolia</i>	5
6	(0.1-20%)	<i>Cirsium arvense</i>	4
6	(1-20%)	<i>Poa pratensis</i>	16
5	(0.1-15%)	<i>Mertensia ciliata</i>	15
5	(1-20%)	<i>Fragaria virginiana</i> ssp. <i>glauca</i>	10

Other species with < 5% average cover present in at least 10% of plots:

Ribes montigenum (1-12%), *Lonicera involucrata* (0.1-15%), *Betula nana* (1-11%), *Taraxacum officinale* (0.1-17%), *Rudbeckia laciniata* var. *ampla* (0.1-7%), *Carex utriculata* (1-8%), *Conioselinum scopulorum* (0.1-15%), *Chamerion angustifolium* ssp. *circumvagum* (1-8%), *Equisetum pratense* (1-5%), *Dasiphora floribunda* (1-5%), *Achillea millefolium* var. *occidentalis* (1-8%), *Geranium richardsonii* (0.1-12%), *Montia chamissoi* (1-4%), *Maianthemum stellatum* (0.1-5%), *Phleum pratense* (1-5%), *Viola canadensis* var. *scopulorum* (1-6%), *Geum macrophyllum* var. *perincisum* (0.1-5%), *Rosa woodsii* (1-3%), *Picea pungens* (0.1-4%), *Cardamine cordifolia* (1-4%), *Picea engelmannii* (1-3%), *Mentha arvensis* (1-2%), *Ribes inerme* (0.1-3%), *Oxypolis fendleri* (1%), *Stellaria crassifolia* (1-1%), *Galium boreale* (0.1-2%), *Aconitum columbianum* (0.1-2%)

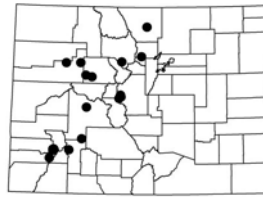
Salix monticola* / *Carex utriculata



Global rank/State rank:
G3 / S3

HGM subclass: S1/2, R2

Colorado elevation range:
6,600-10,300 ft (2,000-
3,100 m)



General Description

The *Salix monticola*/*Carex utriculata* (mountain willow/beaked sedge) plant association is a tall (5-8 ft, or 1.5-2.5 m), deciduous shrubland with an open canopy of willows and a thick understory of grasses and sedges. It occurs on open floodplains and often occupies the entire valley floor. The undergrowth is dominated by patches of *Carex utriculata* (beaked sedge). This association often includes *Carex aquatilis* (water sedge) and *Calamagrostis canadensis* (bluejoint reedgrass), but is distinguished from the *Salix monticola*/*Carex aquatilis* (mountain willow/water sedge) and *Salix monticola*/*Calamagrostis canadensis* (mountain willow/bluejoint reedgrass) associations because *Carex utriculata* is either the clear dominant or most consistently present of the three throughout the stand.

This plant association commonly occurs near beaver ponds. Willows establish on hummocks of higher ground and *Carex utriculata* (beaked sedge) establishes at the pond margins. This association also occurs along wet stream banks and terraces of low gradient (<3%), broad valley bottoms. Stream reaches can be moderately wide with a gentle gradient, wide and meandering, or altered by beaver activity, creating multiple channels. Soils are clay loam, sandy clay loam and heavy silty clay textures with occasional mottling. Some profiles have a buried organic layer. Others have up to 40% organic matter in the top 20 inches (50 cm).

Vegetation Description

This association is characterized by a thick canopy dominated by *Salix monticola* (mountain willow) as the matrix species. The matrix species is the willow with the highest abundance, even though other willow species combined may have greater canopy cover. Other shrub species that may be present include *Salix geyeriana* (Geyer willow), *Salix brachycarpa* (barrenground willow), *Salix drummondiana* (Drummond willow), *Salix. ligulifolia* (strapleaf willow), and *Salix boothii* (Booth willow).

Carex utriculata (beaked sedge) is the most abundant graminoid. Other graminoid cover is minor and includes *Carex aquatilis* (water sedge), *Poa pratensis* (Kentucky bluegrass), and *Deschampsia caespitosa* (tufted hairgrass). Total forb cover is generally less than 10%. Forb species include *Cardamine cordifolia* (heartleaf bittercress), *Mertensia ciliata* (tall fringed bluebells), and *Heracleum maximum* (common cowparsnip).

Ecological Processes

This plant association requires a high water table and saturated soils for much of the growing season and may be an early successional stage of the *Salix monticola*/*Carex aquatilis* and the *Salix monticola*/*Calamagrostis canadensis* associations.

Carex utriculata (beaked sedge), *Carex aquatilis* (water sedge), and *Calamagrostis canadensis* (bluejoint reedgrass) are common dominant undergrowth of several *Salix* plant associations. These three graminoids indicate different micro-environments, generally separating out along a moisture gradient related to the depth of the water table, and can represent different stages of succession of the floodplain. *Carex utriculata* (beaked sedge) occurs on the wettest sites, such as shallow pond margins, low-lying swales, and overflow channel with the shallowest water tables. *Carex aquatilis* (water sedge) occurs on intermediate sites that have saturated but not inundated soils. *Calamagrostis canadensis* (bluejoint reedgrass) dominates the drier sites with lower water tables.

Avg. Cover %	(Range)	Species Name	# Plots (N=30)
52	(10-95%)	<i>Salix monticola</i>	30
39	(1-80%)	<i>Carex utriculata</i>	30
18	(1-60%)	<i>Carex aquatilis</i>	9
16	(7-30%)	<i>Cirsium arvense</i>	3
15	(4-40%)	<i>Salix geeyeriana</i>	9
11	(1-25%)	<i>Salix wolfii</i>	7
9	(1-28%)	<i>Salix brachycarpa</i>	8
7	(2-10%)	<i>Ribes lacustre</i>	4
7	(1-20%)	<i>Salix drummondiana</i>	9
6	(1-20%)	<i>Salix planifolia</i>	4
6	(1-11%)	<i>Salix ligulifolia</i>	5
6	(1-20%)	<i>Cardamine cordifolia</i>	12
6	(3-9%)	<i>Equisetum pratense</i>	3
5	(1-15%)	<i>Betula nana</i>	5
5	(1-15%)	<i>Equisetum arvense</i>	17
5	(1-25%)	<i>Calamagrostis canadensis</i>	9

Other species with < 5% average cover present in at least 10% of plots:

Poa pratensis (1-24%), *Phleum pratense* (1-10%), *Juncus balticus* var. *montanus* (2-8%), *Conioselinum scopulorum* (1-10%), *Glyceria striata* (0.1-15%), *Swertia perennis* (0.1-10%), *Juncus tracyi* (1-9%), *Fragaria virginiana* ssp. *glauca* (1-9%), *Heracleum maximum* (1-10%), *Mertensia ciliata* (1-20%), *Oxypolis fendleri* (1-7%), *Trifolium repens* (0.1-8%), *Geum macrophyllum* var. *perincisum* (0.1-15%), *Alnus incana* (1-5%), *Lonicera involucrata* (1-7%), *Dasiphora floribunda* (1-5%), *Picea pungens* (1-6%), *Pedicularis groenlandica* (1-6%), *Taraxacum officinale* (1-5%), *Achillea millefolium* var. *occidentalis* (0.1-5%), *Deschampsia caespitosa* (1-4%), *Senecio triangularis* (1-3%), *Angelica ampla* (1-3%), *Chamerion angustifolium* ssp. *circumvagum* (1-3%), *Aconitum columbianum* (1-3%), *Geranium richardsonii* (0.1-3%), *Ribes inerme* (1%), *Rosa woodsii* (1%), *Castilleja miniata* (1%).

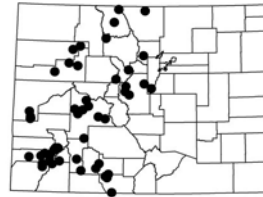
***Salix monticola* / Mesic forbs**



Global rank/State rank:
G4 / S3

HGM subclass: S1/2, R2,
R3/4

Colorado elevation range:
6,800-10,700 ft (2,070-
3,260 m)



General Description

The *Salix monticola*/mesic forbs (mountain willow/mesic forbs) plant association is a tall (5-8 ft, 1.5-2.5 m), deciduous shrubland with a dense or open canopy and an herbaceous layer dominated by a variety of forbs and grasses. While no single herbaceous species is a clear dominant, total forb cover is generally greater than 30% and exceeds total graminoid cover.

This association occurs along broad, swift-moving streams and active floodplains in narrow to moderately wide valleys. The ground surface is usually undulating, from past flooding or beaver activity. Stands form narrow bands at the stream edge, ranging from 1-6 ft (0.1-2 m) above the channel elevation. In wider valley bottoms, stands occur further from the bank, but never more than 2.5 ft (0.75 m) above the annual high water mark. Most stands occur adjacent to straight, wide, and shallow channels ranging from bedrock to silty-bottomed reaches. A few stands occur on meandering, cobble-bottomed reaches or streams braided by beaver activity. Soils are fine textured sandy clays to silty and sandy clay loams.

Vegetation Description

Salix monticola (mountain willow) forms a dense to open canopy, and if not the clear dominant, then it is the matrix willow. The matrix species is the willow with the highest abundance, even though other willow species combined may have greater canopy cover. Other shrub species that may be present include *Ribes inerme* (whitestem gooseberry), *Salix drummondiana* (Drummond willow), *S. planifolia* (planeleaf willow), *S. bebbiana* (Bebb willow), *S. geyeriana* (Geyer willow), *S. brachycarpa* (barrenground willow), *S. wolfii* (Wolf willow), *S. lucida* ssp. *caudata* or *lasiandra* (shining willow), *Alnus incana* (thinleaf alder) and *Lonicera involucrata* (twinberry honeysuckle).

Total forb cover ranges from 10-70%. No one forb species is noticeably more abundant than any other, nor is any species consistently present in all stands. Forb species that may

be present include *Heracleum maximum* (common cowparsnip), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Mertensia ciliata* (tall fringed bluebells), and *Fragaria virginiana* (strawberry). Graminoid cover may be absent or up to 50% cover; in general it does not exceed the total forb cover. Graminoid species that may be present include *Calamagrostis canadensis* (bluejoint reedgrass) and *Carex utriculata* (beaked sedge). Generally, forbs are dominant under shrubs on hummocks and ridges while graminoids dominate the undergrowth in low-lying, wetter swales. Exotic graminoid and forb species include *Poa pratensis* (Kentucky bluegrass), *Trifolium repens* (white clover), and *Taraxacum officinale* (dandelion).

Ecological Processes

Salix monticola (mountain willow) dominated plant associations appear to be long-lived and stable. They occur on mesic sites that support a diversity of graminoids and forbs. *Salix monticola* appears to grow only where the water table does not drop below 3 ft (1 m) of the surface. It appears to be limited to cold, wet environments in broad valley bottoms at high elevations. Due to the colder environments, organic matter builds up in the soils, and it is likely that succession to other associations is slow. This plant association occurs on mesic sites and supports a rich diversity of forbs. On broad, hummocky floodplains stands can form extensive willow carrs. Sites with a higher abundance of exotic forbs and graminoids may be grazing-induced. At higher elevations, this association grades into the *Salix planifolia*/mesic forbs (planeleaf willow/mesic forbs) association.

Avg. Cover %	(Range)	Species Name	# Plots (N=93)
58	(1-100%)	<i>Salix monticola</i>	93
17	(1-40%)	<i>Ribes lacustre</i>	26
16	(0.1-60%)	<i>Salix drummondiana</i>	31
16	(1-75%)	<i>Heracleum maximum</i>	49
12	(1-70%)	<i>Ribes inerme</i>	23
11	(1-40%)	<i>Alnus incana</i>	16
10	(1-30%)	<i>Salix geyeriana</i>	15
9	(1-50%)	<i>Poa pratensis</i>	42
9	(0.1-30%)	<i>Salix bebbiana</i>	15
9	(1-20%)	<i>Salix brachycarpa</i>	11
9	(0.1-60%)	<i>Mertensia ciliata</i>	55
9	(1-30%)	<i>Salix planifolia</i>	18
8	(1-28%)	<i>Rudbeckia laciniata</i> var. <i>ampla</i>	13
8	(0.1-30%)	<i>Calamagrostis canadensis</i>	31
7	(1-60%)	<i>Juncus balticus</i> var. <i>montanus</i>	10
7	(1-22%)	<i>Trifolium repens</i>	10
6	(1-14%)	<i>Picea pungens</i>	14
6	(0.1-30%)	<i>Cardamine cordifolia</i>	22
6	(1-20%)	<i>Lonicera involucrata</i>	43
6	(1-25%)	<i>Urtica dioica</i> ssp. <i>gracilis</i>	21
5	(0.1-20%)	<i>Equisetum arvense</i>	44
5	(1-16%)	<i>Aconitum columbianum</i>	18
5	(1-20%)	<i>Carex utriculata</i>	13

Other species with < 5% average cover present in at least 10% of plots:

Picea engelmannii (1-13%), *Bromus ciliatus* var. *ciliatus* (0.1-20%), *Conioselinum scopulorum* (0.1-15%), *Hydrophyllum fendleri* (1-10%), *Carex aquatilis* (1-10%), *Dasiphora floribunda* (0.1-13%), *Fragaria virginiana* ssp. *glauca* (0.1-10%), *Geranium richardsonii* (0.1-10%), *Senecio triangularis* (1-10%), *Taraxacum officinale* (0.1-12%), *Maianthemum stellatum* (0.1-12%), *Achillea millefolium* var. *occidentalis* (1-10%), *Chamerion angustifolium* ssp. *circumvagum* (0.1-11%), *Thalictrum fendleri* (0.1-9%), *Ligusticum porteri* (0.1-10%), *Geum macrophyllum* var. *perincisum* (1-5%), *Rosa woodsii* (0.1-5%), *Oxypolis fendleri* (1-5%), *Vicia americana* (0.1-5%).

Salix planifolia* / *Calamagrostis canadensis



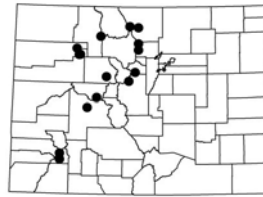
Global rank/State rank:

G4 / S2S3

HGM subclass: S1/2, R1

Colorado elevation range:

8,900-11,800 ft (2,700-3,600 m)



General Description

The *Salix planifolia*/*Calamagrostis canadensis* (planeleaf willow/bluejoint reedgrass) plant association is the least common of the *Salix planifolia* plant associations. It is frequently grazed to the point of shifting the dominant undergrowth grasses. It may have been more abundant historically.

This is a high elevation wetland plant association, usually occurring in broad, glacial valleys and swales where direct snow melt is the primary moisture source throughout the growing season. Stream channels are wide and moderately sinuous, often associated with beaver ponds. This association also occurs in narrow valleys with sinuous streams and wet floodplains. *Salix planifolia* shrublands occur on peat or mineral soils, deep clay loams and sandy clay loams, derived from glacial till. The mineral soils can have a high organic content.

Vegetation Description

Salix planifolia (planeleaf willow) forms a dense shrub layer with 30-100% cover. Other willow species that may be present include *Salix brachycarpa* (barrenground willow), and *Salix wolfii* (Wolf willow). *Calamagrostis canadensis* (bluejoint reedgrass) dominates the dense and sometimes rich herbaceous layer. Several *Carex* (sedge) species can also be present including *Carex utriculata* (beaked sedge), *Carex microptera* (smallwing sedge), and *Carex aquatilis* (water sedge). The forb layer can be diverse, but often has less than 20% total cover. Forb species can include *Caltha leptosepala* (marsh marigold), *Cardamine cordifolia* (heartleaf bittercress), *Pedicularis groenlandica* (elephanthead lousewort), and *Mertensia ciliata* (tall fringed bluebells).

Ecological Processes

Salix planifolia (planeleaf willow), *Salix brachycarpa* (barrenground willow) and *Salix wolfii* (Wolf willow) are abundant low-stature willows of first- and second-order streams of subalpine elevations of Colorado. *Salix planifolia* and *Salix brachycarpa* can form extensive stands, often creating intricate mosaics in broad, subalpine valleys. In general, *Salix planifolia* occupies the wettest micro-habitats on peat soils, although it can grow well on mineral soils. *Salix brachycarpa* is more often found on slightly drier and more well-drained micro-habitats than *Salix planifolia*. *Salix wolfii* grows on deep, undecomposed peat, while *Salix planifolia* tends to grow on more decomposed (humified) organic soils. *Salix planifolia* also grows at elevations below the subalpine and becomes a much taller willow due to a longer growing season. In montane elevations, *Salix planifolia* is often a co-dominant in *Salix monticola* plant associations.

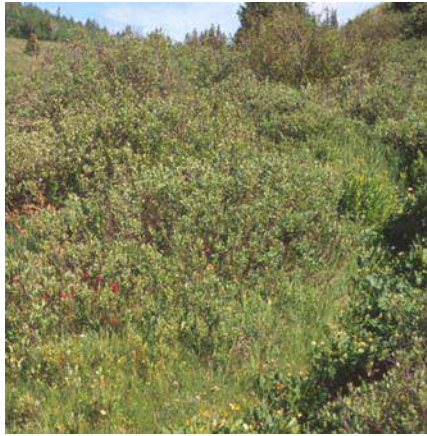


The *Salix planifolia*/*Calamagrostis canadensis* association may represent an ecotonal community to the conifer/*Calamagrostis canadensis* community type. In Colorado, *Salix planifolia*/*Calamagrostis canadensis* stands have been observed at the ecotone to the conifer/*Calamagrostis canadensis* plant association.

Avg. Cover %	(Range)	Species Name	# Plots (N=19)
72	(30-100%)	<i>Salix planifolia</i>	19
39	(5-90%)	<i>Calamagrostis canadensis</i>	19
18	(1-51%)	<i>Betula nana</i>	4
16	(2-30%)	<i>Salix brachycarpa</i>	2
9	(1-30%)	<i>Mertensia ciliata</i>	13
8	(1-25%)	<i>Senecio triangularis</i>	11
8	(5-10%)	<i>Carex microptera</i>	2
7	(1-20%)	<i>Cardamine cordifolia</i>	7
7	(3-10%)	<i>Salix monticola</i>	2
6	(5-7%)	<i>Swertia perennis</i>	2
5	(1-10%)	<i>Carex utriculata</i>	7
5	(5-5%)	<i>Deschampsia caespitosa</i>	2
5	(1-10%)	<i>Caltha leptosepala</i>	6

Other species with < 5% average cover present in at least 10% of plots:
Dasiphora floribunda (3-5%), *Equisetum arvense* (1-5%), *Trisetum wolfii* (2-5%), *Conioselinum scopulorum* (1-5%), *Aconitum columbianum* (1-7%), *Saxifraga odontoloma* (1-7%), *Salix wolfii* (1-5%), *Carex aquatilis* (0.1-5%), *Stellaria calycantha* (0.1-10%), *Oxyopolis fendleri* (1-5%), *Veronica wormskjoldii* (1-6%), *Chamerion latifolium* (1-3%), *Chamerion angustifolium* ssp. *circumvagum* (1-2%), *Viola macloskeyi* ssp. *pallens* (1-2%), *Phleum alpinum* (1%), *Achillea millefolium* var. *occidentalis* (1%), *Stellaria longifolia* (1%), *Thalictrum sparsiflorum* (1%), *Galium trifidum* ssp. *subbiflorum* (1%), *Taraxacum officinale* (1%), *Erigeron coulteri* (1%), *Pedicularis groenlandica* (0.1-1%), *Geum macrophyllum* var. *perincisum* (0.1-1%), *Picea engelmannii* (0.1-1%), *Agrostis scabra* (0.1-1%), *Rhodiola rhodantha* (0.1-1%), *Lonicera involucrata* (0.1-1%), *Poa reflexa* (0.1-1%).

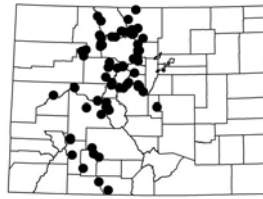
Salix planifolia* / *Carex aquatilis



Global rank/State rank:
G5 / S4

HGM subclass: S1/2

Colorado elevation range:
8,300-11,700 ft (2,530-
3,560 m)



General Description

The *Salix planifolia*/*Carex aquatilis* (planeleaf willow/water sedge) plant association is a low-stature willow shrubland that grows in wet to saturated soils, usually above 9,000 ft (2,800 m). It is a common plant association of subalpine glacial valleys. *Salix planifolia* occasionally mixes with *Salix brachycarpa* (barrenground willow) or *Salix wolfii* (Wolf willow) at higher elevations and grades into taller willow carrs with *Salix monticola* (mountain willow) at lower elevations. This plant association is a common type and occurs throughout the Rocky Mountains of Colorado.

This plant association occurs in wide, wet valleys on snow-melt fed swales. It also occurs in narrow valleys with sinuous streams and wet floodplains associated with beaver ponds. Stream channels are wide and moderately sinuous, narrow and sinuous, or highly braided by beaver activity. Soils have an organic peat top layer over mineral silty clays, heavy silty clay loams, silty loams, sandy loams, or loamy sands. Mottling is often evident.

Vegetation Description

This plant association is characterized by low-stature (1.5-5 ft; 0.5-1.5 m) *Salix planifolia* (planeleaf willow). Other willows that may be present include *Salix monticola* (mountain willow), *Salix wolfii* (Wolf willow), *Salix boothii* (Booth willow), *Salix geyeriana* (Geyer willow), and *Salix drummondiana* (Drummond willow)

The herbaceous undergrowth is dominated by *Carex aquatilis* (water sedge). Other graminoid species that may be present include *Carex utriculata* (beaked sedge), *Calamagrostis canadensis* (bluejoint reedgrass), and *Deschampsia caespitosa* (tufted hairgrass). Total forb cover is often less than 30%. Species that may be present include *Caltha leptosepala* (marsh marigold), *Cardamine cordifolia* (heartleaf bittercress), *Pedicularis groenlandica* (elephanthead lousewort), and *Conioselinum scopulorum* (Rocky Mountain hemlockparsley).

Ecological Processes

Salix planifolia (planeleaf willow), *Salix brachycarpa* (barrenground willow) and *Salix wolfii* (Wolf willow) are abundant low-stature willows of first- and second-order streams of subalpine elevations of Colorado. *Salix planifolia* and *Salix brachycarpa* can form extensive stands, often creating intricate mosaics in broad, subalpine valleys. In general, *Salix planifolia* occupies the wettest micro-habitats on peat soils, although it can grow well on mineral soils. *Salix brachycarpa* is often found on slightly drier and more well-drained micro-habitats than *Salix planifolia*. *Salix wolfii* grows on deep, undecomposed peat, while *Salix planifolia* tends to grow on more decomposed (humified) organic soils. *Salix planifolia* also grows at elevations below the subalpine, and becomes a much taller willow due to a longer growing season. At montane elevations, *Salix planifolia* is often a co-dominant in *Salix monticola* plant associations.

The *Salix planifolia*/*Carex aquatilis* (planeleaf willow/water sedge) plant association occurs in wet swales that are saturated throughout the growing season. The dense canopy layers and thick undergrowth indicate stable conditions. Both *Carex aquatilis* (water sedge) and *Caltha leptosepala* (marsh marigold) can tolerate saturated soils, and occasionally they co-dominate the undergrowth.

Avg. Cover %	(Range)	Species Name	# Plots (N=69)
51	(6.4-96%)	<i>Salix planifolia</i>	69
32	(1-90%)	<i>Carex aquatilis</i>	69
15	(1-40%)	<i>Salix wolfii</i>	20
13	(1-70%)	<i>Caltha leptosepala</i>	31
13	(1-30%)	<i>Carex utriculata</i>	23
13	(0.1-24%)	<i>Salix drummondiana</i>	8
10	(1-38%)	<i>Salix monticola</i>	12
9	(1-33%)	<i>Salix brachycarpa</i>	9
8	(0.1-40%)	<i>Calamagrostis canadensis</i>	40
8	(1-53%)	<i>Picea engelmannii</i>	19
7	(0.1-27%)	<i>Betula nana</i>	19
6	(1-20%)	<i>Ligusticum tenuifolium</i>	7
6	(1-20%)	<i>Saxifraga odontoloma</i>	14
5	(1-20%)	<i>Salix geyeriana</i>	7
5	(1-20%)	<i>Senecio triangularis</i>	29
5	(1-20%)	<i>Trisetum wolfii</i>	7

Other species with < 5% average cover present in at least 10% of plots:
Deschampsia caespitosa (1-20%), *Carex canescens* (0.1-12%), *Viola canadensis* var. *scopulorum* (1-8%), *Conioselinum scopulorum* (1-13%), *Cardamine cordifolia* (1-13%), *Pedicularis groenlandica* (0.1-20%), *Dasiphora floribunda* (1-8%), *Polygonum bistortoides* (1-10%), *Veronica wormskeildii* (1-12%), *Rhodiola rhodantha* (0.1-9%), *Mertensia ciliata* (1-9%), *Equisetum arvense* (1-4%), *Chamerion angustifolium* ssp. *circumvagum* (1-7%), *Fragaria virginiana* ssp. *glauca* (1-13%), *Carex microptera* (1-10%), *Polygonum viviparum* (1-9%), *Luzula parviflora* (1-6%), *Aconitum columbianum* (1-7%), *Achillea millefolium* var. *occidentalis* (1-6%), *Oxypolis fendleri* (1-9%), *Swertia perennis* (0.1-6%), *Taraxacum officinale* (1-4%), *Phleum alpinum* (1-4%), *Poa pratensis* (1-4%), *Geum macrophyllum* var. *perincisum* (1-5%).

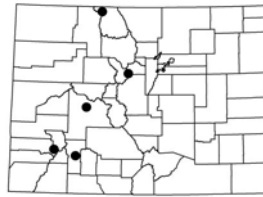
Salix planifolia* / *Carex utriculata



Global rank/State rank:
G3G4 / S2

HGM subclass: S1/2

Colorado elevation range:
8,900-10,760 ft (2,700-
3,280 m)



General Description

The *Salix planifolia*/*Carex utriculata* (planeleaf willow/beaked sedge) plant association is a low-stature willow shrubland that grows in wet to saturated soils above 8,900 ft (2,700 m). It appears to be much less common than the related *Salix planifolia*/*Carex aquatilis* (planeleaf willow/water sedge) association, and is probably indicative of wetter sites.

This plant association occurs in wide, wet valleys on snowmelt fed swales. It also occurs in narrow valleys with sinuous streams and wet floodplains associated with beaver ponds. Soils have an organic peat top layer over mineral silty clays, heavy silty clay loams, silty loams, sandy loams, or loamy sands.

Vegetation Description

This plant association is characterized by 30-90% cover of low-stature (1-5 ft, 0.5-1.5 m) *Salix planifolia* (planeleaf willow). Other willows that may be present include *Salix monticola* (mountain willow), *Salix wolfii* (Wolf willow) and *Salix geyeriana* (Geyer willow). *Betula nana* (= *glandulosa*) (bog birch) and *Dasiphora floribunda* (shrubby cinquefoil) may also be components of the shrub layer.

Diversity of associated forb and graminoid species is typically low, although one plot from North Park had 22 herbaceous species present with cover values <5%. The herbaceous undergrowth is dominated by 11-80% cover of *Carex utriculata* (beaked sedge). Other graminoid species that may be present include *Carex aquatilis* (water sedge), *Calamagrostis canadensis* (bluejoint reedgrass), and *Bromus ciliatus* var. *ciliatus* (fringed brome). Total forb cover is typically less than 20%. Species that were most frequently present include *Conioselinum scopulorum* (Rocky Mountain hemlockparsley), *Geum macrophyllum* var. *perincisum* (largeleaf avens) and *Swertia perennis* (star gentian).

Ecological Processes

Salix planifolia (planeleaf willow), *Salix brachycarpa* (barrenground willow) and *Salix wolfii* (Wolf willow) are abundant low-stature willows of first- and second-order streams of subalpine elevations of Colorado. *Salix planifolia* and *Salix brachycarpa* can form extensive stands, often creating intricate mosaics in broad, subalpine valleys. In general, *Salix planifolia* occupies the wettest micro-habitats on peat soils, although it can grow well on mineral soils. *Salix brachycarpa* is more often found on slightly drier and more well-drained micro-habitats than *Salix planifolia*. *Salix planifolia* also grows at elevations below the subalpine, and becomes a much taller willow due to a longer growing season. At montane elevations, *Salix planifolia* is often a co-dominant in *Salix monticola* plant associations.

Carex utriculata (beaked sedge), *Carex aquatilis* (water sedge), and *Calamagrostis canadensis* (bluejoint reedgrass) are common dominant undergrowth of several *Salix* plant associations. These three graminoids indicate different micro-environments, generally separating out along a moisture gradient related to the depth of the water table, and can represent different stages of succession of the floodplain.

Carex utriculata (beaked sedge) occurs on the wettest sites, such as shallow pond margins, low-lying swales, and overflow channel with the shallowest water tables. *Carex aquatilis* (water sedge) occurs on intermediate sites that have saturated but not inundated soils. *Calamagrostis canadensis* (bluejoint reedgrass) dominates the drier sites with lower water tables. As wetter sites become drier, it can colonize stands of *Carex utriculata* (beaked sedge) and *Carex aquatilis* (water sedge).

Avg. Cover %	(Range)	Species Name	# Plots (N=7)
65	(30-89%)	<i>Salix planifolia</i>	7
48	(11-80%)	<i>Carex utriculata</i>	7
10	—	<i>Salix wolfii</i>	1
10	—	<i>Salix monticola</i>	1
7	(1-20%)	<i>Carex aquatilis</i>	3
6	(2-10%)	<i>Betula nana</i>	2
5	—	<i>Dasiphora floribunda</i>	1

Other species with < 5% average cover present in at least 10% of plots:
Conioselinum scopulorum (1-6%), *Swertia perennis* (2-5%), *Calamagrostis canadensis* (1-5%), *Campyllum stellatum* (3%), *Luzula parviflora* (3%), *Geum macrophyllum* var. *perincisum* (1-3%), *Bromus ciliatus* var. *ciliatus* (2%), *Climacium dendroides* (2%), *Stellaria umbellata* (2%), *Agrostis scabra* (1%), *Mertensia ciliata* (1%), *Pedicularis groenlandica* (1%), *Cardamine cordifolia* (1%), *Caltha leptosepala* (1%), *Dodecatheon pulchellum* (1%), *Fragaria virginiana* ssp. *glauca* (1%), *Galium trifidum* ssp. *subbiflorum* (1%), *Galium triflorum* (1%), *Rhodiola rhodantha* (1%), *Viola canadensis* var. *scopulorum* (1%), *Veronica worms kjoldii* (1%), *Symphyotrichum foliaceum* (1%), *Senecio triangularis* (1%), *Geranium richardsonii* (1%), *Salix geyeriana* (1%), *Gentianopsis thermalis* (1%), *Poa pratensis* (1%), *Phleum alpinum* (1%), *Lonicera involucrata* (1%), *Viola macloskeyi* ssp. *pallens* (1%), *Juncus drummondii* (1%).

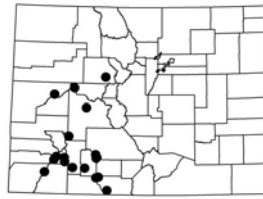
***Salix planifolia* / Mesic forbs**



Global rank/State rank:
G4 / S4

HGM subclass: S1/2, R2

Colorado elevation range:
8,900-12,100 ft (2,700-
3,700 m)



General Description

The *Salix planifolia*/mesic forbs (planeleaf willow/mesic forbs) plant association is a low stature (<2 ft, 0.5 m) shrubland with abundant and diverse forbs under the willow canopy. It is a common community of the subalpine and lower alpine areas. It occurs on mesic soils. This plant association typically occurs in wide, glaciated valleys adjacent to streams. It occurs in swales, depressions and on slopes where snow melt runoff saturates soils for much of the growing season. The ground may be flat or uneven with raised hummocks. Stream gradients range from <1% in broad floodplains to 14% in steep snowmelt basins. Stream channels vary. Channels may be steep and narrow, first-order streams in snow melt basins, relatively wide and straight, narrow, relatively deep, and meandering in broad, glaciated valleys or braided, multiple channels below beaver dams.

Soil textures are highly variable. Mineral soils vary along a moisture gradient. Wet sites have soil textures of silty clays and silt loams, while slightly drier sites have loamy sands and sandy loams overlying gravelly alluvium. Some stands occur on well-drained, mineral soils with well-oxygenated water and no mottled or gleyed layers. Other sites have a shallow organic layer overlying a gravel or cobble layer within 10-20 inches (20-50 cm) of the surface. The water table at these sites is usually near the surface throughout the growing season and may be perched by a clay horizon. Still other stands occur on deep, dark clay loams with high organic content or a fibric or hemic layer on top.

Vegetation Description

Salix planifolia (planeleaf willow) often forms nearly pure stands. Other willows that may be present include *Salix monticola* (mountain willow), *S. brachycarpa* (barrenground willow), *S. boothii* (Booth willow), *S. drummondiana* (Drummond willow), and *S. wolfii* (Wolf willow). *Picea engelmannii* (Engelmann spruce) can occur along the outer edges of the stand.

Typically, the willow canopy is nearly closed and an herbaceous undergrowth occurs only in openings between willow patches. The undergrowth is characterized by an abundance of forbs with few graminoids. Forb species include *Achillea millefolium* var. *occidentalis* (western yarrow), *Mertensia ciliata* (tall fringed bluebells), and *Senecio triangularis* (arrowleaf ragwort).

Ecological Processes

Salix planifolia (planeleaf willow), *Salix brachycarpa* (barrenground willow) and *Salix wolfii* (Wolf willow) are abundant low-stature willows of first- and second-order streams of subalpine elevations of Colorado. In general, *Salix planifolia* occupies the wettest micro-habitats on peat soils, although it can grow well on mineral soils. *Salix brachycarpa* is more often found on slightly drier and more well-drained micro-habitats than *Salix planifolia*. *Salix wolfii* grows on deep, undecomposed peat, while *Salix planifolia* tends to grow on more decomposed (humified) organic soils. *Salix planifolia* also grows at elevations below the subalpine, and becomes a much taller willow due to a longer growing season. In montane elevations, *Salix planifolia* is often a co-dominant in *Salix monticola* plant associations.

The *Salix planifolia*/mesic forbs (planeleaf willow/mesic forbs) plant association occurs in wet swales that are saturated throughout most or all of the growing season. It is a long-lived, stable association that changes with fluctuations in the water table and degree of soil saturation. The *Salix planifolia*/mesic forbs association may be a grazing-induced phase of the *Salix planifolia*/*Caltha leptosepala* (planeleaf willow/marsh marigold) association. Many stands in the Routt National Forest are heavily grazed and contain a high number of exotic and increaser species such as *Taraxacum officinale* (dandelion) and *Fragaria virginiana* (strawberry). Other stands in Colorado, however, do not show an increase in non-native species.

Avg. Cover %	(Range)	Species Name	# Plots (N=17)
59	(14-90%)	<i>Salix planifolia</i>	17
17	(9-28%)	<i>Salix brachycarpa</i>	7
16	(1-34%)	<i>Picea engelmannii</i>	6
14	(1-35%)	<i>Mertensia ciliata</i>	11
8	(1-12%)	<i>Caltha leptosepala</i>	6
8	(1-18%)	<i>Oxyopsis fendleri</i>	8
8	(1-30%)	<i>Salix monticola</i>	5
6	(0.1-22%)	<i>Senecio triangularis</i>	10
5	(1-13%)	<i>Conioselinum scopulorum</i>	5
5	(1-16%)	<i>Deschampsia caespitosa</i>	8
5	(1-10%)	<i>Pseudocymopterus montanus</i>	4

Other species with < 5% average cover present in at least 10% of plots:
Carex aquatilis (1-9%), *Primula parryi* (1-10%), *Calamagrostis canadensis* (1-10%), *Saxifraga odontoloma* (1-9%), *Hymenoxys hoopesii* (1-9%), *Achillea millefolium* var. *occidentalis* (1-13%), *Cardamine cordifolia* (1-9%), *Dasiphora floribunda* (1-7%), *Pedicularis groenlandica* (1-11%), *Geranium richardsonii* (1-7%), *Rhodiola integrifolia* (1-7%), *Aconitum columbianum* (1-5%), *Geum macrophyllum* var. *perincisum* (1-5%), *Bromus ciliatus* var. *ciliatus* (1-4%), *Polygonum viviparum* (1-4%), *Rhodiola rhodantha* (1-4%), *Taraxacum officinale* (1-4%), *Veronica wormskeoldii* (1-2%), *Phleum alpinum* (1-2%), *Polygonum bistortoides* (1-2%), *Castilleja rhexiifolia* (1%), *Luzula parviflora* (1%), *Potentilla pulcherrima* (1%).

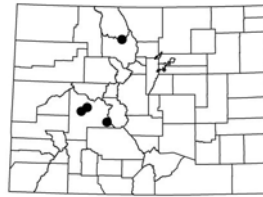
Salix wolfii* / *Calamagrostis canadensis



Global rank/State rank:
G3 / S2S3

HGM subclass: S1/2, R1

Colorado elevation range:
8,700-9,800 ft (2,650-3,000 m)



General Description

In Colorado, *Salix wolfii* (Wolf willow) grows in small patches and does not form large, expansive willow carrs like *Salix planifolia* (planeleaf willow). *Salix wolfii* often forms a mosaic with stands of *Salix planifolia*, *Salix brachycarpa* (barrenground willow) and open *Carex* spp. (sedge) meadows.

This plant association occurs in moderately wide to wide valleys along flat to rolling floodplains. Stream channels are wide and sinuous or sinuous and braided from beaver activity. Soil textures are silty loam, clay, sandy clay loam, and loamy sand with mottling.

Vegetation Description

The shrub layer is a mix of 30-80% cover of *Salix wolfii* (Wolf willow) and 10-30% cover of *Salix planifolia* (planeleaf willow). *Salix monticola* (mountain willow) and *Salix geyeriana* (Geyer willow) may also be present. A dense and rich graminoid undergrowth is dominated by *Calamagrostis canadensis* (bluejoint reedgrass). *Carex utriculata* (beaked sedge), *Carex aquatilis* (water sedge), and *Deschampsia caespitosa* (tufted hairgrass) are also present. Forb cover may be sparse but is diverse.

Ecological Processes

Salix planifolia (planeleaf willow), *Salix brachycarpa* (barrenground willow), and *Salix wolfii* (Wolf willow) are abundant low-stature willows of first- and second-order streams of subalpine elevations of Colorado. Stands of *Salix wolfii* are less frequently encountered, and are usually limited in size. *Salix wolfii* dominated stands are more common on the Western Slope. *Salix wolfii* grows on deep, undecomposed peat, while *Salix planifolia* tends to grow on more decomposed (humified) organic soils.

Avg. Cover %	(Range)	Species Name	# Plots (N=5)
52	(30-80%)	Salix wolfii	5
36	(20-50%)	Calamagrostis canadensis	5
24	(10-30%)	Salix planifolia	4
20	—	Cardamine cordifolia	1
10	—	Vicia americana	1
8	(5-10%)	Senecio triangularis	2
7	(3-10%)	Carex utriculata	2
6	(3-10%)	Carex aquatilis	3
6	(1-15%)	Mertensia ciliata	4
5	—	Valeriana edulis	1

Other species with < 5% average cover present in at least 10% of plots:

Poa pratensis (1-10%), Dasiphora floribunda (1-5%), Alopecurus aequalis (3%), Veronica americana (3%), Conioselinum scopulorum (1-5%), Deschampsia caespitosa (1-3%), Salix geyeriana (1-3%), Salix monticola (1-3%), Phleum pratense (2%), Geum macrophyllum var. perincisum (1-2%), Pedicularis groenlandica (1%), Taraxacum officinale (1%), Carex pellita (1%), Trisetum spicatum (1%), Castilleja sulphurea (1%), Chamerion angustifolium ssp. circumvagum (1%), Trifolium repens (1%), Descurainia incana (1%), Elymus glaucus (1%), Fragaria virginiana ssp. glauca (1%), Achillea millefolium var. occidentalis (1%), Senecio bigelovii var. hallii (1%), Scirpus microcarpus (1%), Rhodiola integrifolia (1%), Salix boothii (1%), Thalictrum alpinum (1%).

Salix wolfii* / *Carex aquatilis



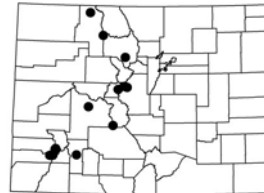
Global rank/State

rank:
G4/S3

HGM subclass: S1/2,
R

Colorado elevation

range:
8,400-11,400 ft (2,600-
3,500 m)



General Description

The *Salix wolfii*/*Carex aquatilis* (Wolf willow/water sedge) plant association is an uncommon community of very wet subalpine sites in western Colorado. In Colorado, *Salix wolfii* grows in small patches and does not form as large, expansive willow carrs as *Salix planifolia* (planeleaf willow). *Salix wolfii* often forms a mosaic with stands of *Salix planifolia*, *Salix brachycarpa* (barrenground willow) and open *Carex* spp. (sedge) meadows.

The *Salix wolfii*/*Carex aquatilis* (Wolf willow/water sedge) plant association occurs in moderately narrow to wide valleys and glacial basins. It occurs on saturated peat wetlands and floodplains with lateral seepage of groundwater. Stream reaches can be moderately steep (gradient of 3-7%). Stream channels are deep, narrow, and sinuous, shallow, broad, and gently meandering, and highly divided by beaver activity. Soils vary from highly organic or peat to mineral-based. Soil textures include heavy silty clay loams, silty loams, and sandy clay loams with mottling. Some stands occur on deep sandy clays, often with a high organic content, and others occur on shallow silty clays over gravels and rocks.

Vegetation Description

The shrub layer is dominated by 20-70% cover of *Salix wolfii* (Wolf willow). Other willow species that may be present include *Salix planifolia* (planeleaf willow), *Salix boothii* (Booth willow), *Salix monticola* (mountain willow) and *Salix brachycarpa* (barrenground willow). *Betula nana* (= *glandulosa*) (bog birch) may also be present. The herbaceous graminoid cover is generally dense and rich, dominated by *Carex aquatilis* (water sedge). Other graminoid species that may be present include *Carex utriculata* (beaked sedge) and *Deschampsia caespitosa* (tufted hairgrass). Forb cover varies from

sparse (< 10% cover) to very dense (70%) and species are generally diverse. Forb species that may be present include *Caltha leptosepala* (marsh marigold), *Ligusticum tenuifolium* (Idaho licoriceroot) and *Thalictrum alpinum* (alpine meadowrue).

Ecological Processes

The dense shrub canopy and thick undergrowth of the *Salix wolfii*/*Carex aquatilis* (Wolf willow/water sedge) plant association indicate stable conditions. *Carex utriculata* (beaked sedge), *Carex aquatilis* (water sedge), and *Calamagrostis canadensis* (bluejoint reedgrass) separate out along a moisture gradient related to the depth of the water table at a particular site. *Carex utriculata* occurs on the wettest sites, such as low-lying swales, with the highest water tables. *Carex aquatilis* occurs on intermediate sites.

Calamagrostis canadensis dominates the driest sites with the lowest water tables and often colonizes clumps of *Carex utriculata* and *Carex aquatilis*. *Carex aquatilis* is well-suited to wet, organic soils and succession will occur slowly under these conditions. If the water table is lowered, other herbaceous species may become dominant in the undergrowth and eventually give way to non-native graminoid species.

Avg. Cover %	(Range)	Species Name	# Plots (N=19)
42	(10-80%)	<i>Carex aquatilis</i>	18*
40	(20-70%)	<i>Salix wolfii</i>	19
13	(1-30%)	<i>Salix planifolia</i>	9
12	(1-30%)	<i>Betula nana</i>	7
9	(2-20%)	<i>Salix brachycarpa</i>	4
8	(1-20%)	<i>Caltha leptosepala</i>	10
8	(5-13%)	<i>Salix monticola</i>	4
8	(1-20%)	<i>Polygonum bistortoides</i>	3
8	(1-20%)	<i>Aconitum columbianum</i>	3
6	(1-19%)	<i>Carex utriculata</i>	5
6	(2-20%)	<i>Dasiphora floribunda</i>	13
6	(1-25%)	<i>Mertensia ciliata</i>	6
5	(1-20%)	<i>Fragaria virginiana</i> ssp. <i>glauca</i>	5
5	(1-20%)	<i>Geum macrophyllum</i> var. <i>perincisum</i>	7
5	(1-7%)	<i>Swertia perennis</i>	3
5	(1-13%)	<i>Thalictrum alpinum</i>	6

Other species with < 5% average cover present in at least 10% of plots:

Juncus balticus var. *montanus* (1-10%), *Conioselinum scopulorum* (0.1-8%), *Deschampsia caespitosa* (1-7%), *Achillea millefolium* var. *occidentalis* (1-5%), *Cardamine cordifolia* (1-6%), *Taraxacum officinale* (1-5%), *Carex microptera* (1-5%), *Antennaria corymbosa* (1-3%), *Pedicularis groenlandica* (1-7%), *Poa pratensis* (1-3%), *Calamagrostis canadensis* (1-2%), *Veronica wormsjoldii* (1-2%), *Polygonum viviparum* (1-2%), *Castilleja sulphurea* (1-2%), *Equisetum arvense* (1%), *Carex aurea* (1%), *Luzula parviflora* (1%).

* *Carex aquatilis* occurred in all stands, but was not captured in every sample plot.

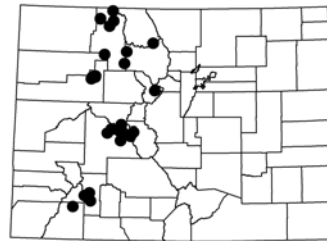
***Salix wolfii* / Mesic forbs**



Global rank/State rank:
G3 / S3

HGM subclass: S1/2, R1

Colorado elevation range:
7,900-11,000 ft (2,400-
3,400 m)



General Description

The *Salix wolfii*/mesic forbs (Wolf willow/mesic forbs) plant association occurs at mid to upper montane and lower subalpine elevations. It frequently covers wide, open, gently sloping areas near first- and second-order streams. It can be recognized by the generally dense layer of low-growing, silvery *Salix wolfii* (Wolf willow) dominating the overstory with a variety of mesic forbs and some graminoids in the undergrowth. In Colorado, *Salix wolfii* (Wolf willow) grows in small patches and does not form as large, expansive willow carrs (i.e., shrubland thickets) like *Salix planifolia* (planeleaf willow). *Salix wolfii* often forms a mosaic with stands of *S. planifolia*, *S. brachycarpa* (barrenground willow) and open *Carex* spp. (sedge) meadows.

This association occurs in wide mountain valleys, along first- or second-order streams on well-drained slopes and hummocks on the valley floor. The water table is usually within the top 3 ft (1 m) of soil and groundwater slowly seeps to the surface. Stream channels are narrow, relatively deep and sinuous. The soils may be saturated in the spring and early summer, but dry somewhat during the summer as the water table drops. Soil textures often have a high organic content and are silty clays, silty clay loams, silty loams, or deep sandy clays, clay loams, and sandy clay loams over gravels and rocks. Some stands have a loamy horizon underlain by a clay horizon.

Vegetation Description

Salix wolfii (Wolf willow) dominates the shrub layer with 10-90% cover. Other willow species that may be present include *Salix planifolia* (planeleaf willow), *Salix boothii* (Booth willow), and *Salix geyeriana* (Geyer willow). Total forb cover exceeds that of total graminoid cover. No single forb species is particularly more abundant than any other, and no one species is present in every stand. Forb species that may be present include *Caltha leptosepala* (marsh marigold), *Mertensia ciliata* (tall fringed bluebells),

Senecio triangularis (arrowleaf ragwort), *Ligusticum porteri* (Porter licoriceroot), *Fragaria virginiana* (strawberry), *Cardamine cordifolia* (heartleaf bittercress), *Geum macrophyllum* (large-leaved avens), and *Heracleum maximum* (common cowparsnip). Graminoid species present are diverse, yet generally have a low cover relative to the amount of total forb cover. Graminoid species may include *Deschampsia caespitosa* (tufted hairgrass), *Calamagrostis canadensis* (bluejoint reedgrass), and various *Carex* (sedge) species.

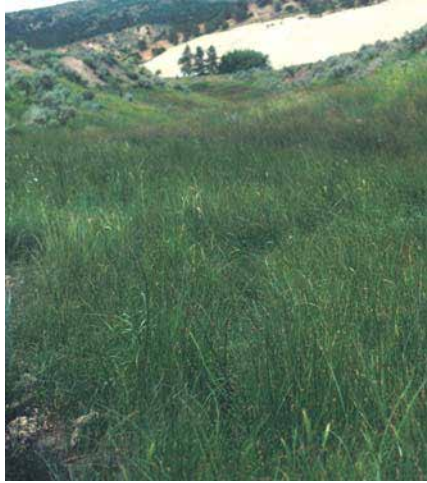
Ecological Processes

Salix planifolia (planeleaf willow), *Salix brachycarpa* (barrenground willow) and *Salix wolfii* (Wolf willow) are abundant low-stature willows of first- and second-order streams of subalpine elevations of Colorado. Stands of *Salix wolfii* are less frequently encountered, and are usually limited in size. *Salix wolfii* grows on deep, undecomposed peat, while *Salix planifolia* tends to grow on more decomposed (humified) organic soils.

When non-native and increaser species are abundant, the *Salix wolfii*/mesic forbs association may be a grazing-induced phase of the *Salix wolfii*/*Carex aquatilis* (Wolf willow/water sedge) association. Many stands in the Routt National Forest are heavily grazed and contain a high number of exotic and increaser species such as *Taraxacum officinale* (dandelion) and *Fragaria virginiana* (strawberry). However, other stands in Colorado without abundant increaser or non-native species do not appear to be grazing induced.

Avg. Cover %	(Range)	Species Name	# Plots (N=36)
58	(10-98%)	<i>Salix wolfii</i>	36
25	(1-80%)	<i>Salix planifolia</i>	15
21	(3-40%)	<i>Salix boothii</i>	9
12	(1-40%)	<i>Carex aquatilis</i>	20
10	(1-60%)	<i>Caltha leptosepala</i>	18
10	(1-70%)	<i>Carex utriculata</i>	12
10	(3-20%)	<i>Betula nana</i>	12
8	(1-20%)	<i>Calamagrostis canadensis</i>	13
7	(1-40%)	<i>Deschampsia caespitosa</i>	20
6	(1-22%)	<i>Mertensia ciliata</i>	16
5	(1-15%)	<i>Fragaria virginiana</i> ssp. <i>glauca</i>	22
5	(1-20%)	<i>Thalictrum alpinum</i>	10
5	(1-10%)	<i>Juncus balticus</i> var. <i>montanus</i>	6
5	(1-15%)	<i>Dasiphora floribunda</i>	23
Other species with < 5% average cover present in at least 10% of plots:			
<i>Conioselinum scopulorum</i> (1-15%), <i>Maianthemum stellatum</i> (1-16%), <i>Carex microptera</i> (1-15%), <i>Swertia perennis</i> (0.1-10%), <i>Symphyotrichum foliaceum</i> (1-8%), <i>Poa pratensis</i> (1-10%), <i>Taraxacum officinale</i> (1-10%), <i>Rhodiola rhodantha</i> (1-5%), <i>Aconitum columbianum</i> (1-9%), <i>Geranium richardsonii</i> (1-10%), <i>Senecio triangularis</i> (1-8%), <i>Cardamine cordifolia</i> (1-10%), <i>Geum macrophyllum</i> var. <i>perincisum</i> (1-10%), <i>Pedicularis groenlandica</i> (1-10%), <i>Phleum alpinum</i> (1-10%), <i>Achillea millefolium</i> var. <i>occidentalis</i> (1-6%), <i>Gentianopsis thermalis</i> (0.1-5%), <i>Galium boreale</i> (1-6%), <i>Saxifraga odontoloma</i> (1-5%), <i>Equisetum arvense</i> (1-3%), <i>Trisetum wolfii</i> (1-5%), <i>Vicia americana</i> (1-3%), <i>Thalictrum fendleri</i> (1-3%), <i>Luzula parviflora</i> (1-2%), <i>Castilleja sulphurea</i> (0.1-2%), <i>Oxypolis fendleri</i> (1%), <i>Veronica wormskjoldii</i> (1%), <i>Polygonum viviparum</i> (0.1-1%).			

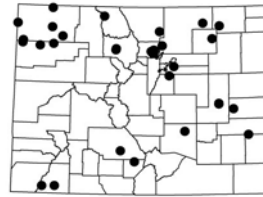
Schoenoplectus pungens



Global rank/State rank:
G3G4 / S3

HGM subclass: D2/3

Colorado elevation range:
3,800-7,800 ft (1,050-2,400 m)



General Description

The *Schoenoplectus pungens* (= *Scirpus pungens*) (threesquare bulrush) plant association forms small low stature (1-3 ft, 0.3-1 m) marshes in low-lying swales, abandoned channels, and overflow channels where soils remain saturated. This association is characterized by pure stands of *Schoenoplectus pungens*, occasionally associated with a few other graminoid species.

This association also occurs on silt and sand bars within the active channel where the water velocity is lowest. Soils from the Colorado River Basin are black, anoxic, organic soils and gleyed, clay-loam, alkaline soils.

Vegetation Description

This plant association can be pure stands of *Schoenoplectus pungens* (threesquare bulrush). Some stands include other graminoids such as *Juncus balticus* var. *montanus* (mountain rush), *Hordeum jubatum* (foxtail barley), *Phragmites australis* (common reed), *Spartina gracilis* (alkali cordgrass), *Muhlenbergia asperifolia* (alkali muhly), and *Eleocharis palustris* (common spikerush). On alkaline soils, *Distichlis spicata* (inland saltgrass) is a common associate.

Ecological Processes

Schoenoplectus pungens (threesquare bulrush) is an early colonizer and is adapted to saturated conditions on streamsides, sandy shores, marshes, and reservoir margins. Because of the wet soil conditions and aggressive growth of *Schoenoplectus pungens*, most other species are precluded from the sites. Disturbance can cause the establishment of increaser species such as *Juncus balticus* var. *montanus* (mountain rush) and *Hordeum jubatum* (foxtail barley). Lowering the water table may dry the site and result in decreased cover of *Schoenoplectus pungens*. An increase in salinity may increase alkaline tolerant species.

Avg. Cover %	(Range)	Species Name	# Plots (N=94)
59	(6.5-100%)	Schoenoplectus pungens	94
19	(1-62%)	Agrostis gigantea	26
19	(0.1-90%)	Eleocharis palustris	34
14	(1-38%)	Juncus balticus var. montanus	21
9	(0.1-80%)	Mentha arvensis	17
5	(0.1-37%)	Hordeum jubatum ssp. jubatum	31
5	(1-15%)	Polygonum douglasii	9
Other species with < 5% average cover present in at least 10% of plots:			
Schoenoplectus acutus/tabernaemontani (0.1-10%), Lycopodium americanum (0.1-15%), Cirsium arvense (0.1-25%), Epilobium ciliatum ssp. glandulosum (0.1-15%), Muhlenbergia asperifolia (0.1-10%), Typha latifolia (1-5%).			

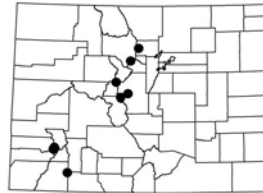
Salix brachycarpa / *Carex aquatilis*



Global rank/State rank:
G2G3 / S2S3

HGM subclass: S1/2,
S3/4

Colorado elevation range:
8,300-11,000 ft (2,530-
3,350 m)



General Description

The *Salix brachycarpa*/*Carex aquatilis* (barrenground willow/water sedge) plant association is a short-stature (2-3 ft; 0.4-1 m) willow shrubland with an open canopy. It grows along narrow, sinuous floodplains in the upper montane or subalpine zones of the Rocky Mountains. Since *Salix brachycarpa* (barrenground willow) is typically not associated with the hydric sedge, *Carex aquatilis*, this plant association may indicate that the site was once wetter and is now becoming drier allowing *Salix brachycarpa* to become established. This plant association occurs in the South Platte and Arkansas River Basins on the Eastern Slope and on San Juan National Forest in the San Juan Mountains on the Western Slope.

This plant association occurs on low floodplains immediately adjacent to the stream channel. Stream gradients are low with channels either broad and meandering or braided. Soils include deep, 24 inches (60 cm), organic soils or loam, sandy clay loam, and silty clay loam. The water table can be within the first 8 inches (20 cm) of soil early in the season. Mottles may also be present in the first layer of the profile.

Vegetation Description

Salix brachycarpa (barrenground willow) is the dominant shrub in this plant association. Other shrubs that may be present include *Dasiphora floribunda* (shrubby cinquefoil), *Salix wolfii* (Wolf willow), and *S. monticola* (mountain willow). The herbaceous undergrowth is a thick carpet of graminoids dominated by *Carex aquatilis* (water sedge). Other graminoids that may be present include *Carex utriculata* (beaked sedge), *Carex scopulorum* (mountain sedge), *Carex interior* (inland sedge), *Juncus balticus* var. *montanus* (mountain rush), and *Deschampsia caespitosa* (tufted hairgrass). Forbs are diverse and include *Thermopsis divaricarpa* (spreadfruit goldenbanner), *Maianthemum stellatum* (starry false Solomon seal), and *Potentilla* spp. (cinquefoil).

Ecological Processes

Salix brachycarpa (barrenground willow) typically grows on sites that are drier than those occupied by *Carex aquatilis* (water sedge) and it is unusual for them to occur together. Soil data indicate that occurrences of this plant association are perennially wet or have been in the past. It may be that with a drop in the water table, possibly due to heavy grazing and recreational use, these sites have begun to dry out and *Salix brachycarpa* is becoming established. In the South Platte River Basin, occurrences of this plant association also have abundant *Dasiphora floribunda* (shrubby cinquefoil) and *Juncus balticus* var. *montanus* (mountain rush) which are increaser species under long-term livestock grazing. These sites may be shifting from wetter *Salix monticola* (mountain willow) or *S. planifolia* (planeleaf willow) associations to drier *S. brachycarpa* or *Dasiphora floribunda* associations.

Avg. Cover %	(Range)	Species Name	# Plots (N=8)
29	(6-80%)	<i>Salix brachycarpa</i>	8
23	(6-40%)	<i>Carex aquatilis</i>	8
14	(1-22%)	<i>Juncus balticus</i> var. <i>montanus</i>	4
11	(4-25%)	<i>Carex utriculata</i>	5
11	(0.1-21%)	<i>Carex scopulorum</i>	2
10	(1-15%)	<i>Thalictrum alpinum</i>	3
10	(5-15%)	<i>Kobresia simpliciuscula</i>	2
7	(4-10%)	<i>Carex interior</i>	2
6	(2-11%)	<i>Picea pungens</i>	3
6	(3-9%)	<i>Dasiphora floribunda</i>	4
6	(3-10%)	<i>Deschampsia caespitosa</i>	3
5	(2-7%)	<i>Salix wolfii</i>	2

Other species with < 5% average cover present in at least 10% of plots:
Salix monticola (3-5%), *Poa pratensis* (1-8%), *Swertia perennis* (0.1-5%), *Cardamine cordifolia* (1-6%), *Triglochin palustre* (1-5%), *Betula nana* (1-5%), *Calamagrostis canadensis* (2-2.9%), *Equisetum arvense* (1-4%), *Senecio triangularis* (1-3%), *Pedicularis groenlandica* (0.1-5%), *Fragaria virginiana* ssp. *glauca* (1-2%), *Trifolium repens* (1-2%), *Mertensia ciliata* (1%), *Taraxacum officinale* (1%), *Achillea millefolium* var. *occidentalis* (1%), *Geum macrophyllum* var. *perincisum* (1%), *Carex aurea* (1%), *Aconitum columbianum* (1%).

PLANT ABSTRACTS

Aquilegia saximontana (Rocky Mountain columbine)

Taxonomy

Class: Dicotyledoneae

Order: Ranunculales

Family: Ranunculaceae

Genus: *Aquilegia*

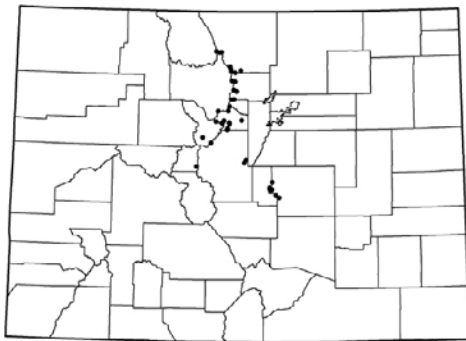
Taxonomic Comments: None.

CNHP Ranking: G3 S3

State/Federal Status: None.



Photo by B.Jennings



Colorado Distribution

Plant abstract adapted from Colorado Rare Plant Field Guide, Spackman et al. 1997, unless otherwise cited.

Description/Phenology: A perennial herb, usually 8-15 cm tall. Flowers bloom in early to late July and are usually less than 2 cm long with blue spurs and sepals; fruit is produced in August.

Habitat Comments: Found on cliffs and rocky slopes, supalpine and alpine, between 9,000 and 12,300 feet.

Global Range: Endemic to central and north central Colorado.

State Range: See above.

Distribution/Abundance: Near the Continental Divide. 44 occurrences documented in Boulder, Clear, El Paso, Gilpin, Jackson, Jefferson, Lake, Larimer, Park, Pueblo, San Juan, Summit, and Teller Counties.

Known Threats and Management Issues: Threats to this species are currently unknown. It may be somewhat protected by its relatively unusable, inaccessible habitat (CNHP 2006). One report (1975) lists this as a rare endemic which is threatened by collectors who want it for their rock gardens and Weber (1990) states that it is rare or locally abundant (NatureServe 2006).

References: CNHP 2006; NatureServe 2006; Spackman et. al. 1997

Version date: March 2006

Astragalus osterhoutii (Osterhout milkvetch)

Taxonomy
Class: Dicotyledoneae
Order: Fabales
Family: Fabaceae
Genus: *Astragalus*

Taxonomic Comments: None.

CNHP Ranking: G1 S1

State/Federal Status: LE: Listed endangered (13Jul1989)
U.S. Fish & Wildlife Service Lead Region: R6 –
Rocky Mountain.



Colorado distribution

Phenology: A perennial herb, 50 to 100 cm tall, with 15-30 mm long linear leaflets and several to numerous erect, rush-like stems. Large cream-colored flowers bloom June-August, followed by laterally compressed, 40 mm pendulous pods (Spackman et al. 1997, NatureServe 2006).

Habitat Comments: Found at elevations of 7,400-7,900 feet, on moderate slopes, in highly seleniferous soils (grayish-brown clays) derived from Niobrara

Shale; sometimes found growing up through sagebrush (Spackman et al. 1997). Associated species include *Artemisia tridentata*, *Chrysothamnus viscidiflorus*, *Gutierrezia sarothrae*, *Eurotia lanata*, *Phlox hoodii*, *Eriogonum brevicaulis* and *Agropogon smithii*.

Global Range: Endemic to small area in Grand County, Colorado.

State Range: See above.

Distribution/Abundance: CNHP has 6 recorded occurrences of this species mostly in the vicinity of Muddy Creek, but also along Troublesome and Rock Creek drainages in Grand, Colorado. Numbers of individuals observed range from < 25 to several thousand.

Known Threats and Management Issues: Threats include off-road vehicles, mining, grazing, and oil and gas drilling. The most critical threat regards the construction of Muddy Creek dam and the inundation of approximately 10% of the individuals there. Secondary impacts such as recreational use and development around the proposed reservoir will also affect a large percent of the local population (NatureServe 2006). The primary pollinator of this species is a ground bumble bee which could also be impacted by surface disturbances and inundation (NatureServe 2006).

References: CNHP 2006; NatureServe 2006; Spackman et al. 1997

Version date: March 2006

***Botrychium echo* (reflected moonwort)**

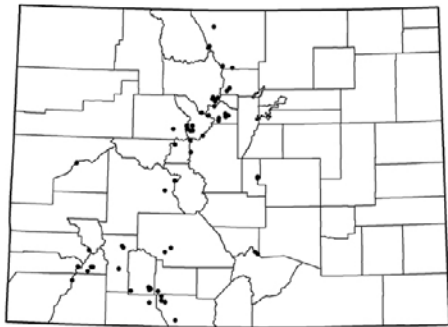
Taxonomy

Class: Ophioglossopsida
Order: Ophioglossales
Family: Ophioglossaceae
Genus: *Botrychium*

Taxonomic Comments: None.

CNHP Ranking: G3 S3

State/Federal Status: None.



Colorado Distribution



Photo by L. Yeatts

Plant abstract adapted from NatureServe Explorer 2006, unless otherwise cited.

Description/Phenology: A perennial fern that produces a shiny green leaf (the trophophore) and a taller, erect spore-bearing spike (the sporophore). Both arise from a common stalk and can be thought of as a single, highly modified fern frond. This species tends to have a reddish brown stripe along the common stalk from the base of the trophophore stalk. Mature plants are 3-15 cm tall. *B. echo* produces clusters of minute, spheric gemmae at the root bases. Leaves appear in June and die in September. Spores produced in July (Spackman et al. 1997).

Habitat Comments: Naturally occurring on disturbed sites. Found along gravelly soils by roadsides and trails, rocky hillsides, grassy slopes, meadows and lake edges at elevations between 9,500 and 11,000 feet (CNHP 2006; Spackman et al. 1997).

Global Range: N. Arizona, N. Utah and central Colorado.

State Range: Mostly documented along the continental divide and central Colorado, with 64 occurrences documented by CNHP.

Distribution/Abundance: Occurrences scattered across northern Utah and central Colorado. Report for northern Arizona needs verification. Many occurrences consist of fewer than ten individuals and the total number of individuals documented at all extant sites is less than 50. This species hybridizes with western moonwort (*B. hesperium*). Several known populations of *B. echo* in Colorado are near roads or trails or picnic areas. If these areas receive heavy use during its growing season, it could negatively impact some populations.

Known Threats and Management Issues: This species naturally occurs on disturbed sites, therefore it is somewhat tolerant. However, it cannot withstand trampling from sheep grazing and it can be forage for animals.

References: CNHP 2006; NatureServe 2006; Spackman et al. 1997
Version date: March 2006

***Carex stenoptila* (small-winged sedge)**

Taxonomy

Class: Monocotyledoneae

Order: Cyperales

Family: Cyperaceae

Genus: *Carex*

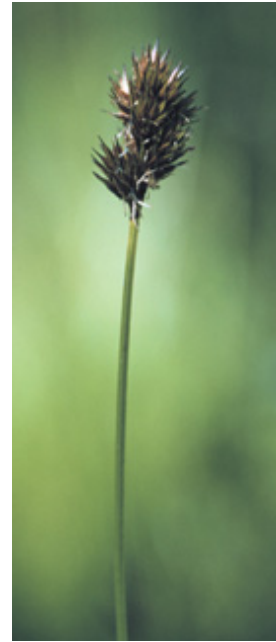
Taxonomic Comments: None.

CNHP Ranking: G2 S2?

State/Federal Status: None.



Colorado Distribution



*Photo by Jennifer Whipple,
courtesy of Montana Natural
Heritage Program*

Plant abstract adapted from NatureServe Explorer 2006, unless otherwise cited.

Description/Phenology: This sedge forms clumps with stems that are 2-8 dm high and which arise from short rhizomes. The few leaves, 1-4 mm wide, are flat and clustered near the base. Flowers are clustered in 7-10 spikes aggregated into a tight head at the top of the stem. The female perigynia occupy most of the spike, with only a few inconspicuous male flowers (recognized by old stamens) at the base. The light brown perigynia are narrowly lance-shaped and 4-5 mm long, with a gently tapered tip that is entire-margined, deeply cleft, and round in cross-section at the tip. There are 5-7 nerves on the convex outer face of the perigynia. The dark to pale brown scales are smaller than the perigynia that they subtend. There are 2 stigmas. The seed is lens-shaped and fills the body of the perigynium.

Habitat Comments: This species occurs at 8,000 to 9,000 feet, in rocky openings and dry, coniferous woods in the mountains and on high plateaus.

Global Range: Colorado, Montana, Wyoming

State Range: Documented in Grand and Routt Counties by CNHP. The USDA Plants Database reports *C. stenoptila* from Park County as well.

Distribution/Abundance: Sparsely found across its range. There are approximately 25 locations known for this species from Montana, Wyoming, and Colorado.

Known Threats and Management Issues: Unknown.

References: CNHP 2006; MNHP 2006; NatureServe 2006; USDA, NRCS 2006

Version date: March 2006

***Draba crassa* (thick-leaf whitlow-grass)**

Taxonomy

Class: Dicotyledoneae

Order: Capparales

Family: Brassicaceae

Genus: *Draba*

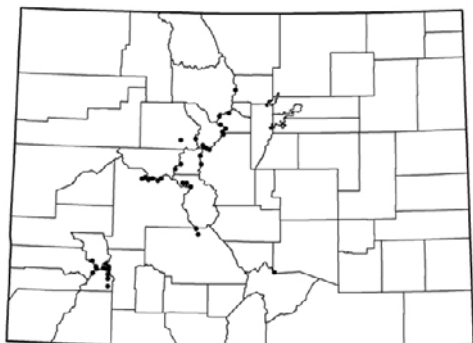
Taxonomic Comments: None.

CNHP Ranking: G3 S3

State/Federal Status: None.



Photo by
Rebecca Day-Skowron, July 2001



Colorado Distribution

Description/Phenology: Perennial forb, 5-15 cm tall with mostly basal leaves. A raceme of 4-25 yellow flowers blooms in late June through early July with fruit in the form of siliques in mid to late July.

Habitat Comments: Alpine tundra species typically found in scree, talus, cliffs and rock stripes at elevations of 10,000 to 12,500 feet. Associated species may include *Poa artica*, *Kobresia* spp. and *Draba* spp. (CNHP 2006).

Global Range: Regional endemic known from 23 occurrences; Montana, Utah, Wyoming and Colorado (NatureServe 2006).

State Range: In Colorado CNHP has documented this species in 16 counties.

Distribution/Abundance: 41 occurrences have been documented in Colorado by CNHP in the west-central and southwest portion of the state (CNHP 2006).

Known Threats and Management Issues: May be somewhat protected by its high altitude habitat, but heavy recreational use may impact some populations (CNHP 2006).

References: CNHP 2006; NatureServe 2006; USDA, NRCS 2006; Keinath et al. 2003.

Version date: March 2006

***Draba exunguiculata* (clawless draba)**

Taxonomy
Class: Dicotyledoneae
Order: Capparales
Family: Brassicaceae
Genus: *Draba*

Taxonomic Comments: None.

CNHP Ranking: G2 S2

State/Federal Status: None.



Photo by B. Jennings



Colorado Distribution

Description/Phenology: An alpine perennial herb with flowering stems, 2-7 cm tall, from a tuft of thick basal leaves (NatureServe 2006). Yellow flowers produced in late June through July with fruits in early August.

Habitat Comments: Found at 12,000 to 14,000 feet, on rocky, gravelly slopes and talus; fellfields; usually granitic bedrock (Spackman et al. 1997).

Global Range: Endemic to Colorado.

State Range: See above.

Distribution/Abundance: Found only in Colorado in Boulder, Clear Creek, El Paso, Gilpin, Grand, Lake, Park and Summit Counties. CNHP has documented 18 occurrences ranging in size from fewer than 15 to as many as 100 individuals.

Known Threats and Management Issues: Trampling and recreational disturbances are the only known threats at this time and is not a major concern (NatureServe 2006).

References: CNHP 2006; NatureServe 2006; Spackman et al. 1997

Version date: March 2006

***Draba grayana* (Gray's Peak whitlow-grass)**

Taxonomy

Class: Dicotyledoneae

Order: Capparales

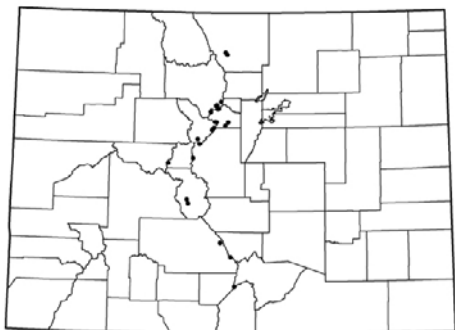
Family: Brassicaceae

Genus: *Draba*

Taxonomic Comments: None.

CNHP Ranking: G2 S2

State/Federal Status: S-FS.



Colorado Distribution



Photo by P.Lehr

Description/Phenology: An alpine, perennial herb, 2-5 cm tall with several hair covered stems forming compact tufts. Yellow, clawed petaled flowers bloom from mid-July through August with glabrous, long, slender fruits forming August through September.

Habitat Comments: Found on gravelly alpine slopes and fellfields at elevations between 11,500 – 14,00 feet (Spackman et al. 1997).

Global Range: Restricted to the high peaks of central and northcentral Colorado (NatureServe 2006).

State Range: See above.

Distribution/Abundance: Endemic to Colorado (Chaffee, Clear Creek, Gilpin, Grand, Huerfano, Lake, Larimer, Park, Pitkin, Saguache and Summit Cos.). 22 occurrences documented by CNHP, ranging from <10 to 70 individuals.

Known Threats and Management Issues: Threats include trampling by hikers, trail development, and botanical collectors (CNHP 2006).

References: CNHP 2006; NatureServe 2006; Spackman et al. 1997

Version date: March 2006

***Draba porsildii* (Porsild's whitlow-grass)**

Taxonomy

Class: Dicotyledoneae

Order: Capparales

Family: Brassicaceae

Genus: *Draba*

Taxonomic Comments: None.

CNHP Ranking: G3G4 S1

State/Federal Status: None.



Photo by Bob Skowron, August 2003



Colorado Distribution

Description/Phenology: (Adapted from Natureserve Explorer 2006) A low perennial herb with few to many leafless stems that are 1-6 cm high and which arise from basal leaf rosettes that, in turn, arise from the ends of a simple or branched rootcrown. The lance-shaped leaves are 3-12 mm long, have entire margins, and are covered with branched hairs. The stalked flowers are borne at the tops of the stems in nearly flat-topped inflorescences. Each flower has 4 separate sepals, 4 separate, white petals, and 4 long and 2 short stamens. The style is approximately 0.2 mm long. The glabrous, narrowly elliptic capsules are 4-8 mm long and are borne on ascending stalks that are 1-2 mm long. Flowers and fruits in July.

Habitat Comments: Limestone talus slopes, moist banks, and turfy slopes at high elevations; also boreal spruce forests. Documented at elevations between 10,920–14,270 feet in Colorado (CNHP 2006).

Global Range: Occurs in the mountains of Alberta, British Columbia, north into the Northwest Territories, the Yukon, and Alaska, and south into Montana, Wyoming and Colorado.

State Range: Documented in Boulder, Chafee, Clear Creek, Costilla, Gilpen, Grand, Gunnison, Huerfano, Lake, Park, Pitkin, San Juan, and Summit counties.

Distribution/Abundance: Number of occurrences; wide range in Rocky Mountains of U.S. and Canada (NatureServe 2006). CNHP has documented 13 occurrences.

Known Threats and Management Issues: Trail use has been documented as a potential threat.

References: CNHP 2006; NatureServe 2006; Rocky Mountain Rare Plants 2006

Version date: March 2006

Eriogonum exilifolium (dropleaf buckwheat)

Taxonomy

Class: Dicotyledoneae

Order: Polygonales

Family: Polygonaceae

Genus: *Eriogonum*

Taxonomic Comments: None.

CNHP Ranking: G3 S2

State/Federal Status: S-FS.



Colorado Distribution



*Photo by Walter Fertig,
courtesy of Wyoming Natural Diversity Database*

Description/Phenology: (Adapted from Keinath et al. 2003)

A dense, mat forming, taprooted perennial herb, up to 10 cm tall, and 10-20 cm across. The 3-6 cm long, narrowly linear, leaves are basal. White to pale pink flowers are borne in a dense cluster mid-June. 3-angled, brown achenes 2-3.5 mm long are produced into late August. The inflorescence is a

compact head of 3-7 involucre borne on sparsely woolly stems 3-10 cm long.

Habitat Comments: Hills, plains and sagebrush flats. Occurs on semi-bare, sandy-clay gumbo flats, white shaley-gypsum ridges, red clay hills, and limestone outcrops in cushion plant-bunchgrass communities with low total cover (Keinath et al. 2003). In the Shirley Mountains, this species is found on seleniferous clay-gumbo soils in barrow pits and dirt roadsides with average vegetative cover of 10-25% (Keinath et al. 2003). Occurrence elevations ranges from 6,900 to 8,700 feet. Associated species include *Artemisia* sp. and *Chrysothamnus* sp.

Global Range: A regional endemic of south-central Wyoming and north-central Colorado.

State Range: Documented in Grand, Jackson and Larimer Counties. Most observations occur on badlands of Niobrara and Troublesome formations.

Distribution/Abundance: May be locally common. Colorado has documented 7 occurrences ranging in size from a few plants to over 1,000,000 estimated at a site in Larimer County. Found in Albany and Carbon counties, Wyoming. In Wyoming, this species is restricted to the Laramie and Shirley basins and foothills of the Medicine Bow and Laramie ranges; occurrences in Wyoming: known from 7 occurrences in Wyoming, all of which have been relocated or discovered since 1979 (four of these have been located since 1995) (Keinath et al. 2003).

Known Threats and Management Issues: Threats relatively low. Plants appear to do well with some disturbance (such as on roadcuts exposing bare soil) (Keinath et al. 2003). Threats include oil, coalbed methane, and gas development, range improvements, off-road vehicle use and other recreation, secondary effects of grazing, road building and management, residential and commercial development, reservoir creation, coal mining, non-native species invasion, and effects of small population size (Anderson 2004). Individual plants appear to do well with some disturbance (such as on road cuts exposing bare soil) (Fertig 2000a).

References: Anderson 2004a; CNHP 2006; Fertig 2000a; NatureServe 2006; Keinath et al. 2003

Version date: March 2006

***Lomatium nuttallii* (Nuttall desert-parsley)**

Taxonomy
Class: Dicotyledoneae
Order: Apiales
Family: Apiaceae
Genus: *Lomatium*

CNHP Ranking: G3 S1

State/Federal Status: None.



Photo by D. Culver



Colorado Distribution

Plant abstract adapted from NatureServe Explorer 2006, unless otherwise cited.

Taxonomic Comments: Here (following Kartesz 1994 and 1999) excluding the taxa variously known as *Lomatium graveolens*, *kingii*, and *graveolens/kingii* var. *alpinum*. LEM 5Mar94 & 29Jun00. The name *Lomatium nuttallii* has traditionally been applied to

what is now referred to as *Lomatium graveolens*; \Nuttall's plant, excluding *L. graveolens*, has generally been called *L. megarrhizum*, occurring in western Nebraska and Wyoming, and possibly in Colorado and Montana.

Description/Phenology: A perennial herb that is aromatic and glabrous, standing 10-40 cm tall with basal leaves, once pinnately compound or three parted. Few to many, small, yellow flowers in flat-topped compound umbels bloom from mid-May to late June. Flattened, narrowly oval shaped mature fruit with marginal wings and low ribs on the flat faces are produced beginning in late June.

Habitat Comments: Found on highly erodable soils of silt and sand (characteristic badlands) associated with seleniferous plants and limestone hills in the spruce-fir zone. Vegetation cover is sparse. Surrounding habitat consists of sagebrush hills and grasses. Elevation ranges from 7,500-10,500 feet (CNHP 2006).

Global Range: Regional endemic of at least central Wyoming, western Nebraska, Colorado, South Dakota and Montana. It is not common in Wyoming, which comprises the majority of its range.

State Range: Found in Colorado in Grand and Weld Counties.

Distribution/Abundance: CNHP has documented 6 occurrences ranging in size from 100 to 6000 individuals. Along Troublesome Creek in Grand Co, and Chalk bluffs in Weld County.

Known Threats and Management Issues: The Montana occurrence is potentially impacted by mining; threats rangewide are low.

References: CNHP 2006, NatureServe 2006

Version date: March 2006

Mimulus gemmiparus (Weber's monkey flower)

Taxonomy

Class: Dicotyledoneae

Order: Scrophulariales

Family: Scrophulariaceae

Genus: *Mimulus*

Taxonomic Comments: None.

CNHP Ranking: G1 S1

State/Federal Status: (C2),S-FS.



Photo copyright © 1999 by B. Jennings



Colorado Distribution

Description/Phenology: A small, annual herb, completely glabrous; stems 1-10 cm tall, unbranched with opposite, ovate leaves up to 10 mm long and 7mm wide. Rarely produces sterile, solitary, yellow flowers in July. Reproduction is by propagula - a dormant embryonic shoot forms inside the leaf stems, which are swollen, and sac-like; these fall off the mother plant as it matures and are thought to be water dispersed (NatureServe 2006).

Habitat Comments: A subalpine species found at elevations between 8,500-10,500 feet. Found on granitic seeps, slopes and alluvium in open sites within spruce-fir and aspen forests (Spackman et al. 1997). Often observed with other *Mimulus* species in areas protected by granite overhangs (NatureServe 2006).

Global Range: A narrowly restricted Colorado endemic with a small-moderate population size which is known only from higher elevations in and around Rocky Mountain National Park and surrounding counties (NatureServe 2006).

State Range: See above.

Distribution/Abundance: Eight occurrences documented by CNHP in Boulder, Clear Creek, Grand, Jefferson, Larimer and Park Counties; each occurrence ranging in size from a few to 1500 individuals.

Known Threats and Management Issues: Most populations are not seriously threatened, though one large population is bisected (as of 1983) by a hiking trail in Rocky Mountain National Park and could receive damage from hikers or inadvertent damage from trail maintenance activities (NatureServe 2006). Infrequent flowering can also make this species difficult to identify and survey for.

References: CNHP 2006; NatureServe 2006; Spackman et al. 1997

Version date: March 2006

***Penstemon harringtonii* (Harrington beardtongue)**

Taxonomy

Class: Dicotyledoneae

Order: Scrophulariales

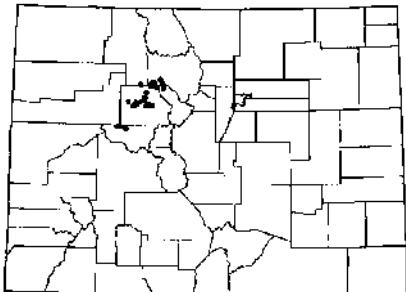
Family: Scrophulariaceae

Genus: *Penstemon*

Taxonomic Comments: None.

CNHP Ranking: G3 S3

State/Federal Status: (C2), S-FS/BLM.



Colorado Distribution



Photo Copyright © 1999 by C. Crawford

Description/Phenology: A perennial herb, 30-70 cm tall. Showy blue to pinkish lavender flowers occur in a loose spike during the month of June. Fruiting occurs in July and August with most seed dispersed by September.

Habitat Comments: Typically found in open sagebrush stands on gentle to moderate slopes at elevations between 6,800 and 9,200 feet. Less commonly occurring in pinyon-juniper habitats. Soils are typically rocky loams and rocky clay loams derived from coarse calcareous parent materials (Spackman et al. 1997). Most commonly associated with *Artemisia tridentata* var. *vaseyana*, *Chrysothamnus viscidiflorus*, *Phlox hoodii*, *Poa fendleriana*, *Oryzopsis hymenoides*, *Sitanion hystrix*, *Pseudoroegneria spicata*, *Koeleria macrantha*, *Stipa comata* as well as with microbiotic crust or lichen. The total bare ground/rock/lichen cover is often high (20-30%) (CNHP 2006).

Global Range: Colorado endemic, occurring mostly in Eagle County, but also in Garfield, Grand, Pitkin, Routt and Summit Cos. (Spackman et al. 1997).

State Range: See above.

Distribution/Abundance: CNHP has documented 70 occurrences and approximately 68% of those occur in Eagle County.

Known Threats and Management Issues: The main threats seem to be from housing and recreational developments, with concern also over loss of potential habitat due to overgrazing and possible effects from chemical use on sagebrush. According to David Johnson of Western Resource Development on 6/27/97, *P. harringtonii* may peak every 4 to 5 years due to its short-lived perennial life cycle, which may explain the drastic change in numbers of individuals seen in subsequent years (NatureServe 2006).

References: CNHP 2006; NatureServe 2006; Spackman et al. 1997

Version date: March 2006

***Penstemon penlandii* (Penland beardtongue)**

Taxonomy

Class: Dicotyledoneae

Order: Scrophulariales

Family: Scrophulariaceae

Genus: *Penstemon*

Taxonomic Comments: None.

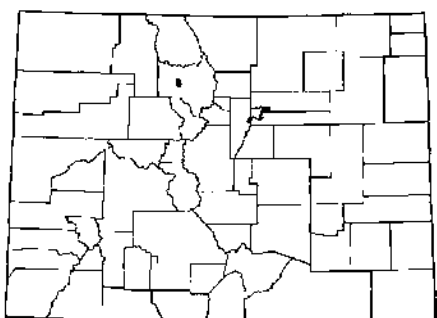
CNHP Ranking: G1 S1

State/Federal Status: U.S. Endangered Species Act:

LE: Listed endangered (13Jul1989).



Photo by B. Jennings



Colorado Distribution

Description/Phenology: (Adapted from Colorado Rare Plant Field Guide, Spackman et al. 1997) A perennial herb, up to 25 cm tall, 5-15 bicolored flowers with blue lobes and a violet throat; anthers with short hairs; staminode bearded; leaves linear 1-2 mm wide, involute or folded. Flowers in June and July with fruit in August and September.

Habitat Comments: Found on strongly seleniferous clay-shales of the Troublesome Formation; on sparsely vegetated steep barrens, sagebrush badlands; at elevations between 7,500 and 7,700 feet (Spackman et al. 1997). *Penstemon penlandii* is present on the alkaline clays containing selenium, which are toxic to most plants. Sagebrush becomes the dominant species and *Penstemon penlandii* drops out where erosion has caused mixture of the selenium clays with less toxic materials. Optimum habitat appears to be in runoff channels, shaded by the deeply cut banks. The species' deep root structure secures it to the underlying shales so that it is not dislodged by subsequent torrents (NatureServe 2006). Associated scattered shrubs of *Artemisia tridentata*, *Chrysothamnus* sp., *Tetradymia* sp., *Symphoricarpos* sp., and/or *Cercocarpus* sp. Common perennials include *Lupinus* sp. and *Eriogonum* sp. It is often with *Lomatium nuttallii*, and/or *Astragalus osterhoutii* (CNHP 2006).

Global Range: Northern Colorado endemic. Documented narrow range is approximately 7.5 square miles.

State Range: Documented only in Grand County, Colorado on clay badlands of the Middle Park Troublesome Formation.

Distribution/Abundance: Restricted to a narrow, unusual habitat and known only from a very small area (about 5 miles by 1.5 miles) (NatureServe 2006). Total estimated number of individuals within the two element occurrences is over 2000 individuals (CNHP 2006).

Known Threats and Management Issues: Due to the steep topography and soil composition, off-road vehicle use becomes a primary threat to the populations; County Road 2 runs through one population; road widening and weed control are threats to that occurrence (NatureServe 2006). The habitat is included within the Wolford Mountain Travel Management Plan which involves 33,152 acres of public land north of Kremmling (CNHP 2006).

References: CNHP 2006; NatureServe 2006; Spackman et al. 1997

Version date: March 2006

ANIMAL ABSTRACTS

Boreal Toad (*Bufo boreas boreas*)

Taxonomy:

Class:

.0 Amphibia

Order: Anura

Family: Bufonidae

Genus: *Bufo*

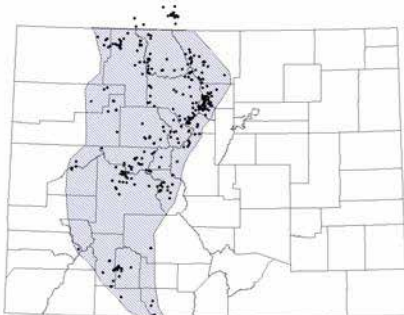


Taxonomic Comments: Prior to the 1990s, morphological, biogeochemical, and vocal differences were noted between toads of the *Bufo boreas* complex in the southern Rocky Mountains and those in the Pacific Northwest (Burger and Bragg 1947, Hubbard 1972). Goebel (1996) described *Bufo boreas* in the southern Rocky Mountains as genetically distinct from those in the Pacific Northwest. These differences may warrant recognition as one or more distinct species. Until this change is formally accepted, Hammerson (1999) has offered the common name of Mountain Toad for the interim, and suggests that the Latin name may become *Bufo pictus*. For the purposes of this report, we are referring all naming to boreal toad (*Bufo boreas boreas*).

CNHP Ranking: G4T1Q, S1

State/Federal Status: State Endangered/USFWS candidate for listing (warranted but precluded)/USFS Sensitive

Habitat Comments: The boreal toad breeds in still or slowly moving water such as can be found in marshes, ponds, and lakes. Successful breeding generally requires permanent or semipermanent water sources. Post breeding, one may find the boreal toad in more terrestrial environments. Though they still tend to linger near water in damp environments, some females will use drier, more densely vegetated areas. Rocks, logs and rodent burrows provide cover while away from water during periods of inactivity (Hammerson 1999).



Distribution: The southern Rocky Mountain population of boreal toads is likely distinct from other populations (A. Goebel, unpubl. data). Although relationships among populations of this toad are not resolved, recent genetic evaluations suggest that the southern Rocky Mountain population ranges from southern Idaho to New Mexico (Goettl 1997; Steve Corn pers. comm.; A. Goebel unpubl. data). In Colorado, this species

occurs throughout the mountains above approximately 8,000 feet in elevation. There are approximately 206 historical localities for the boreal toad in Colorado, while currently there are just 35 known active breeding sites.

Important Life History Characteristics: Boreal toads are long-lived, reaching ages of nine years or more (Campbell 1976). Reproductive maturity does not occur until age four in males and six in females (Carey 1976). Other important considerations include sensitivity to toxicants, relatively short breeding season (starting as the winter snowpack begins to thaw), and slow metabolic rates of the larvae (Hammerson 1999).

Known Threats and Management Issues: The boreal toad is currently found in 67 known Colorado breeding locations comprising 32 populations, only two of which are considered viable (T. Jackson, CDOW, pers. comm.). This species has disappeared from 83 percent of its historic locations in Colorado, 94 percent in Wyoming, and is believed to be extirpated from New Mexico (USFWS 2004). The boreal toad was once known from 25 counties in Colorado, including Grand County, where it was considered common. Its distribution in Colorado is now restricted to 14 counties. Available information suggests that boreal toad populations continue to decline (Keinath and McGee 2005). Reasons for the declining toad population are still being investigated. Proposed causes include chytrid fungus (*Batrachochytrium dendrobatidis*), acid rain, drought, pollution, increased UV radiation, natural population flux, or some synergistic combination of these and/or other factors (USFWS 2004). The major source of decline is believed to be chytrid fungus, which has been linked to major declines in proximate areas such as Rocky Mountain National Park (Muths et al. 2003, USFWS 2004). Examinations of infected toads show that chytrid fungus suppresses the immune system to a point that a secondary infection (e.g. red-leg disease) is usually the ultimate cause of death (USFWS 2004). Researchers hypothesize that one or a combination of environmental stressors is reducing the toads' ability to survive this pathogen (Loeffler 2001a). At this time, researchers do not know whether or not populations can persist in the presence of chytrid fungus. Research is on-going, but it may be several more years before this question can be answered (T. Jackson, CDOW, pers. comm.).

Grand County contracted with the Colorado Natural Heritage Program (CNHP) to evaluate boreal toad habitat within the proposed road corridor, and to identify impacts that could result from implementation of Fraser Valley Parkway project. CNHP conducted surveys for the boreal toad within and adjacent to the proposed Fraser Valley Parkway alignment during the spring and summer breeding season of 2005. No toads, tadpoles, egg masses, or metamorphs in any of the surveyed areas along the road alignment. CNHP biologists estimated about 2.3 ha of summer habitat and no breeding habitat would be directly affected by the road. About 3 ha of possible breeding habitat and about 14 ha of possible summer habitat within and/or adjacent to the proposed parkway would be affected (Gaughn and Grunau 2005).

Wood Frog (*Rana sylvatica*)

Taxonomy:

Class: Amphibia

Order: Anura

Family: Ranidae

Genus: *Rana*



Photo by G. Hammerson

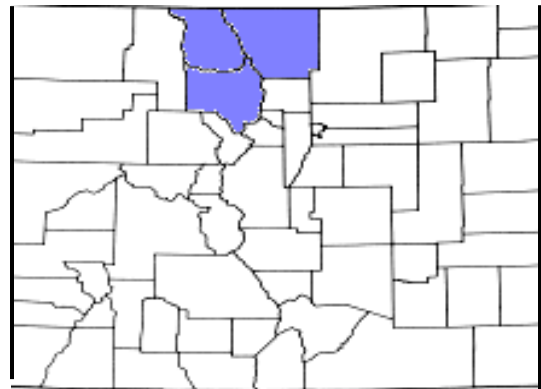
Taxonomic Comments: Dark “mask” on each side of the face; dorsolateral folds present; hind toes webbed; usually a light mid-dorsal stripe; skin relatively smooth.

CNHP Ranking: G5, S3

State/Federal Status: FS Sensitive

Habitat Comments: Various kinds of forest/woodland habitats; edges of ponds and streams; also willow thickets and grass/willow/aspen associations. When inactive, hides in logs, humus, leaf litter, or under logs and rocks. In winter upland habitat in eastern Massachusetts, adult males greatly outnumbered adult females in areas close to (within 65 m of) breeding pools; two wintering areas were not used during the summer active period (Regosin et al. 2003).

Eggs are laid and larvae develop usually in small fish-free ponds, temporary or permanent, in wooded (usually) or open areas. In the Shenandoah Mountains, breeding adults were 100% faithful to the ponds in which they first bred; approximately 18% of the juveniles dispersed to breed in ponds other than the one of origin (Berven and Grudzien 1991). Experiments and field observations by Hopey and Petranksa (1994) indicate that adults are able to assess the presence of fishes in ponds and may change breeding sites accordingly to avoid those with predatory fishes. In northern Minnesota, successful reproduction in acidic bog water either does not occur or is a rare event (Karns 1992).



Distribution: Migrates up to several hundred meters between breeding ponds and nonbreeding terrestrial habitats. In Maine, adult and juvenile *R. sylvatica* readily traveled in excess of 300 m from their pools of origin (Vasconcelos and Calhoun 2004). Bellis (1965) determined that adult and juvenile *R. sylvatica* in a peat bog had traveled at least 410 m from the nearest breeding pool. Berven and Grudzien (1990) found that dispersing *R. sylvatica* juveniles traveled an average of 1,208 m from their natal pools, usually remaining in an area <100 m across after leaving the breeding pond.

The range of the wood frog (*Rana sylvatica*) in North America covers approximately 10.5 million square kilometers of habitat and is exceeded by only one other frog or toad the

northern leopard frog (*Rana pipiens*). However, Colorado's disjunct population lies approximately 450 miles southwest of the closest continuous portion of this species range, which is in North and South Dakota (Horstman 2000). The known wood frog occurrences in Grand County are in the Kawuneeche Valley and the Grand Lake Metropolitan Recreation District.

Important Life History Characteristics: Explosive breeder, with all egg laying in a given pond generally occurring within a brief period of several days. Eggs laid in winter in the Ozarks and southern Appalachians, late February in Maryland, February-March in Missouri, mainly March in southern New England, mostly late May-early June in Colorado; mean date of breeding increases 5.2 days per degree of latitude (Guttman et al. 1991). Eggs hatch in about 1-2 weeks. Larvae metamorphose within a few months, in spring or summer, depending on locality. Period from fertilization to emigration from pond averages about 11 weeks in Michigan, 13 weeks in Maryland, 15-16 weeks in Virginia (Riha and Berven 1991). In Maryland, 20,262 juveniles emerged from a single pond in one year (Berven 1988). Sexually mature in 2-3 years (in Maryland, females mainly in 2 years, rarely in 1 year; Berven 1988).

Inactive during cold season in north and at high elevations. Primarily diurnal in northwest and in spring at high elevations, though breeding activities may occur at night as well. Most active in summer in damp conditions.

Metamorphosed frogs eat various small invertebrates, mostly terrestrial forms. Larvae eat algae, plant tissue, organic debris, and minute organisms in water; capable of eating amphibian eggs and hatchlings and invertebrates as well (Petranka et al. 1994, Petranka and Kennedy 1999; Baldwin and Calhoun, 2002).

Known Threats and Management Issues: Not threatened overall, but threats to local populations include intensive timber harvesting practices that reduce canopy closure, understory vegetation, uncompacted forest litter, or coarse woody debris (moderately to well-decayed) in areas surrounding breeding sites (deMaynadier and Hunter 1999). Negative impacts of intensive timber harvesting extend at least 25-35 m into uncut forest (deMaynadier and Hunter 1998). Not likely to be at risk from present acidification inputs in the Rocky Mountains (Corn and Vertucci 1992).

Widespread and abundant in North America, currently not of conservation concern in the vast majority of the range, though many local populations have declined as a result of agricultural and residential development and intensive timber harvesting practices.

Bald Eagle (*Haliaeetus leucocephalus*)

Taxonomy:

Class: Aves

Order: Falconiformes

Family: Accipitridae

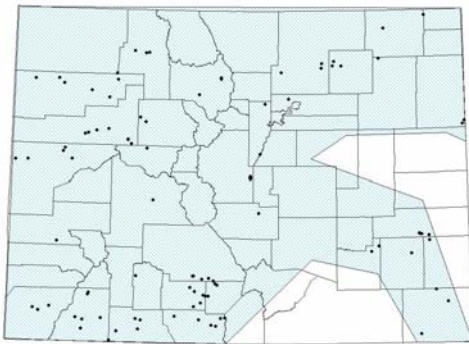
Genus: *Haliaeetus*

Taxonomic Comments: none

CNHP Ranking: G4 S1B, S3N

State/Federal Status: Federally threatened

Habitat Comments: Bald Eagles that nest in Colorado use large, mature cottonwoods or pines, often along rivers, to hold their heavy nests (CBBA 1998). Wintering populations will use major rivers, reservoirs, and prairie dog towns (MBW).



Distribution: Bald Eagles live throughout North America - from Alaska to Newfoundland, and from the tip of Florida to southern California, and nest across Colorado (CBBA 1998).

Important Life History Characteristics: Bald Eagles begin nesting in late February, and can often be observed feeding their young into late June (CBBA 1998).

Known Threats and Management Issues: Continued threats to this species include high pesticide use, poisoning, poaching, and loss of nesting habitat due to the enduring popularity of waterfront development (CNHP 1997).



Boreal Owl (*Aegolius funereus*)

Taxonomy:

Class: Aves

Order: Strigiformes

Family: Tytonidae

Genus: *Aegolius*

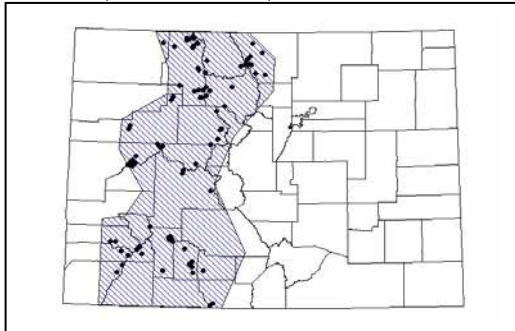
Taxonomic Comments: All Boreal owls in North America belong to one subspecies: *Aegolius funereus richardsoni*.

CNHP Ranking: G5, S2

State/Federal Status: none



Habitat Comments: In Colorado, boreal owls occur mainly in mature to old-age (150+ years) Englemann spruce and subalpine fir above 9500 feet in elevation, but also frequent higher-elevation lodgepole pine and aspen stands (Hayward and Hayward 1993). They prefer wet areas near streams or bogs because these often have good populations of small rodents (CBBA 1998).



Distribution: The boreal owl inhabits spruce-fir/lodgepole pine forests from the Rocky Mountains of Colorado northwest into Canada and Alaska (National Geographic Society 1987). Scattered populations also occur in northern Minnesota, the Cascade ranges, and south in the Rocky Mountains into north-central New Mexico. Field workers have found boreal owls in most Colorado mountain

ranges, including the Elk, San Juan, Sangre de Cristo, and Wet mountain ranges, as well as the Grand Mesa, Park Range, and Flat Tops areas (CBBA 1998).

Important Life History Characteristics: In Colorado, nest initiation for boreal owls range from late-May to late-June. The summer home ranges of three radio marked adults near Cameron Pass averaged 731 acres, while the winter ranges averaged 2796 acres (CBBA 1998).

Boreal Owls do not migrate, but they are nomadic in response to cyclic prey populations. Nesting is initiated as early as mid April and most young leave the nest by mid June. The diet consists of small mammals, especially red-backed voles.

Known Threats and Management Issues: No population trends are available for the Colorado boreal owls since large areas remain unsurveyed for this species. However, Stokes Field Guide (1996) reports a small downward trend for the boreal owl based on Christmas Bird Count data. There are few obvious threats to this species, except where development alters nesting habitat.

The distribution and abundance of Boreal Owls is largely tied to nest cavity availability (they require large trees and snags for nesting) and prey populations. The principal prey species, the red-backed vole, prefers mature, mesic forests with high canopy closure and large downed woody material; it is absent from clearcut areas, but local populations appear largely unaffected by patch cuts (<1.2 ha; 3 ac) or selection cuts (Martell 1983).

Boreal Owls require large areas of mature spruce-fir forest--home ranges in Colorado have been measured at about 1500 ha (3,700 ac) (Palmer 1986). By protecting habitat for Boreal Owls, managers will ensure habitat protection for other spruce-fir species. Boreal Owls are classified as a Sensitive Species in U.S. Forest Service Region 2. Due to this species' nocturnal habits and early nesting season, no data from BBS or other long-term monitoring projects are available. Grande Mesa and Uncompahgre National Forests began an attempt to monitor this species with a nest box program in 1993. This species is monitored by *MCB* with nocturnal surveys.

Conservation goals are to maintain the current distribution of the Boreal Owl as determined by nocturnal surveys of the *MCB* monitoring program, the nest box project of Grande Mesa and Uncompahgre National Forests, and other monitoring programs.

Brown-Capped Rosy Finch (*Leucosticte australis*)

Taxonomy:

Class: Aves

Order: Passeriformes

Family: Fringillidae

Genus: *Leucosticte*

Taxonomic Comments: Brown-capped rosy finch (*Leucosticte australis*), a Southern Rocky Mountains endemic, nest in vertical cliffs and crags of the tundra and feed in the surrounding area. They often use snowfields for feeding, especially when strong winds cross snowfields the updrafts are cut off and insects fall stunned on the snow surface, where these finches forage on an abundant food source (Nelson 1998).



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CNHP Ranking: G4,S3BS4N

State/Federal Status: none

Habitat Comments: These finches make their nests in vertical cliffs and crags above the timberline in the high alpine zone.

Distribution: Endemic to the southern Rockies, mainly Colorado but it can be found across the Wyoming border in the Snowy Range and across the New Mexico Border in the southern Sangre de Cristos as well.

These finches range from the San Miguels and San Juans to the Sangre de Cristos and the Spanish Peaks; from the West Elks and Elks up to the Sawatch to the Mosquitoes and Park Range over all the Front Range from Pikes Peak to the Mummy Range, Never Summers, and Rawah Wilderness.



Important Life History Characteristics:

These finches are one of the few passerines whose females determine territories and choose nest sites. Males have poorly developed songs because they do not use them to defend territories.

Males outnumber females 6:1. The female chooses a mate based on the display by the male, and they form a monogamous bond for the nesting season. The female incubates a single brood of 4-5 eggs in a bulky grass nest that she builds and may use for several seasons. After 12-14 days the eggs hatch and the young fledge for only 18 days more.

Brown-capped Rosy-Finch Distribution (Birds of North America 2006).

Columbian Sharp-Tailed Grouse (*Tympanuchus phasianellus columbianus*)

Taxonomy:

Class: Aves

Order: Galliformes

Family: Tetraonidae

Genus: *Tympanuchus*

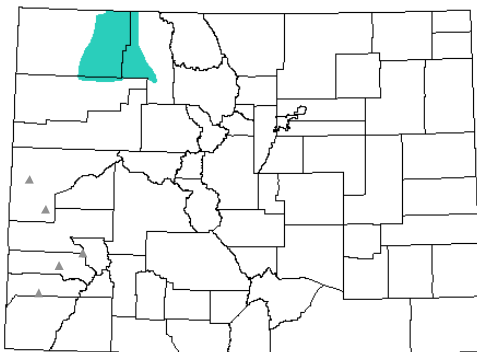


Taxonomic Comments: The Sharp-tailed grouse consists of two subspecies in North America: *Tympanuchus phasianellus jamesii* on the Great Plains, and *T. phasianellus columbianus* in the western mountains. *T. phasianellus columbianus* is described as a local resident in northwestern Colorado (Andrews and Righter 1992). Specifically, it is known from Routt and eastern Moffat counties, with smaller, localized populations south to Montezuma County, where it is a year-round resident (see next page). Populations of Columbian sharp-tailed grouse have declined over the years due to habitat alteration (Braun et al. 1991).

CNHP Ranking: G4T3, S2

State/Federal Status: FS Sensitive/BLM Sensitive

Habitat Comments: This is a bird of mountain shrublands, including Gambel oak, Serviceberry, and Sagebrush (Andrews and Righter 1992; Saab and Marks 1992), where it feeds on insects during the summer and berries in the fall. Typical breeding seasons begin in late March and early April, when males of the species congregate on prominent hilltops to drum, or “broadcast their mating call” (R. Hoffman pers. comm.). Drumming attracts nearby females to the area, who then proceed to select a male for breeding, mate, and finally leave to nest elsewhere. This behavior is commonly known as lekking.



Colorado year-round distribution
(Andrews and Righter 1992; CNHP 1997)

Distribution: Columbian sharp-tailed grouse were found near the southeastern rim of the Book Cliffs (Township 5S, Range 94W, section 35) on NOSR-1 property in July of 1996 (Figure 6 and Appendix A). The female observed had a brood of young birds in trail, which indicated breeding nearby. The Colorado Division of Wildlife plans to conduct breeding season surveys in 1997 on the Roan Plateau in response to the report of this species there; since we do not yet know if NOSR-1 is a lekking site for Columbian sharp-tailed grouse. They will also be examining the area as a potential location for transplanting or reintroducing this species (R. Hoffman pers. comm.).

Greater Sage Grouse (*Centrocercus urophasianus*)

Taxonomy:

Class: Aves

Order: Galliformes

Family: Phasianidae

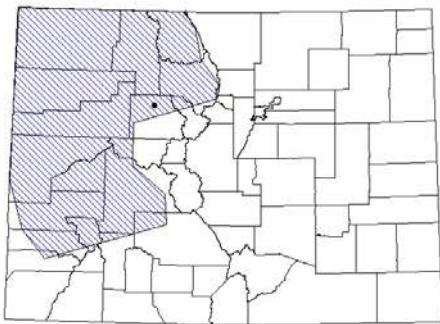
Genus: *Centrocercus*

Taxonomic Comments: Northern Sage Grouse are sagebrush obligates, depending upon big sagebrush as a primary food and as habitat for nesting, brood rearing, and roosting.

CNHP Ranking: G4, S4

State/Federal Status: State Special
Concern Species/BLM Sensitive/FS Sensitive

Habitat Comments: Sage Grouse depend totally upon sagebrush-dominated habitats and prefer large contiguous patches on flat or gently rolling terrain (CBBA 1998). They avoid very steep slopes and sagebrush intermixed with pinyon/juniper (Rogers 1964). Males require tall, mature sagebrush near their leks for day use (Rogers 1964). The presence of tall grass within the sagebrush communities also protects nests from predation (CBBA 1998). They prefer shrub canopy cover averaging between 10% and 20% in brood rearing areas and between 20% and 30% in adult loafing areas. They require the higher percentages for winter habitat (Braun et al. 1977). In northwestern Colorado these grouse most commonly reside between 2400 and 2900 m (7,900-9,500 ft) elevation.



Distribution: Sage Grouse range from the Canadian border southward through the intermountain west to central Nevada, Utah, and Colorado (Terres 1980). The original distribution of Sage Grouse in Colorado apparently extended to the southern border of the state with populations in at least 23 counties (Braun 1995).

The largest populations of Northern Sage Grouse in Colorado inhabit Jackson, Moffat, Rio Blanco, and Routt counties with smaller populations (<500 birds) occurring in Larimer, Grand, Eagle, Garfield, and Mesa counties. Populations in Moffat, Routt, and Jackson counties are contiguous with populations in Utah and Wyoming.

Important Life History Characteristics: Sage-grouse nests are generally located within 2 mile radius around the strutting ground (Crawford et al. 2004, Apa 2005).

Courtship activities begin in early April and the subsequent nesting and fledging of young is not completed until Early August (CBBA 1998).

Males begin arriving on lekking areas (strutting grounds) in March; hen attendance on leks peaks and mating occurs in early to mid April. Strutting grounds may have 50-100 males, although only a few dominant males perform the majority of copulations. Hens disperse up to 30 km (19 mi) for nesting, although most nest within 5 km (3 mi) of the lek where they mated. Except for summer, when insects and forbs predominate the diet, Sage Grouse depend upon the leaves of sagebrush for food.

Known Threats and Management Issues: Sage Grouse have been extirpated from four states and are considered at risk in six additional states--including Colorado--and two Canadian provinces. Long term data indicate Sage Grouse populations have declined by 33% range-wide since the mid-1980s, and show a 31% decline in Colorado. The loss of sagebrush habitats through burning, herbicide applications, and conversion to cropland present the greatest threat to Sage Grouse. Additionally, excessive livestock grazing is believed to have detrimental effects upon Sage Grouse nesting and brood-rearing habitat. Better than average grass cover is associated with better than average nest success. Livestock loafing areas around ponds and salting areas coinciding with leks during the spring months may remove the lek from use by grouse.

The viability of Greater sage-grouse depends on large, continuous blocks of viable sagebrush habitat (Braun et al. 1977). Sagebrush control by prescribed burning can be used to enhance sage-grouse habitat by reducing sagebrush canopy cover where dense sagebrush canopy cover limits understory forbs and grasses. Livestock grazing may positively or negatively affect sage-grouse and sage-grouse habitat, depending on the timing and intensity of grazing. Chemical and mechanical treatments intended to provide increased quantities of grass forage for livestock have indirectly reduced the acceptability of sagebrush rangelands (Beck and Mitchell 2000). Other sagebrush shrubland obligates include: Columbian Sharp-tailed Grouse (*Tympanuchus phasianellus columbianus*), Sage Sparrow (*Amphispiza belli*) and Brewer's Sparrow (*Spizella breweri*).

This species has a high conservation need locally and throughout its range. Although this species is not monitored by the BBS, data from state wildlife agencies have documented severe population declines and loss of sagebrush habitats range-wide. The BLM lists Sage Grouse as a Sensitive Species. This species is not on the national Watch List, but it would qualify based on its National Partners in Flight Database scores. This species is monitored by CDOW.

Damage to stands of tall, mature sagebrush often leads to the abandonment of leks (Rogers 1964). Land management practices such as burning, herbicide spraying, and overgrazing fragment large contiguous areas of sagebrush and cause the Sage Grouse populations to decline (CBBA 1998).

Biological objective is to maintain or increase the distribution of this species and increase size and productivity of all breeding populations, based on CDOW surveys. These improvements are critical to reversing the trends in population and productivity.

Greater Sandhill Crane (*Grus canadensis tabidia*)

Taxonomy:

Class: Aves
Order: Gruiformes
Family: Gruidae
Genus: *Grus*

Taxonomic Comments:

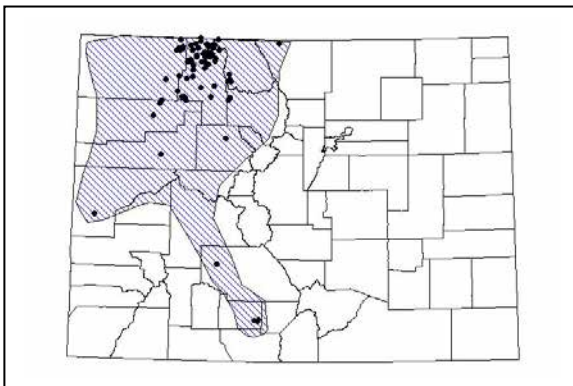
CHNP Ranking: G5T4, S2BS4N

State/Federal Status: none

Habitat Comments: Sandhill cranes have been found breeding in a variety of wetland habitats, particularly flooded fields and beaver ponds, marshes, and wet meadows (CBBA 1998).



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Distribution: The greater sandhill crane winters in southern North America and Central America and breeds in northern North America (NGS 1997). Sandhill cranes are abundant spring and fall migrants in the San Luis Valley and occasional to irregular migrants along river valleys of eastern plains, and valleys and parklands of the western mountains of Colorado (Andrews and Righter 1992).

Important Life History Characteristics: Sandhill cranes begin nesting in May, and fledge their young in June and July (CBBA 1998). After the young reach the flight stage, Colorado's cranes use ranch hayfields as staging grounds for their southern migration.

Known Threats and Management Issues: Drainage of and /or vegetative encroachment on preferred mud flats and sandbar habitats in river and meadow systems along migratory routes, in addition to the availability of spilled grains in adjacent agricultural areas are key conservation considerations for this species (Renner et al. 1991).

Sage Sparrow (*Amphispiza belli*)

Taxonomy:

Class: Aves

Order: Passeriformes

Family: Mimidae

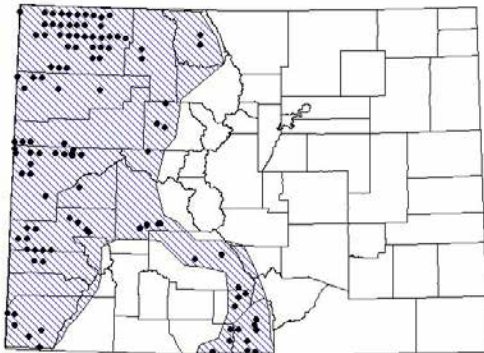
Genus: *Amphispiza*

Taxonomic Comments:

CNHP Ranking: G5, S3B

State/Federal Status: FS Sensitive

Habitat Comments: Sage Sparrows select sizable, low-elevation stands of big sagebrush or mixed big sagebrush and greasewood for nesting (CBBA 1998). However, high-country and plains sagebrush do not make suitable nesting habitat for this species, nor do sagebrush parks of less than 30 acres (Knick and Rotenberry 1995).



Distribution: The breeding range for the Sage Sparrow extends primarily across the Great Plains and onto the Columbia Plateau, but the species is also a permanent resident west over the Sierras and onto the California coastline (NGS 1997). Sage Sparrows occur locally in the lower elevation sagebrush steppes of western Colorado (Andrew and Righter 1992).

Important Life History Characteristics: Sage Sparrows begin to return to Colorado in February and reach full numbers by mid-April. Courtship begins in Early June and the young are fledged by mid-August (CBBA 1998).

Known Threats and Management Issues: The loss of sagebrush shrubland habitat occurring throughout its range as well as the relatively low population size are two factors that threaten this species (CNHP 1997).

White-tailed Ptarmigan (*Lagopus leucurus*)

Taxonomy:

Class: Aves

Order: Galliformes

Family: Tetraonidae

Genus: *Lagopus*



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Taxonomic Comments: The most petite member of the Tetraonidae family in North America, *Lagopus leucurus* is a medium-sized, round-shaped bird whose distinguishing characteristics include: distinct white tail feathers (rectrices) in adults; a small black bill; and feet and legs covered by stiff feathers. The white rectrices differentiate this species from all other ptarmigan species, which have black rectrices. Its heavily feathered legs help to create a "snowshoe" effect, aiding locomotion on snow. Another distinctive trait of the white-tailed ptarmigan is the change of its plumage with the seasons-it molts almost continually from late April to early November. In the spring, summer, and fall, this species assumes a mottled brown-gray coloration, with a white tail and outer wing feathers; in the winter it turns completely white, except for the beak, eye and eye comb, and claws.

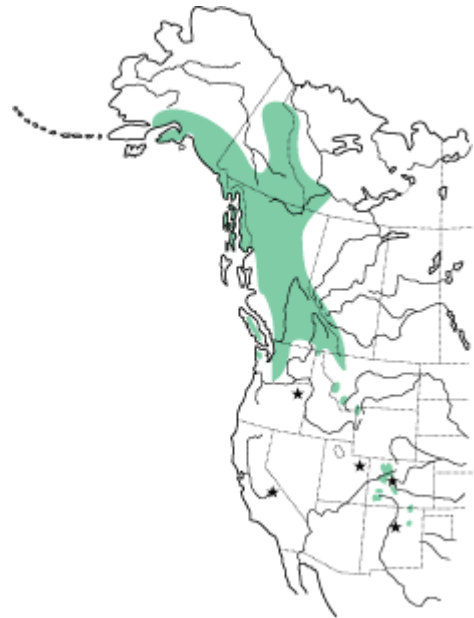
Males and females only differ slightly in body size, shape, and winter plumage. During breeding season males can be identified by crimson eye combs over (these combs are most prominent during breeding season), and black and white barring on the breast. Females on the other hand, have smaller, pinkish colored eye combs, and they have brown and black plumage with yellow barring.

CNHP Ranking: G554

State/Federal Status: FS Sensitive

Habitat Comments: They occur in alpine tundra. Areas that are mostly snow free early in the season are used for breeding, and females with broods generally occur on rocky, wet tundra. Males generally winter above timberline in areas of short willow thickets, while females often winter at or below timberline in taller, denser willow thickets and along willow-dominated watercourses (Hoffman and Braun 1977).

Distribution: Common summer resident above timberline. Birds are widely distributed across the alpine tundra during the summer, when it occurs only at or above timberline. Common local winter resident above treeline and in higher mountains



North American Distribution of White-tailed Ptarmigan (Birds of North America 2006)

below treeline. During fall and winter, they are very concentrated, and large areas may be unoccupied. Females may winter below timberline in higher mountains, and in areas of western Colorado where snowfall is heavy, both sexes move below timberline. There are records into the lower mountains in late fall and winter (C. Braun, personal communication). This species was successfully introduced onto Pikes Peak in 1975 (Hoffman and Giesen 1983).

Important Life History Characteristics: Arrives on breeding areas in April-May but nesting delayed until late June or July. Remains in alpine until winter snows cause migration to lower elevations. Diet is comprised primarily of vegetative material, especially seeds of grasses, sedges, and forbs (Braun 1980). Brown-capped Rosy-Finches are commonly observed at feeders in mountain or foothill urban areas in winter. Often nomadic outside the breeding season. Knowledge of many aspects of their ecology is lacking.

Known Threats and Management Issues: Suitable nesting habitats considered limiting. Grazing, mining, recreation, road building, and water storage development have impacted alpine habitats. Because breeding areas are very localized, this species is vulnerable to environmental and human disturbances. Because of its isolated breeding range, it is not monitored by the BBS or other monitoring programs.

This species has a high conservation need locally and throughout its range. Also, a very high proportion of this species' total population (estimated at 100%) occurs within this physiographic area, indicating that this area has the highest (and perhaps sole) responsibility for the conservation of this species.

Conservation objectives are to maintain current populations and breeding distribution of this species in alpine habitats of Colorado, New Mexico, and Wyoming, as based on results from the *M2001* and other monitoring programs and to protect cliffs, talus slopes, and cirques known to have breeding populations of Brown-capped Rosy-Finches.

Colorado River Cutthroat Trout (*Oncorhynchus clarki pleuriticus*)

Taxonomy:

Class: Actinopterygii

Order: Salmoniformes

Family: Salmonidae

Genus: *Oncorhynchus*



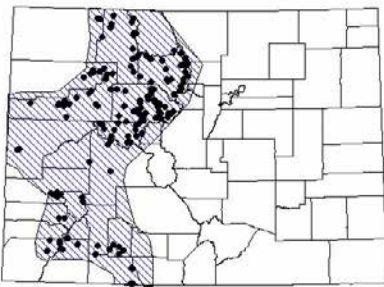
Taxonomic Comments: Subclass – Neopterygii. The only trout species native to Colorado is the cutthroat (Sealing et al. 1992). Drainage histories have isolated four distinct subspecies of cutthroat trout in Colorado; the Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*), the Greenback cutthroat trout (*O. clarki stomias*), the Yellowfin cutthroat trout (*O. clarki macdonaldi*), and the Rio Grande cutthroat trout (*O. clarki virginalis*). Of these four, the Yellowfin cutthroat trout is extinct, and the distributions of the remaining three have been reduced to a fraction of their respective historic ranges (Behnke 1988; Sealing et al. 1992).

CNHP Ranking: G4T3, S3

State/Federal Status: State Species of Special Concern/FS Sensitive/BLM Sensitive

Habitat Comments: The historical habitat included most clearwater streams and rivers of western Colorado (Behnke 1992). Good stream conditions for Colorado River cutthroat trout include cold, clear-running water with high oxygen content, rocky substrates, fairly high stream gradients, and a pH ranging from 6 to 9 (Binns 1977; Sealing et al. 1992).

Distribution: Historic distributions of the Colorado River cutthroat trout extended from the headwaters of the Colorado River basin downstream to the Dirty Devil River in Utah and to the San Juan River drainage in Colorado, New Mexico, and Arizona (Sealing et al. 1992). Refer to the following page for current distributions. The introduction of non-native trout species, dating to 1872 in Colorado, is considered a primary cause for the decline in numbers and genetic purity of Colorado River cutthroat trout (Sealing et al. 1992; Wiltzius 1985). Wernsman (1973) reported only three populations of relatively pure Colorado River cutthroat trout in Colorado. These were in Cunningham Creek (Pitkin County), Northwater Creek (Garfield County), and the headwater area of the Colorado River in Rocky Mountain National Park (Grand County).



Most of the remaining Colorado River cutthroat trout are found in small headwater streams or alpine lakes that have resisted colonization of non-native trout (Proebstel 1994).

Important Life History Characteristics: Competition and hybridization with non-native salmonids occurs. This trait has contributed to the current preferences of this native trout for lakes, beaver ponds, and small streams. Clean, cold water running over a boulder-cobble substrate marks the preferred habitat of this trout (Trotter 1987).

Spawning occurs from late spring through early summer (Behnke and Zarn 1976; Sealing et al. 1992). Sexual maturity is usually reached between the ages of 2 and 4 years (Martinez 1988; Sealing et al. 1992).

Known Threats and Management Issues: The Colorado River cutthroat trout is heavily managed and studied. Presently, there are 42 populations in Colorado judged to be genetically pure (Proebstel 1994). However, the primary reasons for conservation concern at the global and state levels are long-term trend prognoses and threats. Populations continue to decline in many streams (Young et al. 1996); hybridization between this species and non-native trout species (Rainbow trout *Onchorhynchus mykiss*) poses the greatest threat to the elimination of pure populations. Competition with non-native trout species and exotic fish diseases also pose threats, and declines have been hastened by loss of habitat to grazing, clearcutting, water diversions, and stream channelization (Trotter 1987).

The Colorado River cutthroat trout population in Northwater Creek is still intact. We also found this fish in Trapper Creek and East Fork Parachute Creek on NOSR-1 (see Figure 6 and Appendix A), though the population in Trapper Creek was apparently impacted from degraded stream conditions. The lack of shrub cover along the stream likely causes increased water temperatures that are detrimental to the fish. This lack of cover apparently stems from a long history of grazing by domestic livestock.

Roundtail Chub (*Gila robusta*)

Taxonomy:

Class: Actinopterygii

Order: Cypriniformes

Family: Cyprinidae

Genus: *Gila*

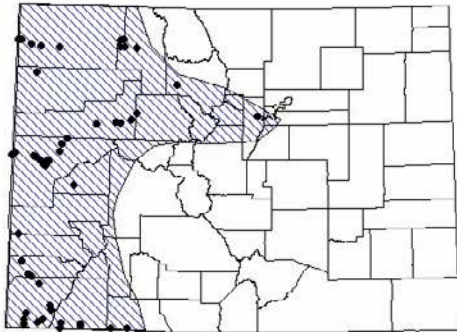


Taxonomic Comments: Subclass Neopterygii

CNHP Ranking: G3, S2

State/Federal Status: State Species of Special Concern/ BLM Sensitive/FS Sensitive

Habitat Comments: The Roundtail chub occurs in large streams and intermediate sized rivers (Page and Burr 1991).



Distribution: The Roundtail Chub is endemic to the Colorado River basin (Page and Burr 1991). In Colorado, this species occurs in the Colorado River mainstem and its larger tributaries, including the White, Yampa, Dolores, San Juan, and Gunnison rivers (CNHP 1997).

Important Life History Characteristics:

Roundtail chub occupies slow moving water adjacent to areas of faster water. Gravel substrates are required for spawning (Woodling 1985).

Known Threats and Management Issues: The main threats to this species are habitat degradation and its restricted range (CNHP 1997). Warm water temperatures are required during the summer for breeding, and the release of cold water from dam facilities during the summer may contribute to the decline of this species (Woodling 1985).

Rocky Mountain Jutta Arctic (*Oeneis jutta reducta*)

Taxonomy:

Class: Insecta

Order: Lepidoptera

Family: Satyridae

Genus: *Oeneis*

Taxonomic Comments: Upperside is gray-brown. Both wings have a broken yellow-orange submarginal band surrounding 2-4 black spots. Underside of hindwing is mottled brown and gray with an obscure median band.

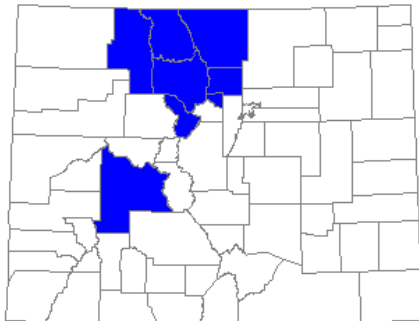


Photo by Paul Opler

CNHP Ranking: G5T4, S1

State/Federal Status: none

Habitat Comments: Wet tundra, spruce bogs, lodgepole pine forest.



■ Confirmed Records ■ Unconfirmed or Dubious Records

Distribution: Holarctic. In North American subarctic habitats from Alaska east across Canada and the northern Great Lakes to Maine. Isolated populations south in the Rocky Mountains to Colorado.

Important Life History Characteristics: Males perch on logs and vegetation, and occasionally patrol,

to find females. Eggs are scattered near the host plants. In some areas, 2 years are required to complete development; young caterpillars hibernate the first winter, older caterpillars the second. Caterpillar hosts are sedges, including cottongrass, while adult food is flower nectar.

Known Threats and Management Issues: Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.

Potential Conservation Areas supporting *Oeneis jutta reducta*:

Schryver's Elfin (*Callophrys mossii schryveri*)

Taxonomy:

Class: Insecta

Order: Lepidoptera

Family: Lycaenidae

Genus: *Callophrys*

Taxonomic Comments: Upperside of male grayish brown with a tan patch on hindwing inner margin; female light brown to tan with dark borders. Underside coppery brown to purplish brown; inner half of hindwing darker than light outer half.

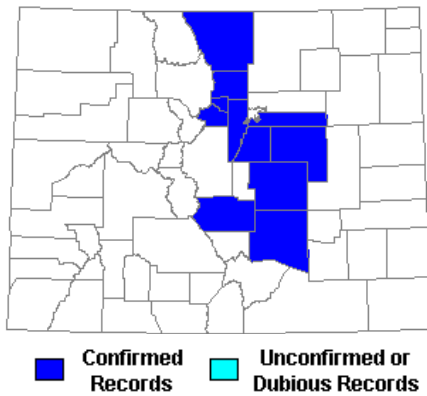


Photo of caterpillar by Paul Opler

CNHP Ranking: G4T3, S2S3

State/Federal Status: none

Habitat Comments: Rocky outcrops, woody canyons, cliffs.



Distribution: Patchy, isolated populations from British Columbia south to southern California, east to Wyoming and Colorado.

Important Life History Characteristics: In California, males perch on shrubs or at tops of cliffs to watch for females; in Colorado they perch in gulches. Eggs are laid singly on the underside of host plant leaves. Young caterpillars feed on leaves; older ones on flowers and fruits. Chrysalids hibernate. Caterpillar

hosts are Stonecrop (*Sedum*, *Sedella*, *Dudleya*, and *Parvisedum*) species in the Crassulaceae family.

Yellow Dotted Alpine (*Erebia pawlowskii*)

Taxonomy:

Class: Insecta

Order: Lepidoptera

Family: Satyridae

Genus: *Erebia*



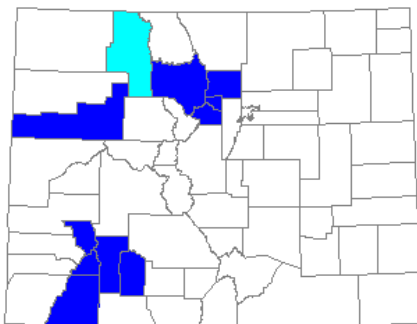
Photo by Paul Opler

Taxonomic Comments: Wings are dark brown with no eyespots. Upperside has a submarginal row of orange dashes across both wings. Underside of forewing repeats the upperside pattern; hindwing has a row of yellow-cream spots. It has been recently discovered that the Theano Alpine is a species restricted to a small area of Asia, and *Erebia pawlowskii* Menetries is the proper name for our North American butterfly. The species also occurs in Asia.

CNHP Ranking: G5, S3

State/Federal Status: none

Habitat Comments: Grassy areas in and above wet tundra, bogs.



■ Confirmed Records ■ Unconfirmed or Dubious Records

Distribution: Several isolated populations in North America from Alaska south in the mountains to Colorado; along the western edge of Hudson Bay to northern Manitoba.

Important Life History Characteristics: Adults fly infrequently and mostly rest in the grass. Males patrol

slowly above grasses to find females. Eggs are laid singly on dead leaf blades near grasses, sedges, and rushes. Two years are required by the caterpillars to complete development; hibernation is by young caterpillars the first winter, mature caterpillars the second winter. Caterpillar hosts are grasses and sedges while adults feed on flower nectar.

Lynx (*Lynx canadensis*)

Taxonomy:

Class: Mammalia
Order: Carnivora
Family: Felidae
Genus: *Lynx*

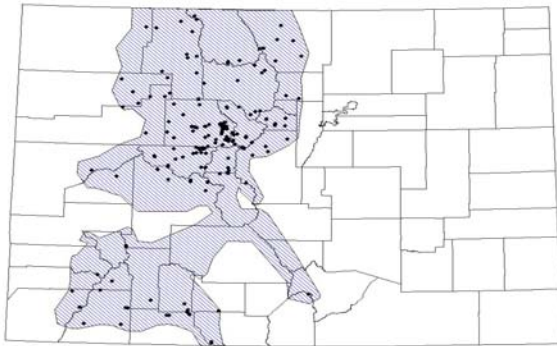
Taxonomic Comments:

CNHP Ranking: G5, S1

State/Federal Status: State
Endangered Species/FS Sensitive



Habitat Comments: Northern coniferous forests are the preferred habitat of the lynx. Uneven-aged stands with relatively open canopies and well-developed understories form good habitat for the snowshoe hare, which is the lynx's primary prey (Fitzgerald et al. 1994). Studies of lynx in Colorado suggest a preference for dense spruce-fir stands in association with rock outcrops and large boulders (Fitzgerald et al. 1994).



Distribution: Historically, the lynx ranged from Oregon across the U.S. to northern Virginia and Delaware and throughout the continent to the north (Fitzgerald et al. 1994). In Colorado, fewer than 50 records have been documented, most of which are historical (CDOW 1996; CNHP 1997). No definitive data exist concerning the population status of this species in Colorado. However,

studies indicate that existing records may represent sporadic populations based more upon wandering and dispersing individuals rather than viable, long-term populations (Ruggiero 1994; Halfpenny et al. 1980).

Important Life History Characteristics: Lynx breed in March, April, or May in Canada in Alaska. The single annual litter contains an average of three young. Females raise the litter and the young disperse in the fall or the following spring. Lynx mortality appears to be primarily due to loss of kittens during cycles of low snowshoe hare availability (Fitzgerald et al. 1994).

Known Threats and Management Issues: The lynx is considered globally secure but critically imperiled in Colorado due to an extremely small population size, few occurrences, and significant threats including habitat fragmentation, increased backcountry access by humans and habitat conversions.

Pygmy Shrew (*Sorex hoyi montanus*)

Taxonomy:

Class: Mammalia

Order: Insectivora

Family: Soricidae

Genus: *Sorex*



Photo by Mathew Wund

Taxonomic Comments: *Sorex hoyi* (formerly known as *Microsorex hoyi*) are the smallest American mammals by weight. They are approximately 3.15-3.6 inches in total length. The tail accounts for approximately 1/3 of that length at 1-1.25 inches. They possess a narrow head, pointed nose, and obvious whiskers. The eyes are inconspicuous, being covered by short, soft fur. Dorsal coloration varies from gray-brown in the summer to gray in the winter. The under parts are a lighter gray.

CNHP Ranking: G5T2T3, S2

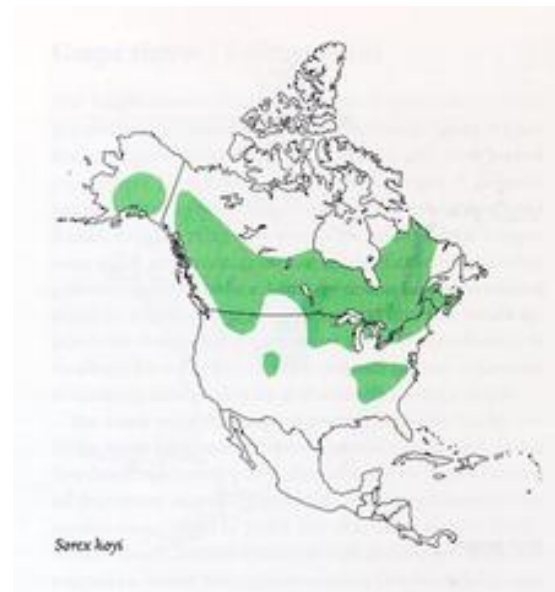
State/Federal Status: FS Sensitive

Habitat Comments: The pygmy shrew occupies a wide variety of habitat types throughout their range. These include coniferous and deciduous forests, swamps, grassy clearings, bogs and floodplains. An equally wide array of microhabitats is acceptable to these animals. They have also been found in diverse microhabitats such as sphagnum moss, moist soil, mammalian tunnel networks, insect tunnel networks, leaf litter, root systems, and stumps.

Distribution: The pygmy shrew is distributed throughout the boreal region of North America. The northern limit of its range spans from Alaska to the east coast of Canada south of the tundra. It ranges as far south as the Rocky Mountains of Colorado and the Appalachian Mountains of the northeastern United States.

Important Life History Characteristics:

Information regarding the reproductive biology is speculative. Based on the condition of the reproductive glands in males throughout the year, the mating season of this shrew seems to be from June through August and the gestation period is estimated to be about 18 days. Females produce one litter of 3-8 young per year which reach sexual maturity in their second summer.



Adapted from Discover Life 2006.

Sorex hoyi are proficient diggers in soft, moist soil and leaf litter. They use tunnel networks made by other animals to find food. In captivity pygmy shrews alternate between short periods (about 3 minutes) of activity and short periods of rest. When

frightened or agitated, they produce a musky odor from their flank glands. Captive pygmy shrews have been known to attack and kill one another.

Pygmy shrews primarily eat insects and other invertebrates. This may include ants, flies, spiders, earthworms, beetles, grubs, and caterpillars. Captive pygmy shrews have been known to eat dead vertebrates such as masked shrews, red-backed voles and white-footed mice.

Wolverine (*Gulo gulo*)

Taxonomy:

Class: Mammalia

Order: Carnivora

Family: Mustelidae

Genus: *Gulo*

Taxonomic Comments:

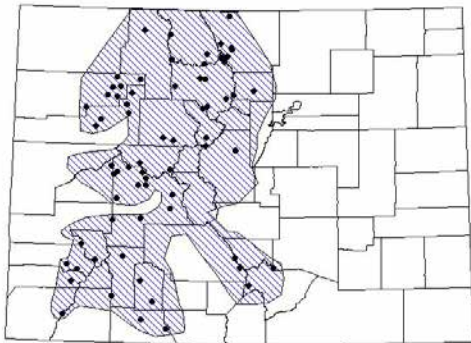
CNHP Ranking: G4, S1

State/Federal Status: State Endangered
Species/FS Sensitive



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Habitat Comments: Wolverines are animals of boreal forests and tundra and prefer marshy areas such as the lowland spruce forests that support extensive wetlands (Fitzgerald et al. 1994).



Distribution: Historically, the wolverine ranged from central Colorado and northeastern Utah across the Rockies into Canada and Alaska. In Colorado, recent reports of this species are restricted to the central mountains of the Park and Gore ranges south to the San Juans (Fitzgerald et al. 1994). Colorado mountain habitats represent the extreme southernmost edge of the species historic and present range.

Important Life History Characteristics: Wolverines are mostly nocturnal and active year round. They are typically solitary, with pairing occurring only during the brief mating season. Home ranges for the wolverine vary from 94 to 288 km² for females, and 422 to 666 km² for males (Fitzgerald et al. 1994).

Known Threats and Management Issues: The status of the wolverine is due to the critically low number of occurrences, lack of verifiable records, low population density in any remaining pockets of habitat, and habitat fragmentation by roads (Fitzgerald et al. 1994).

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