City of Boulder
Open Space and Mountain Parks

West Trail Study Area

Inventory Report Executive Summary and Key Findings

Final Draft
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INTRODUCTION

The overall purpose of the West TSA Plan is to provide the management direction and describe the strategic actions that will protect natural and cultural resources, improve the visitor experience, and provide a physically and environmentally sustainable trail system in the West TSA.

The West TSA Plan will articulate the community's long-term vision, define desired future conditions, and identify on-the-ground management actions directed at achieving and maintaining desired conditions. The West TSA Plan will guide both day-to-day and long-term management decisions.

The Inventory Report represents a compilation and analysis of information about existing conditions for the natural, cultural, and recreational resources in the West Trail Study Area. The information is based on field work, research studies, surveys, resource inventories, and on-the-ground knowledge of the area by OSMP staff and the public. The goal of the Inventory Report is to help inform West TSA decisions about how to balance providing a quality visitor experience and sustainable access and protecting the area's natural and cultural resources.

The West TSA Inventory Report is comprised of the executive summary / key findings (this report) and three separate reports dealing with natural, cultural, and recreational resources. While the reports vary to some extent based on the different resources, a common inventory approach was used.

Description of the West Trail Study Area

Setting. The West TSA forms the spectacular mountain backdrop to the City of Boulder. It contains highly diverse forested and grassland ecosystems at the juncture of the Rocky Mountains and the Great Plains. It is one of the most biologically diverse areas in Open Space and Mountain Parks (OSMP) and the Colorado Front Range. The West TSA mountain backdrop and transitional area to the plains is a globally unique and highly valued natural resource heritage. It also contains many cultural resources which tell stories of Boulder's past.

This dramatic rise of the mountains from the vast flat of the Great Plains not only sets the biological stage for high biodiversity and beauty, it also offers a wide range of exciting recreational opportunities. The West TSA contains many high-use visitor areas, receives almost half of the visitation to OSMP, and is a regional destination for recreation. In addition, the West TSA shares boundaries with numerous city and county neighborhoods whose residents access and recreate on the nearby OSMP lands. With so many people enjoying the beauty of this area, the juxtaposition of high resource values and high visitor use creates many challenges to sustaining the health of ecosystems and providing high-quality visitor opportunities that are compatible with resource conservation.

Location and Acreage. The West Trail Study Area includes Open Space and Mountain Parks lands west of Broadway and SH 93 from Linden Avenue to Eldorado Springs Drive. See West TSA Basemap. The large size of the West TSA requires an area-wide planning approach to address habitat protection and connections at a landscape level and address trails and trail connections in a larger geographic context. The West TSA includes approximately 11,250 acres, with 10,700 acres owned and managed by OSMP and 550 acres of federal lands where OSMP is cooperatively assisting in the management of natural resources and visitor use (approximately 100 acres of National Institute for Standards and Technology property and 450 acres of National Center for Atmospheric Research property).

The Visitor Master Plan management area designations are shown on the West TSA Basemap (see descriptions on page 5). The management areas include Passive Recreation Areas (1,500 acres), Natural Areas (5,240 acres), and Habitat Conservation Area (3,960 acres).

The West TSA Basemap identifies OSMP conservation easements (CEs). These CE lands are owned by other parties, but OSMP has conservation easement agreements on them which preclude most or all new development and require protection of the conservation values on the property. The privately-owned CE lands do not allow public access and their management is outside the scope of the West TSA Plan and therefore not included in the West TSA planning area.

Appendix B summarizes legal agreements and past planning affecting West TSA recreational access.

Natural Ecosystems. Many of the ecosystems in the West TSA are generally healthy and functioning naturally. The West TSA contains a wide array of rare, sensitive, and unique plant species and communities and wildlife species, some of which are highly sensitive to human presence and visitor use. In the ever increasing urbanization of the Front Range, the West TSA provides extremely valuable habitat and refuge to sensitive species. Some of these natural assets are or will be threatened by high and increasing visitor use and increasing dispersal of the use. A major focus of the West TSA Plan will be to maintain or increase the level of natural resource protection and restoration, in order to maintain the balance between resource protection and recreation.

Cultural and Geological Resources. The West TSA contains a wide range of important paleontological, archaeological, historic, and geologic resources. There are cultural features and sites important to indigenous people, sites and structures indicative of European settlement and mining, and trails and structures constructed by the Civilian Conservation Corps (CCC) still used by visitors. The well-known West TSA geological formations, such as the Flatirons and Red Rocks, showcase Boulder's geological history and contribute to the beauty of the mountain backdrop. Some of these cultural and geological resources require a higher level of protection, in order to enable long term stewardship of the resource.

Recreational Resources. Recreational opportunities abound in the West TSA, and many consider it a world-class recreational destination. The West TSA offers a wide range of recreational opportunities—from hiking, contemplation, and nature study to rock climbing, horseback riding, and dog walking. Most visitors to OSMP (and likely to the West TSA) report a high quality of experience, and a large number of visitors greatly enjoy the natural setting for passive recreation. However for many visitors, increasing levels of visitor use over time have degraded the visitor experience with loss of remoteness and increased visitor conflict. Another major focus for the West TSA Plan will be to maintain or improve the quality of visitor experience.

Trail System. The West TSA contains an extensive designated trail system (78 miles), in places densely packed together, with many mountain backdrop trails developed in the early 20th century. A majority of these older designated trails were not located or built to be physically and environmentally sustainable. Many were built in canyon riparian areas, which are some of the most ecologically sensitive lands in the West TSA. A large number of user-created undesignated trails (58 miles) also exist that may not be physically or environmentally sustainable. Some undesignated trails provide access to destinations not served by designated trails, while others result in multiple trails to the same destination. Another major focus for the West TSA Plan will be on making the existing trail system more sustainable and on reducing the extensive network of undesignated trails to reduce resource impacts. A large number of proposed West TSA trail and trailhead improvements (trail reconstructions, refurbishments, and reroutes; trailhead / trail access improvements; priority new trail connections; and critical road crossings) are identified in the Visitor Master Plan. These improvements are intended to improve trail sustainability. A definition that OSMP uses

is that a trail or visitor facility is considered sustainable when principles of ecology, economics, and ethics have been incorporated into the physical design in an effort to achieve ecological and biological integrity, quality user experience, and performance for current and future generations with a minimum of maintenance and upkeep.

Visitor Master Plan Management Area Designations in the West Trail Study Area

West TSA Plan recommendations will include management objectives and strategies for providing resource protection and visitor opportunities. Management Area designations, adopted as part of the Visitor Master Plan (VMP), will provide the context for decision making.

All OSMP lands are categorized under one of four management area designations in the VM P. Three of these management area designations exist in the West TSA: Passive Recreation Area (1,470 ac), Natural Area (5,240 ac), and Habitat Conservation Area (HCA—3,959 ac). The VMP identifies goals and specific management strategies to be applied to the different areas, which are based on different land characteristics (e.g., physical and ecological qualities, existing and anticipated visitor use patterns, existing and potential visitor infrastructure, among others).

The primary goal of each management area is to plan for and facilitate visitor use in areas that can best accommodate the use, which includes providing a high-quality visitor experience and ensuring compatibility of visitor use with natural, cultural, and agricultural resources. The Management Area Designations provide a framework to decide what level of resource protection, visitor access and activities, and trail and facility development are most suitable in a given area.

On one end of the spectrum, the emphasis in Passive Recreation Areas is on providing a high-quality visitor experience in areas that are closer to where people live and work and accommodating a higher level of visitor use, while protecting the natural and cultural resources. At the other end of the spectrum, in Habitat Conservation Areas the emphasis is on protecting and restoring the high habitat values in the more pristine, less human-modified areas within OSMP, while providing a high quality visitor experience in more remote areas. Natural Areas are in the middle of the spectrum, where the emphasis is on protecting the natural and cultural resources and accommodating low to moderate levels of visitor use.

The following is an abbreviated list of characteristics and goals of the three management areas in the West TSA. The complete description of the management areas can be found in the VMP (pp. 47-55).

Passive Recreation Areas (PRA)

- Generally in close proximity to city or county development and may include patches of high quality habitat.
- Offer destinations for a wide range of different passive recreational activities.
- Accommodate high levels of visitor use with appropriate management, trails and trailheads and services.
- Provide a high level of public access to destinations and connections through designated trails (also have a relatively high density of trails).
- Discourage travel on undesignated trails.

Natural Areas (NA)

- Relatively high resource and recreation values.
- Varying levels of visitor use, types of activities, and availability of facilities.
- Provide opportunities for passive recreational and educational activities that require topographic relief or a natural setting (e.g., hang/paragliding, climbing/bouldering).
- Interspersed recreational and natural values require that management determine the appropriate mix of open space purposes and manage multiple uses accordingly.
- Eliminate undesignated trails when they are redundant or damaging to resources.

Habitat Conservation Areas (HCA)

- Tend to be located in remote areas and represent the largest blocks of an ecosystem type with few, if any, trails or roads.
- Naturally functioning ecosystems, contain important habitat connections, high potential for restoration of natural ecosystems.
- Low level of visitor use and low level of developed facilities.
- Provide public access and passive recreational opportunities that foster appreciation and understanding of ecological systems and have minimal impacts on native plant communities and wildlife habitats or other resources.
- Eliminate all undesignated trails, unless they are made part of the designated trails system or provide specialized access to appropriate low-use destinations.

West TSA Planning Process and Next Steps beyond the Inventory

There are three phases of the West TSA planning process:

Phase 1: Inventory of Existing Conditions

Phase 1 is conducted primarily by OSMP staff (with input from the public and the Open Space Board of Trustees). Phase 1 is focused on providing the essential information base and management direction for the rest of the planning process.

Key Questions:

- What resources (and essential qualities) should the plan focus on?
- What are the existing conditions for those natural, cultural, and recreational resources?
- What key issues influence or are likely to influence existing and future conditions, and which ones are most important to deal with?

Planning Steps:

- Identify targets, attributes, and indicators (TAIs) for natural, cultural, and recreational resources *(see definitions below)*, which organize the inventory of existing conditions.
- Characterize existing resource conditions using the TAIs.
- Review information and direction from adopted plans and identify what the Open Space and Mountain Parks Department and the Open Space Board of Trustees consider essential requirements (sideboards) to be built into the West TSA Plan.
- Assess the existing situation, which involves identifying key issues and interests articulated in interviews with a number of community members.
- Identify and prioritize problems and constraints affecting existing and future conditions.

Completion of this phase involves review by the Open Space Board of Trustees and the public and then revision of the reports:

- West TSA Targets, Attributes, and Indicators Report
- West TSA Inventory of Existing Conditions Report (this report)
- West TSA Sideboards Report

What are Targets, Attributes, and Indicators?

- **Targets** broadly define what we are planning for—those natural, cultural, and recreational resources that we are trying to protect, provide, and manage.
- **Attributes** define essential qualities or components of targets that, when present, result in long term sustainability of the target. When these attributes are absent or are severely compromised, the target is no longer sustainable without significant management effort and could be lost completely.
- **Indicators** are quantitative and qualitative measures of the attributes; they are what we measure to track conditions of the attributes. One or more indicators are selected for each attribute. Indicators help us characterize existing and desired future conditions for the attributes and inform us of their status or health. Thresholds can be selected for indicators to help identify at what point conditions are acceptable or within the range of desired conditions.

Examples:

Target	Attribute	Indicator
Mixed Conifer Forest	Wildlife and Habitat Effectiveness	% of Highly Suitable Goshawk Habitat in the Target
Historic Buildings and Structures (BSOs)	Integrity of Historic Buildings and Structures	% in Excellent to Good Condition
Visitor Experience	Access to Destinations	Proportion of Key Destinations Served by a Designated Trail in Each of the VMP Management Area

The West TSA Plan will include recommended actions to maintain existing acceptable (or good) conditions and bring unacceptable (fair or poor) conditions up to acceptable for many of the West TSA natural, cultural, and recreational attributes and indicators. OSMP is using the Conservation Action Planning (CAP) framework, where feasible, to set measurable standards for what is considered "acceptable" and direct proposed management strategies and actions to maintain or achieve acceptable conditions. Standards or thresholds of acceptability may be developed by the Community Collaborative Group for selected indicators. In some cases the indicator data is collected system-wide only (such as responses from the Visitor Survey); in other cases West TSA-specific data is collected (such as condition of particular trail segments). The indicators can help assess the overall effect of the package of individual on-the-ground management actions in moving toward acceptable conditions at the system-wide or TSA-wide level. The indicators also can help assess the effect of individual management actions in moving toward acceptable conditions of the targets and attributes.[1]

A detailed description of the West TSA TAIs can be found in the West TSA Targets, Attributes, and Indicators Report (March 2009). Appendix A includes a summary table identifying the West TSA TAIs.

[1] **Note:** At this stage of the planning process, no commitments have been made on which of the indicators will be monitored over the long-term. During the final stage of plan development, implementation strategies, actions and priorities will be formulated, including commitments for ongoing monitoring of selected indicators of resource conditions and the effect of implementation actions and strategies on those conditions. Some of the indicators monitored will be West TSA specific. Some indicators will apply to the entire OSMP system, but will yield useful information where inferences can be made about the West TSA.

Phase 2: Definition of Desired Conditions

Phase 2 is conducted by a Community Collaborative Group (CCG) with the involvement of OSMP staff. This group will be composed of a representative cross-section of diverse community interests that have a stake in the West TSA. Phase 2 involves defining a broad-brush vision for the West TSA, prioritizing issues and opportunities to focus on, and defining desired future conditions with enough specificity to drive the rest of the planning process.

Key Questions:

- What are the desired future conditions for natural, cultural, and recreational resources that the plan focuses on?
- How do existing conditions and desired future conditions compare?
- What are the prospects of achieving desired conditions?

Planning Steps:

- Define desired future conditions for natural, cultural, and recreational resources using the selected targets, attributes, and indicators.
- Set management objectives and thresholds of acceptability for the attributes and indicators.
- Assess what resources meet or exceed desired conditions and what resources fall short of desired conditions and assess the prospects of maintaining existing conditions that are close to desired and bringing existing conditions up to the desired level.
- Identify best opportunity areas to meet desired conditions for natural, cultural, and recreational resources.

Phase 3: Development of Plan Implementation Strategies

Phase 3 is conducted by the CCG with the involvement of OSMP staff. A consensus-based plan is produced by the CCG. The focus is on finding creative solutions to planning problems and opportunities. The CCG will grapple with the tradeoffs involved in meeting competing needs and desires, and attempt to strike the right balance between resource protection and visitor use. The aim of the plan is to provide a package of on-the-ground changes that will provide overall improvement in conditions for natural, cultural, and recreational resources.

Key Question:

- What is the most beneficial and feasible package of plan proposals to maintain or achieve desired conditions?

Planning Steps:

- Develop and evaluate plan alternatives and scenarios that involve on-the-ground management strategies and actions to maintain desired conditions and bring existing conditions up to desired conditions.
- Select preferred plan alternatives.
- Develop a cohesive plan and implementation program (including monitoring) for the West TSA.

Once the plan is adopted, management actions are implemented, success is monitored and management strategies and actions are adjusted to improve their effectiveness. The plan implementation horizon for the West TSA Plan is ten years (although a much longer view is considered in the plan for sustaining natural, cultural, and recreational resources in perpetuity). The plan will be revised approximately every five years, with course corrections made as needed.

A major goal for the West TSA Plan is to make the existing trail system more physically and ecologically sustainable. Much of the West TSA trail system was developed without consideration of minimizing impacts on natural resources. If new trails are planned in the West TSA, they will have to minimize impacts on natural resources.

Ensuring the long-term sustainability of ecosystems is an underlying goal for all OSMP plans. For TSA plans, maintaining or improving natural resource conditions frames decisions on the best way to enhance and manage recreational access and opportunities. Natural, cultural, and recreational resource information in the West TSA Inventory Report, along with subsequent work to assess the current health or status of these resources, will help us decide the best way to provide natural resource protection in the context of high visitation and the desires for enhanced recreational opportunities.

The West TSA Inventory Report provides information and analysis to identify the most ecologically valuable and sensitive habitat areas and map these identified areas with an overlay of designated and undesignated trails and access points, and cultural resources. Knowing where the most valuable habitat areas and culturally significant sites are will help guide decisions on where existing trails should be rerouted to avoid or minimize impacts and where undesignated trails should be designated / improved or closed and restored. Knowing where these habitats areas and culturally significant sites are will also guide decisions on where to locate new trails to minimize impacts. "Best opportunity areas" will be identified—places where compatibility between resource protection and recreational access has the best potential.

SUMMARY OF KEY FINDINGS

Natural Resources

The West Trail Study Area is a complex and diverse mosaic of ecosystems and habitats, which supports a rich diversity of plant and animal species and ecological communities. Large contiguous blocks of ponderosa pine woodlands and mixed-conifer forests support forest interior species and allow wide-ranging species to move across the landscape. Riparian areas and cliffs provide unique habitat types for some of the rarest species on the OSMP system. Forest / grassland edges and forest meadows provide habitat for species adapted to both forest and grassland ecosystems and are some of the most productive and diverse zones on the landscape. Grassland habitat supports diverse plant and animal communities, including several rare or imperiled species.

Rare Plant Species and Communities

Rare plant species and communities are widely distributed in the West TSA. The highest number of occurrences is located in riparian areas and the largest acreage in the xeric tallgrass prairie. Rock cracks and crevices harbor many rare plant species and communities.

Non-Native Weed Prevalence

The targets with the most complete non-native weed mapping are Foothills and Montane Riparian, Ponderosa Pine Woodlands and Savannahs, and Foothills and Montane Forest Openings.

Weed prevalence is an indicator of vegetation composition for several natural resource targets. Weed prevalence varies widely among the targets in the West TSA , with very low prevalence in the Mixed Conifer Forest and Woodlands Target (0.4% of the target has ≥6% weed canopy cover) and the Cliffs and

Talus Target (1.4% of the target has ≥6% weed canopy cover). For the other targets (Ponderosa Pine, Riparian, and Forest Openings), it ranges from 6.2 to 12.6 %.

Of the areas that have been mapped to date, the highest weed concentrations occur in the Sanitas, Anemone Hill, and Chautauqua areas, and the grassland area south of NCAR and Shanahan Ridge. Trails in the higher elevation foothills generally have lower weed prevalence, while lower elevation trails have higher weed prevalence.

Potential Highly Suitable Wildlife Habitat and Trail Effects

All areas within the West TSA provide habitat for plant and animal species. These lands provide habitat for both common and rare species. Known information about existing wildlife populations and their occupied habitat was compiled for the West TSA Plan. This on-the-ground wildlife and habitat information will be considered when areas are identified and evaluated for possible changes to the existing trail system and visitor activities (in addition, new focused field work may be completed for this evaluation).

Because it is not feasible to survey and inventory all species and habitats on the ground, potential wildlife habitat in the West TSA has been identified and evaluated for selected wildlife indicator species using habitat suitability (HS) models. These wildlife indicator species are characteristic of the ecosystem type where they occur, and they play the role of "umbrella" species, i.e., they represent the habitat needs of many other species with similar needs. The well-supported assumption is that maintaining or restoring good habitat for the wildlife indicator species directly benefits many other species with similar habitat needs.

Habitat suitability models are commonly used to identify areas that have the characteristics to be highly suitable for the indicator species. Key environmental and biological characteristics and habitat requirements of the wildlife indicator species were identified from the scientific literature and other habitat suitability models. The HS models identified wildlife habitat suitable for each of the indicator species. Then "the best of the best" of the suitable habitat was identified as highly suitable habitat.

The number of acres and percent of highly suitable habitat in the West TSA for each of the wildlife indicator species is as follows:

Northern Goshawk Habitat	482 acres, 5%
Abert's Squirrel Habitat	944 acres, 9%
Prairie Falcon	51 acres, 0.5%
Black Bear	1,280 acres, 12%
Wild Turkey Habitat	466 acres, 4%
Shrub-Nesting Bird Habitat	114 acres, 1%
Grasshopper Sparrow	624 acres, 6%

For the highly suitable wildlife habitat, "trail effect" was analyzed using known information about the flushing or disturbance distance caused by human presence on roads or trails, which varies for the different indicator species. Trails and roads were overlayed on the highly suitable habitat. Trails and roads reduce the effectiveness of wildlife habitat, which potentially reduces the amount of highly suitable habitat. Taking trail effect into account in the model, the results show that the percent of highly suitable wildlife habitat in the West TSA is potentially reduced, as follows:

- **Northern Goshawk Habitat.** Highly suitable habitat decreased from 482 acres to 313 acres due to trail effect.
- **Abert's Squirrel Habitat.** Highly suitable habitat decreased from 944 acres to 538 acres due to trail effect.

- **Wild Turkey Habitat.** Highly suitable habitat decreased from 466 acres to 145 acres due to trail effect.
- **Shrub-Nesting Bird Habitat.** Highly suitable habitat decreased from 114 acres to 25 acres due to trail effect.
- **Grasshopper Sparrow Habitat.** Highly suitable habitat decreased from 624 acres to 212 acres due to trail effect.

These decreases in highly suitable habitat for wildlife indicator species result from the extensive network of designated and undesignated in the West TSA. Specifics for the habitat suitability models can be found in Appendix A of the Natural Resource Inventory.

Trails in Riparian Areas

The development of many of the trails in the West TSA follow historical settlement roads, mining roads, regional roads providing access to the western mountains, and user-created trails. As a consequence, almost all the east-west canyons (Sunshine Canyon, Boulder Creek, Gregory, Long, Lost Gulch, Greenman, Bear Creek, Shadow, and South Boulder Creek) have designated trails or roads in them, and all major drainages have trails immediately adjacent to or within the riparian vegetation for much of their lengths. Since riparian areas provide important habitat for many rare and sensitive plant communities and sensitive wildlife species, the presence of trails or roads decreases the effectiveness of wildlife habitat and wildlife movement corridors.

Approximately 28 % (22.5 miles) of the West TSA's 78 designated trail miles are in or near riparian areas. Approximately 19% (14.7 miles) of the West TSA's designated trail miles are in critical bear foraging habitat, and approximately 13% (7.3 miles) of the West TSA's 58 undesignated trails are in this habitat. In critical bear foraging habitat, dogs are allowed on 14 miles out of 15 designated trails. Designated trail density in critical bear foraging habitat is an average of 61 feet per acre; for undesignated trails it is an average of 30 feet per acre. Additional mapping will allow comparison of this trail density among different creek canyons.

Mapping of the occupied range for the Federally-threatened Prebles's meadow jumping mouse shows that almost all the major drainages in the West TSA provide suitable Preble's habitat according to the U.S. Fish and Wildlife Service and the Colorado Division of Wildlife.

Cliff-Nesting Bird Protection

The Boulder mountain backdrop has one of the highest densities of productive nests for cliff-nesting falcons and eagles in the entire Front Range. Not only does the mountain backdrop offer many steep rock walls and crags, but known active nests are protected by seasonal wildlife closures.

44% of highly suitable cliff-nesting raptor habitat falls within an existing seasonal wildlife closure.

Wildlife Population Monitoring

These are key points summarizing results from recent monitoring:

Forest Birds

- Forest birds have significantly higher numbers of individuals and species in thinned, open ponderosa pine forest stands as compared to un-thinned, dense areas.
- Forest stands that have been thinned provide habitat for a wider range of forest bird species.

Accipiter Surveys

- Surveys of accipiters (hawks that inhabit deeply wooded areas) were conducted in 2008 to locate potential breeding areas for forest raptors in the West TSA.
- Staff surveyed Gregory Canyon, Flagstaff, Panther Canyon, Lost Gulch, North Draw and Aspen Canyon during the 2008 field season.
- In Lost Gulch staff located two Cooper's Hawk nests where successful breeding had taken place.
- In Aspen Canyon, staff observed two Cooper's Hawk fledglings close to a nesting site.
- A juvenile Northern Goshawk responded to broadcasts at two stations in the Flagstaff study area but was not detected during subsequent surveys.

Forest Owl Surveys

- Staff surveyed four canyons, Gregory, Aspen, Shadow and Panther, for Flammulated Owls during the 2008 field season.
- Surveys in all four canyons produced responses from Flammulated Owls.
- A Long-eared Owl was also detected in Shadow Canyon.
- Fledging Long-eared Owls were located on Shanahan Ridge.

Cliff-nesting Raptor Monitoring

- During 2008, 49 volunteers logged 587 site visits for the cliff-nesting raptor monitoring program.
- In total, three Prairie Falcon pairs produced 15 fledglings, two golden eagle pairs fledged three young, and two Peregrine Falcon pairs fledged three young.
- Cliffs in the West TSA provide unique and exceptional habitat for cliff-nesting raptors.

Northern Leopard Frog Monitoring

- Northern leopard frog populations on OSMP property face threats that affect many other Western U.S. populations and have led to a precipitous decline in leopard frogs in the Western U.S. The most apparent threats are habitat degradation and loss, fungal infection, and predation from non-native species.
- In the West TSA, eight sites were surveyed for Northern Leopard Frogs from 2006-2008. Leopard frogs were observed at one of these sites in 2006 and two of these sites in 2007.

Bat Monitoring

- On average 20-40 volunteers spend 400 hours/year conducting auditory and visual counts of bats at water holes.
- Volunteers and staff monitor wildlife closures for 2 imperiled bat species, the Fringed Myotis (*Myotis thysanodes*) at Der Zerkle and the Townsend's Big Eared Bat (*Corynorhinus townsedii*) at Harmon and Mallory Caves.
- Seven watering holes and four roost sites are regularly sampled for bats within the West TSA boundary.

Tallgrass West Bird Monitoring

- Tallgrass West (the area of grassland habitat west of Hwy 93 between Shanahan Ridge to north and Eldorado Springs Drive to south) is an area of regional importance characterized by locally rare big bluestem communities that serve as home to many grassland nesting bird species of conservation concern.
- Over the four years of study completed to examine effects of grazing regime shifts, staff detected 51 species of birds at the Tallgrass West study sites. Of these, 49 were native and five are considered grassland specialists.

Cultural Resources

The West TSA is rich in cultural resources, ranging from fossilized remains of ancient sea life and dinosaurs, sites and artifacts used by Native Americans, and roads, mining sites and homesteads used by Euro-Americans. These and other cultural resources tell stories of past human activities, how people lived over the ages, and their effects on the land. For the West TSA, cultural resource management actions will be planned to preserve and in some cases interpret those cultural resources that are frequented by OSMP visitors or are near current or planned trails.

Some paleontological sites and features in the West TSA have been identified. Fossilized dinosaur footprints, worm trails, mollusks, stromatolites and trace fossils of ripples have been found in the West TSA. Current information will be supplemented by a comprehensive survey of these resources and their protection needs to be completed in fall 2009.

Several locations of aboriginal sites and artifacts are known. Aboriginal features in the West TSA are predominately scatters of flakes, rock shelters, or stone structures (e.g., hunting blinds, tipi rings). However, resource protection needs and agreements dictate that these locations not be shared with the public.

Euro-American sites, buildings, and structures reveal much about early settlement times. Physical remains and recorded historical accounts point to a wide variety of historic land use activities in the West TSA. The major activities included:

- Mining of gold and other minerals
- Homesteading, farming, ranching, and logging
- Early recreation (summer cabins)
- Entertainment, education, and recreation (Chautauqua National Historic District)
- Health care related to clean air and the outdoors (Sanitas)
- Depression-era economic recovery (numerous recreational shelters, roads, Sunrise Circle Amphitheater, Green Mountain Lodge built by the Civilian Conservation Corps/ CCC)
- Transportation (roads leading to mines and other settlements, bridges, rock walls, trails)
- Water transmission (ditches and pipelines)

Information on the current physical condition of many of the Euro-American sites, buildings, and structures will be updated with field work in 2009. Previous cultural resource inventories completed in the 1990s provided an assessment of the condition of Historic Buildings and Historic Structures. Results for Historic Building showed that 54% of Historic Buildings were in excellent or good condition and 46% were in fair, deteriorated or ruins condition. Results for Historic Structures showed that 31% were in excellent or good condition: and 69% in fair, deteriorated or ruins condition.

A large proportion (73%) of the Euro-American sites, buildings, and structures are in close proximity (100 feet) to roads, trails, trailheads, and other visitor use areas. This proximity provides opportunities for interpreting the resources to enhance visitor appreciation of them and also provides, in some cases, the need to secure these resources from the impacts of visitor use.

Recreational Resources

Visitation Patterns

- **Visitation Numbers.** The Visitation Study conducted in 2004-05 estimates that system-wide there were approximately 4.7 million person visits annually on OSMP (compared to about 3 million visits in 1996), with 40-45% of the visits in the West TSA.

- **Visitor Activities.** In the 2004-05 Visitor Survey, the activities that were most reported by respondents as the purpose of their visit to OSMP (not just the West TSA) were as follows:
    - Hiking 55%
    - Viewing scenery 52%
    - Dog walking 32%
    - Running 24%
    - Wildlife viewing 24%
    - Meditation 15%
    - Biking 13%
    - Social gatherings 12%

  Note that respondents could select more than one activity, so the total exceeds 100%.
- **Regional Destination for Recreation.** System-wide, 81% of the survey respondents were Boulder County residents (57% were city residents and 24% other cities plus unincorporated), 8% Denver metro residents, and 11% other residents. The percent of out-of-county visitors may be higher in the West TSA because Boulder Mountain Parks is well-known nationally and even internationally as a destination.
- **High-Use Areas.** Of the 236 designated access points system-wide thought to have at least three or more visitors per day, 42% (100) of them are in the West TSA. In the West TSA, undesignated trail density was found to be the highest in the vicinity of Chautauqua Meadow, Flagstaff, the 1st and 2nd Flatirons, and Settlers Park.
- **Seasonality of Use.** Some sites see their biggest visitation in the summer followed by spring and fall. Other sites, such as the Chautauqua and Sanitas areas, see regular visitation year-round.

Recreational Opportunities

- **Types of Recreational Activities.** The West TSA offers a wide range of passive recreational activities from hiking, contemplation, and nature study to rock climbing, horseback riding, picnicking and social gatherings, and dog walking. Some activities are currently prohibited, most notably bicycling and paragliding / hang gliding.
- **Comparison to Other Peer Agencies.** OSMP was compared to other similar front-range open space agencies with respect to recreational opportunities and management strategies (Boulder County, Jefferson County, Larimer County, Douglas County, Golden Gate Canyon State Park, and Eldorado Canyon State Park). Some results:
    - OSMP offers more off-leash dog walking opportunities compared to other agencies, with 31% of OSMP's trails requiring dogs to be on-leash (26% for the West TSA); all other agencies require dogs to be on-leash on 100% of the trails that allow dogs.
    - OSMP offers both fewer and more trail miles that prohibit dogs compared to other agencies, with 10% no-dog trails for OSMP and 5% for the West TSA; the range of no-dog trails for three of the peer agencies is 10-39%, but for the other three peer agencies the range of no-dog trails is 0-2%.
    - OSMP offers fewer bike opportunities than other agencies, with 34% of the trails allowing bikes in the system; the comparable number for the other agencies ranged from 55% to 92%.
- **Dog Walking.** Dog walking in the West TSA is primarily off-leash under voice and sight control. Considering dog walking regulations on the West TSA trails, the current situation is: 70% are off-leash under voice-and-sight control (55 miles), 25% on-leash year-round or seasonally (25 miles), and 5% no dogs (4 miles).
- **Accessibility.** In the West TSA, there are 1.1 miles of trails accessible to people with disabilities. Seven trailheads are accessible.

Access to Destinations

- **Key Visitor Destinations.**
  - In the West TSA OSMP has identified 106 key destinations (visitor facilities, natural features, popular gathering spots, and popular rock climbing and bouldering areas).
  - 81 (76%) of the key destinations are served by a designated trail, with all key destinations served in the Habitat Conservation Area, 55% in the Natural Area, and 82% in the Passive Recreation Area.
- **Trail Mileage.** The West TSA has 78 miles of designated trails (13.1 miles in the Habitat Conservation Area, 24.9 miles in the Natural Area, and 33.2 miles in the Passive Recreation Area;; other trail miles are on NCAR, NIST, and the Boulder Creek Path). These trails provide visitors access to a variety of destinations, provide connections within the trail system, and offer quality recreational experiences. Some of these trails may not be physically or environmentally sustainable.
- **Undesignated Trails.**
  - The West TSA has 58 miles of undesignated trails. Split out by VMP management area:
    - Habitat Conservation Area: 3.5 miles
    - Natural Area: 27.7 miles
    - Passive Recreation Area: 20.9 miles
    - NIST and NCAR: 6.2 miles
  - Undesignated trails result from a variety of causes, including: users creating access to destinations or links between designated trails; users avoiding muddy areas which results in trail braiding; and neighbors accessing OSMP lands from a host of undesignated access points.
  - Often multiple undesignated trails go to the same destination.
  - Most undesignated trails have significant problems with physical sustainability or are located in sensitive habitat. 36% of the undesignated trails are in the very high to high impact (on natural resource) rating category, 58% are in the moderate impact rating category, 6% are in the mid-low-least impact rating category.
  - Most undesignated trails are in close proximity to designated trails and roads, with the highest undesignated trail densities found in Chautauqua Meadow, Flagstaff Mountain, and Settlers Park.
  - Some undesignated trails are caused by missing key trail connections.
- **Designated and Undesignated Access Points.**
  - Visitor access to the West TSA is widely dispersed along its boundaries.
  - There are 51 designated access points (including trailheads and other signed entry points) in the West TSA.
  - There are 129 undesignated access points (and undesignated trails leading from them) along the western edge of the city, primarily originating from neighborhoods.
  - The 51 designated access points provide convenient access to adjacent neighborhoods, with almost 80% of them located within ½ mile of another access point.
  - Eight of the designated access points are within ¼ mile of a bus stop.
- **Wayfinding Signs.** Intended to guide visitor travel, wayfinding signs are provided at about 2/3 of the designated trail intersections. There are very few signs indicating to visitors that an undesignated trail is not a designated trail to discourage trail use.

Lack of Conflict

- **Visitor Conflict.**
  - On any give day, most OSMP visitors on OSMP do not experience conflict or unpleasant circumstances.
  - The 2004-05 Visitor Survey reports that system-wide 96% of visitors did not experience conflict with other visitors on the day they completed the survey. Some visitors, however,

experience visitor conflicts that occur when they encounter other visitors whose behaviors are annoying or unpleasant.
    - About 4% of visitors system-wide reported they had experienced conflict on the day they were surveyed. With 4.7 million annual person visits to OSMP, this percent could result in almost 200,000 yearly conflict incidents system-wide.
    - Visitors reported system-wide that 60% of the conflicts involved dogs and dog excrement, 17% involve management-related concerns, and 15% involve inconsiderate behavior.
- A different survey, the 2004-05 Citizen Survey, shows that bikes and dogs were the greatest source of conflicts (37% and 23% respectively).

Connection with the Land

- **Interpretive Hikes.** OSMP offers hundreds of natural and cultural history interpretive hikes every year, and participant feedback surveys show that a very high degree of satisfaction with them (average rating of 9.2 out of 10).
- **Educational Events.** In the 2004-05 Citizens Survey, 47% of the respondents said they had participated in an OSMP educational event, including guided hikes but also a wide range of other events (such as in-school programs, Farmer's Market, and educational and outreach information provided on-line and in the media).
- **Volunteer Opportunities.** A wide range of volunteer opportunities are offered (15 programs, resulting in 25,000 volunteer hours per year), and OSMP volunteers report they are very satisfied with their volunteer experience.

Safety

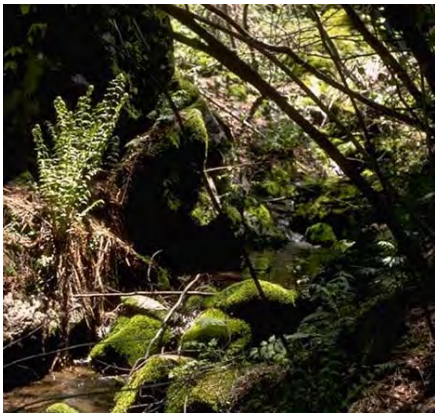
- **Perception of Safety.**
    - The 2004-05 Citizens Survey indicates that 95% of participants consider their OSMP visits safe, with 74% rating their visits as "very safe".
    - The most reported reasons in the 2004-05 Citizens Survey for not feeling safe were:
        - Presence of mountain lions / fear of being killed by a bear
        - Concerns about being alone / not knowing who else is visiting
        - Security gaps / not enough rangers / car break-ins
- **Law Enforcement Incidents.** Rangers respond to many different types of law enforcement incidents in the West TSA. In 2008 the most numerous incidents were dog related (268) and illegal camping (68).

Remoteness

- **Perception of Remoteness.** Visitors to the West TSA have numerous opportunities to experience the feeling of remoteness and escape from the built environment on designated trails and off-trail. There are several factors that create this feeling of remoteness in the Western Mountain Parks Habitat Conservation Area (HCA) and other areas in the West TSA, including the large physical size of the area, steep topography and forested landscape, significant time required to access more distant trails, and low visitation on many trails.
- **Undesignated Trails.** There are 3.5 miles of undesignated trails in the Western Mountain Parks HCA, which may detract from some visitors' perceptions of remoteness.
- **Trail Signs.** Sign structures along a trail can detract from a sense of remoteness. The HCA and Natural Areas in the West TSA have about 3 ½ sign structures per mile.
- **Trail Conditions.**
    - OSMP manages 78 miles of designated trails in the West TSA over many different kinds of terrain.
    - Many of the West TSA mountain backdrop trails were built in the early 20th century and were not located or built to be physically and environmentally sustainable.

- OSMP has established trail construction and maintenance guidelines and standards that are designed to match different classes of trails, which vary based on the allowed uses on the trail and the level of development. These standards set the benchmark to assess the condition of the trails over time and determine appropriate trail management actions.
- Each trail is assigned a trail class and is rated against its appropriate standards, which are factored into its Trail Management Objective (TMO) Index. A determination can then be made on whether any given trail is in or out of compliance with its TMO Index.
- A current inventory of the condition of trail segments in the West TSA reveals that 63% are in Very Good or Good condition (49 miles), and 29% are in Fair, Poor, or Very Poor condition (23 miles). The inventory has not yet been completed for 8% (6 miles).
- Of the West TSA trail segments that do not comply with their TMOs, 81% of the trails are out of compliance due to grades being too steep, and 14% due to trails being too wide.

- **Trail Maintenance.**
  - Erosion is the primary maintenance problem, with the most eroded trails in the Kohler Mesa, mountain backdrop, Flagstaff Road, Red Rocks, and Mount Sanitas areas.
  - Several reasons are behind the fact that over 1/3rd of the West TSA Trails are not sustainable and are in fair or poor condition, including: unsustainable location or design, steep grades and erodible soil substrates, high levels of use, and long-term lack of regular maintenance.
- **Concentrated Use Area Conditions.** Examples of concentrated use areas include trailheads, access points, road crossings, overlooks, amphitheaters, picnic areas, and large group areas. There are 51 Concentrated Use Areas in the West TSA, fourteen are trailheads, 33 are access points, and four are recreational facilities. OSMP has established Classes and Standards for trailheads, access points and recreational facilities, which are used to evaluate the conditions, determine whether they are in or out of compliance, and identify necessary upgrades. None of the Trailheads in the West TSA are in compliance, around 67% (22 of 33) of the Access Points comply, and 33% (1of 3) of the Recreational Facilities comply.



City of Boulder
Open Space and Mountain Parks

West Trail Study Area
Natural Resource Inventory Report

Final Draft
August 2009

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West TSA Natural Resource Inventory Report

Introduction

The West Trail Study Area is a complex and diverse mix of ecosystems, habitats, wildlife and plant species, and natural processes making this roughly 11,000 acres one of the most biologically rich areas in the Colorado Front Range. The TSA area contains two designated State Natural Areas that highlight the area's state-wide and regional significance and is home to 14 imperiled or critically imperiled plant species, over 1,000 acres of imperiled or critically imperiled vegetation associations, and a long list of wildlife species that are rare or sensitive according to the Colorado Natural Heritage Program, the US Forest Service, or the Colorado Division of Wildlife.

In addition to the discrete occurrences of rare species, the West TSA is made up of a broad mix of ecosystems. The larger matrix habitats in the TSA support a rich diversity of plant and animal species. Large contiguous blocks of ponderosa pine woodlands and mixed-conifer forests provide habitat for wide-ranging animals and allow for their movement across the landscape. Riparian areas and cliffs are much smaller in relative size but provide unique habitat for some of the rarest species on the OSMP system. Forest/grassland edges or ecotones support unique vegetation associations and virtually all the local wildlife species spend at least a portion of their lives in these openings and along these edges (Map 1).

The West TSA Natural Resource Inventory Report is a synthesis of the existing knowledge and data that relates to this portion of the OSMP system. The report integrates background information, data models and GIS, and recent monitoring data into an assessment of current conditions for targets, nested targets, attributes and indicators. The focus of this report is the newly developed TAIs for the forested portion of the system. Complete target descriptions as well as current conditions in the ***grassland portions*** of the TSA are described and detailed in the OSMP Grassland Ecosystem Management Plan (City of Boulder 2009).

Top: Wood lilly (*Lilium philadelphicum*)

Bottom: Peregrine falcon (*Falco peregrinus*)

This inventory report is also supplemented by a report prepared in the fall of 2008 by ERO Resources Corp. The ERO report focuses on nested targets or those species that are rare or sensitive and have unique conservation needs provided by the target. The report reviews recent research conducted on OSMP and other published works to describe some of the nested targets in the TSA and

provide spatial data for species occurrences. The report also provides a summary of research done on recreation and human impacts to wildlife. Much of this information is integrated into the Habitat Suitability Models of this report. While the ERO report provides background information on geology, soils, and vegetation, its focus is upon wildlife species of special concern.

Future West TSA planning will identify and describe:

- Desired Conditions
- Management Issues
- Recommended strategies to deliver a high quality visitor experience, sustainable visitor infrastructure and the conservation of resources

Parts of this Report

Target Descriptions and Current Conditions (Main Report)- The main body of this report gives an in-depth description of each natural resource target and reports out the current conditions of general target attributes as well as the current conditions for each indicator. The methods and specific data used to develop the current conditions are described in the following appendices.

Habitat Suitability Models and Trail Effects (Appendix A) - The wildlife indicators selected for the WTSA planning process focus on a subset of "umbrella species" that were selected because they have habitat needs within the specific target that also apply to a much broader suite of wildlife species. Theses indicator species were selected because there is sufficient baseline data to accurately model habitat needs on the system, there is a range of research on those habitat needs so the models could be appropriately refined, and the indicators are species that are sensitive to change due to visitor use.

This inventory report uses a technique called Habitat Suitability Modeling to map the potential habitat of the indicator species in each natural resource target. The models are based on a wide range of OSMP GIS data and incorporate species specific research and monitoring. Habitat models have obvious limitations and no model is perfect but they allow staff to get a system-wide perspective on resource values, provide an easily measured value of the status of habitat and inform future follow-up when finer scale management decisions are necessary. The habitat models are one tool being used at a coarse scale to identify areas in the West TSA where existing natural resource conditions could be improved. These coarse assessments will be followed by finer scale evaluations when specific

project areas are identified through the planning process. The models will allow for a more efficient and focused use of limited resources.

Existing literature and research was reviewed to identify human impacts related to each of the indicator species and these potential impacts were incorporated into the models. The trail and road effects portion of the models use the best available information to make general assumptions about potential effects. The models are limited by the amount of specific research that has been done for each species and, while the results of studies are not often conclusive, at the coarse level the modeled trail effects provide a tool to identify areas where natural resource values may be impacted and where changes to existing infrastructure could improve natural resource target conditions.

On-going Wildlife Monitoring Projects (Appendix A) - The methods and findings described in this section relate to on-going research and monitoring projects being conducted by OSMP staff in the West TSA. While many of these projects are not designed to specifically look at the impacts of trails or human use, they can inform the trail study area process. These studies can provide relatively current and discrete occurrence data for many nested target species and provide baseline information on species richness and abundance.

Rare Plant and Vegetation Monitoring (Appendix B) - This section of the report describes the monitoring methods used to track rare plants and communities across the OSMP system. Tables are included that report the numbers of subpopulations for each nested plant species and acres of each nested vegetation association.

Non-Native Species Mapping and Prioritization (Appendix C) - The final appendix in the report outlines OSMP's methods for mapping non-native vegetation. The rapid assessment weed mapping was used to develop the management priority weed indicator for each target. The appendix also includes a species prioritization developed by staff and based on associated habitats, ecological threat, difficulty of management, and state weed designations.

Conservation Target: Mixed Conifer Forests and Woodlands

Summary Statistics:

Total acres of the target in the entire OSMP system (fee properties): **4,242 acres**
Percentage of all OSMP vegetation in the target: **12.5 %**
Total acres of the target in the West TSA: **3,832 acres**
Percentage of the target in the West TSA: **90.3 %**

Miles of OSMP designated trails in the target: **18.4 miles**
Miles of undesignated trails in the target: **11.2 miles**

Background

Mixed conifer forests and woodlands form the largest target within the West TSA covering roughly 39% of the total area. Approximately 90% of all mixed conifer areas on the system occur within the TSA boundary. This focal target covers some of the steepest and most varied topography on the system and forms some of the largest intact habitat blocks in the forested areas on OSMP. Dense canopy, more mesic conditions, and relatively low levels of disturbance make this target a large contributor to the overall biological diversity of the OSMP system.

The majority of the Mixed Conifer target occurs west of the Mesa Trail on steep slopes. The soils that support this target are of the Judget and Fern Cliff series. These soils are generally coarse gravel or sandy loams with some large rock inclusions. These soils are well drained with moderate permeability and can be prone to erosion (Moreland and Moreland 1975).

Vegetation Composition (Attribute)

This target occurs within the lower and upper montane life zones from about 6,800 feet to roughly 8,500 ft on OSMP. Mixed Conifer forests and woodlands are recognized by canopy covers greater than 25%. On OSMP the dominant overstory species in this target are Douglas-fir (*Pseudotsuga menziesii*) and ponderosa pine (*Pinus ponderosa subsp. scopulorum*), usually in equal proportions or dominated by Douglas-fir. In addition to these two common species there are also small scattered patches or individual occurrences of limber pine (*Pinus flexilis*), blue spruce (*Picea pungens*), lodgepole pine (*Pinus contorta*), Rocky Mountain juniper

(*Sabina scopulorum*), and quaking aspen (*Populus tremuloides*). Many of these stands favor the wetter, north-facing slopes of the mountain backdrop but can also be found on ridgelines and in draws and canyons.

In many mixed conifer areas understory growth can be greatly inhibited by the heavy canopy cover. Conditions favor more shade-tolerant species in the understory and the establishment of Douglas-fir seedlings. Shrub species like Rocky Mountain maple, ninebark (*Physocarpus monogynus*), and waxflower (*Jamesia americana*) can form thick stands within these forested areas. Other common understory plants include elk sedge (*Carex geyeri*), wild rye (*Leymus ambiguus*), ricegrass (*Piptatherum micranthum*), pipsissewa (*Chimaphila umbellata*), and one-sided wintergreen (*Orthilia secunda*). The moist, shaded conditions also support a unique suite of rare plants including picture-leaf wintergreen (*Pyrola picta*), wood lily (*Lilium philadelphicum*), Alaskan orchid (*Piperia unalascensis*), and western polypody (*Polypodium saximontanum*).

Current Conditions:

- 17% of the target area has been mapped for weeds, of this 0.4% of the target area has a weed canopy cover greater than 6%
- There are currently 9 known populations of rare plant species with a total of 26 subpopulations
- Potential high suitability Northern Goshawk habitat covers 5% of the West TSA. When trail effects are considered- highly suitable habitat is reduced to 3% of the WTSA

Indicator: Percentage of target with a prevalence of management priority weed species- *System-wide weed mapping data that includes species, percent cover, and patch size were used to identify areas in the TSA with relatively high weed cover. A list of the management priority weed species used in this target analysis and a description of the mapping methodology can be found in Appendix C. Approximately* ***17% of the mixed conifer target in the TSA has been mapped for weeds****. Within the mapped portion of the mixed conifer target,* ***0.4% of the target area has a weed cover greater than 6%****. Mapping in 2009 will focus on mixed conifer forests to increase data on weed prevalence in this target. The low overall weed occurrence is likely the result of dense canopy cover and low levels of historic disturbance. Map 2 shows weed densities across the West TSA and areas of greater weed concentrations based on patch size and density.*

Indicator: Number of populations and subpopulations of local suite of rare species and communities-
Rare plant occurrences have been mapped across the OSMP land system. New occurrences are discovered each year. The values for this indicator are based on the most current information recognizing that new discoveries or environmental factors will likely cause changes in what rare plant species and the numbers that are found in the target. A list of the rare and sensitive plant species and communities that contribute to this indicator can be found in Appendix B. Within the mixed conifer target area ***there are currently nine known populations of rare plants with a total of 26 subpopulations and 36.5 acres of rare plant communities****. The known occurrences of rare plants and communities have been generalized on Map 3. Populations are all occurrences of a species within a distance of 2 km of each other when suitable habitat is present. Subpopulations are all individuals grouped within a distance of 50 m (NatureServe 2004).*

Wildlife and Habitat Effectiveness (Attribute)

The mixed conifer forests of OSMP provide essential habitat for interior wildlife species or those species that require blocks of intact, dense forest cover. Interior forests are defined as being more than 200 m from an ecotonal edge (Robbins et al. 1989, Bock et al. 1999) and higher basal area values are a good predictor for interior species use (Jones 1990). Interior bird species utilize the dense canopy of the mixed conifer target for foraging, nesting and breeding. There is a wide range of interior bird species that use OSMP lands including accipiters like Northern Goshawks and Cooper's Hawks and smaller species like Flammulated Owls, Hairy Woodpeckers, Red-breasted Nuthatches, and Hermit Thrushes. All of these bird species utilize the habitat that is provided by the dense patches of forest on OSMP.

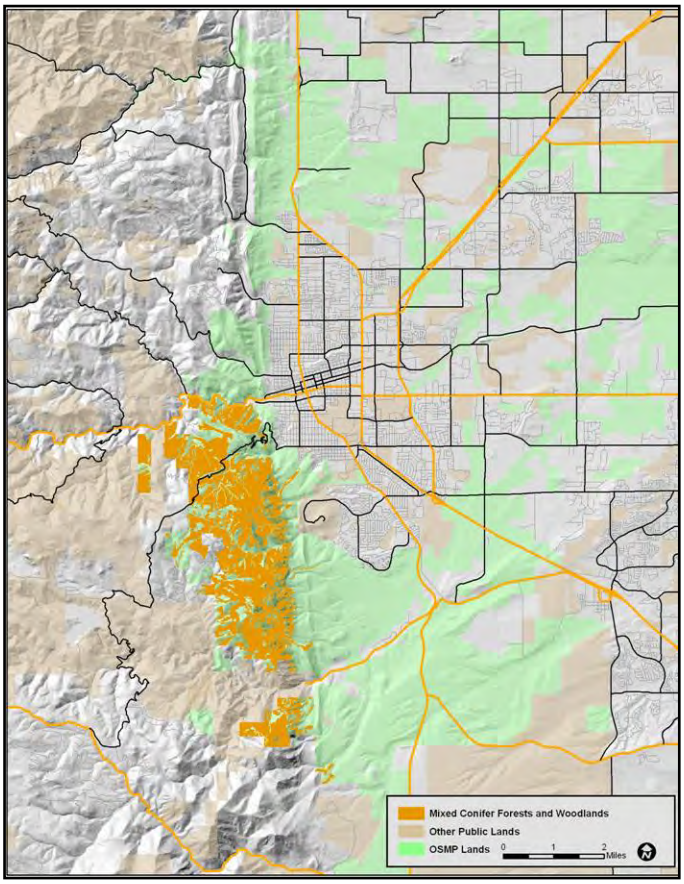
In addition to interior bird species, more generalist mammal species like mountain lions, black bears and bobcats use the mixed conifer forests. The dense canopy and rocky conditions provide areas for dens and day-bedding. The small patches of aspen that intermix with mixed conifer stands also provide forage for ungulates and ideal snags for cavity nesting birds and bats.

Indicator: Percent of West TSA with highly suitable Northern Goshawk habitat- *Northern Goshawk habitat was selected as an indicator for mixed conifer forests because it represents forest conditions that are ideal for a wide range of interior forest species and Northern Goshawks can be sensitive to human disturbance (ERO 2008). Northern Goshawk occurrences in the West TSA are uncommon and infrequent but more common species like Cooper's hawks are often found in very similar habitats. There is a wide range of research on Goshawk habitat needs which allowed OSMP staff to create a strong habitat model for this species. Highly suitable Northern Goshawk habitat represents areas in the TSA that have large, mature trees, high snag densities, and a dense forest structure usually dominated by Douglas-fir. The specifics of the Goshawk habitat model can be found in Appendix A.*

The habitat analysis in the West TSA was done in two steps. The first simply identified all potential suitable habitat based on the environmental variables in the model. All the data that was greater than one standard deviation above the mean was categorized as "highly" suitable. A minimum patch size of 10 ha (25 acres) was applied and patches smaller than this were removed from the highly suitable habitat. ***Five percent (5%) of the entire WTSA was categorized as potential highly suitable Northern Goshawk habitat*** *(Map 4). The second step was to incorporate existing trail and road influence into the model to map the current habitat conditions. A 6 meter (20 foot) buffer was put on voice and sight designated trails to account for people and dogs leaving the trail corridor and a 50 meter buffer was put on roads to account for road disturbance. All designated and undesignated trails were used to split potential habitat blocks. Patches of potentially highly suitable habitat smaller than 10 hectares (25 acres) were removed from consideration; patches greater than 10 hectares were considered to be highly suitable. The effect of trails and roads on the model was to reduce the amount of highly suitable goshawk habitat from five percent (5%) of the target to* ***three percent (3%) of the WTSA is currently highly suitable Northern Goshawk habitat*** *(Map 5).*

Ecological Processes

The high tree densities that are well-suited for interior wildlife species are a function of both the levels of moisture and soil conditions on the slopes the forests inhabit as well as a historic fire regime that was more intense and sporadic. Unlike the nearby ecotonal ponderosa stands, mixed conifer stands did not historically support high frequency-low intensity burns (Sherriff and Veblen 2004, Kaufmann et al 2007, Sherriff and Veblen 2007). Ecotonal ponderosa stands have heavy grass understorys and adjacent grasslands that are much more prone to ignition. In the mixed conifer forests moist conditions probably prevented widespread fires except under drought conditions. Heavy fuel loads accumulating during the longer period between fires in these areas also added to the fire severity when an ignition occurred (Kaufmann et al. 2006).



Fire scar evidence collected in Boulder County including samples from OSMP lands show that above about 6,900 feet most of the forested areas experienced less frequent fires of mixed or high severity (Sherriff and Veblen 2007). There is no evidence that frequent surface fires played a role in the fire history of these areas. Fire intervals in this target fall within the 30 to 100 year range.

Less frequent, more intense fires lead to more dense forest conditions and areas of even-aged cohorts in this target. While the higher elevation stands of the mixed conifer target have experienced the same levels of fire suppression over the past 100+ years as low elevation areas, the impact on the forest structure and function has been less striking compared to low elevations ponderosa forests. Historically, mixed conifer stands in the WTSA were denser and less diverse structurally. The time since fire suppression began is similar to the upper end of the natural interval between fire events.

Current high tree densities at higher elevations are probably a legacy of historic fire events and less a consequence of fire suppression of low severity fires. There is evidence to show that tree establishment has substantially increased, especially for Douglas-fir, in the last 30 years (Sherriff and Veblen 2004). This heavy overstory layer of trees can impact understory vegetation growth, aspen establishment, and decrease overall biodiversity. These forests also have higher fuel loads-a management

consideration as homes and people have encroached far into the wildland/urban interface.

Conservation Target: Ponderosa Pine Woodlands and Savannahs

Summary Statistics:

Total acres of the target in the entire OSMP system (fee properties): **3,461 acres**
Percentage of all OSMP vegetation in the target: **9.9%**
Total acres of the target in the West TSA: **2,964 acres**
Percentage of the target in the West TSA: **85.6%**

Miles of OSMP designated trails in the target: **22.8 miles**
Miles of undesignated trails in the target: **18.8 miles**

Background

Ponderosa pine woodlands and savannahs make-up the second largest conservation target in the West TSA and cover roughly 25% of the total TSA area. Ponderosa forms a common vegetation type across the eastern Front Range but OSMP's topography and its location at the very edge of the Great Plains and Rocky Mountains create a diversity of flora and fauna in this system not common elsewhere. This is also a vegetation type that has seen many changes over the last 150 to 200 years and is different now both structurally and functionally than it was in the past.

The soils and climate found along the foothills of OSMP contribute to perfect habitat for open ponderosa stands with a diverse understory. Deep, well-drained soils dominate the mesas where many of the ponderosa dominated stands are found on OSMP. The Goldvale rock outcrop complex (or stony coarse sandy loam) and Nederland series (very cobbly sandy loam) are the two soil series in the area and are defined by very coarse soils (Moreland and Moreland 1975). The coarse soils allow for the deep root penetration of ponderosa pine and allow for moderate to high water permeability.

Vegetation Composition (Attribute)

The majority of this target falls within the lower montane or transitional life zone on OSMP at or below 7,000 feet. This target is generally recognized by the low density of tree cover with canopy cover less than

25% for savannahs and between 25% and 60% for woodlands. The overstory of these stands is dominated by ponderosa pine (*Pinus ponderosa subsp. scopulorum*). Some areas of the system have relatively small components of Rocky Mountain juniper (*Sabina scopulorum*) on xeric sites and Douglas-fir (*Pseudotsuga menziesii*) on more mesic sites and in ravines. The open tree canopy often results in a diverse understory dominated by grasses, forbs and shrubs.

At the grassland/forest ecotone where ponderosa savannahs and woodlands dominate, the intermix of prairie grasslands and more montane forest types lead to a diverse and localized set of plant alliances and species. Xeric tallgrass plant communities dominated by big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), and prairie dropseed

(*Sporobolus heterolepis*) intergrade with higher elevation species like mountain muhly (*Mulenbergia montana*) and sun sedge (*Carex pensylvanica*). This unique intersection of ecosystems and the open tree canopy leads to an exceptionally diverse forest understory. Nested target plant species found in this target and in adjacent grasslands include CNHP ranked dwarf leadplant (*Amorpha nana*), Rocky Mountain sedge (*Carex saximontana*), and birds-foot violet (*Viola pedatifida*). During inventories primarily done in low elevation ponderosa stands for the development of the Forest Ecosystem Management Plan, a total of 330 plant species in 232 genera were inventoried with an average richness of 48 species per 400 m^2 plot (City of Boulder 1999).

Current Indicator Conditions:

- 64% of this target has been mapped for weeds showing 6.2% of the target has a weed canopy cover greater than 6%
- There are currently 12 known populations of rare plant species with a total of 41 subpopulations
- Potential high suitability Abert's squirrel habitat covers 9% of the West TSA. When trail effects are considered- highly suitable habitat is reduced to 5% of the WTSA.

Indicator: Percentage of target with a prevalence of management priority weed species- *A list of the management priority weed species can be found in Appendix C. Approximately 64% of the ponderosa pine target in the West TSA has been mapped for priority weed species. Within the TSA,* ***6.2% of the target area has a weed cover greater than 6%****. Many of the highest density weed patches are found in areas of historic disturbance (grazing, roads, etc) and areas with low tree canopy cover. Map 2 shows weed densities across the West TSA and areas of greater weed concentrations based on patch size, density and the proximity of other weed patches.*

Indicator: Number of populations and subpopulations of local suite of rare species and communities-
Within the ponderosa pine target area three species were used to evaluate the rare plant indicator. Rocky Mountain sedge (Carex saximontana), narrow-leaved milkweed (Asclepias stenophylla), and wavy-leaf stickleaf (Nuttallia sinuata) are all commonly found in the low elevation foothills and in open ponderosa pine stands and are all ranked as imperiled or critically imperiled in Colorado (CNHP 2009). Within the TSA ***there are currently 12 known populations of rare plants with a total of 41 subpopulations and 2.1 acres of rare plant communities*** *within the ponderosa pine woodlands and savannah target of the West TSA. The known occurrences of rare plants and communities have been generalized on Map 3.*

Wildlife and Habitat Effectiveness (Attribute)

The habitat and forest structure of OSMP's low elevation ponderosa stands result in a diverse mix of wildlife species. Ungulates such as mule deer and elk use the open savannah areas for forage and retreat to the more shaded woodlands for day-bedding and protection from predators. Large, dead ponderosas create ideal habitat for a suite of cavity nesting birds and bats as well as feeding areas for woodpeckers. Large, old trees create perch sites for forest raptors and turkeys. Denser stands are ideal habitat for Abert's squirrels and raptors such as Sharp-shinned Hawks.

There is potential for 38 different mammal species to occur in OSMP ponderosa woodlands (Jones 1990) and 1998 OSMP inventories recorded 61 different bird species in OSMP low-elevation forest stands (City of Boulder 1999).

Indicator: Percentage of West TSA with highly suitable Abert's squirrel habitat- *Abert's squirrels are the indicator species selected for the ponderosa pine target because they require patches of mature ponderosa pine in a mosaic of uneven-aged stands. This type of woodland has an overstory that provides habitat for many wildlife species, both common and rare. Highly suitable Abert's squirrel habitat is characterized by ponderosa pine with moderate tree densities and many large, mature trees. Many areas identified by the model have characteristics of mature forest stands with trees approaching old-growth. Specific variables used in the development of the Abert's habitat suitability model can be found in Appendix A.*

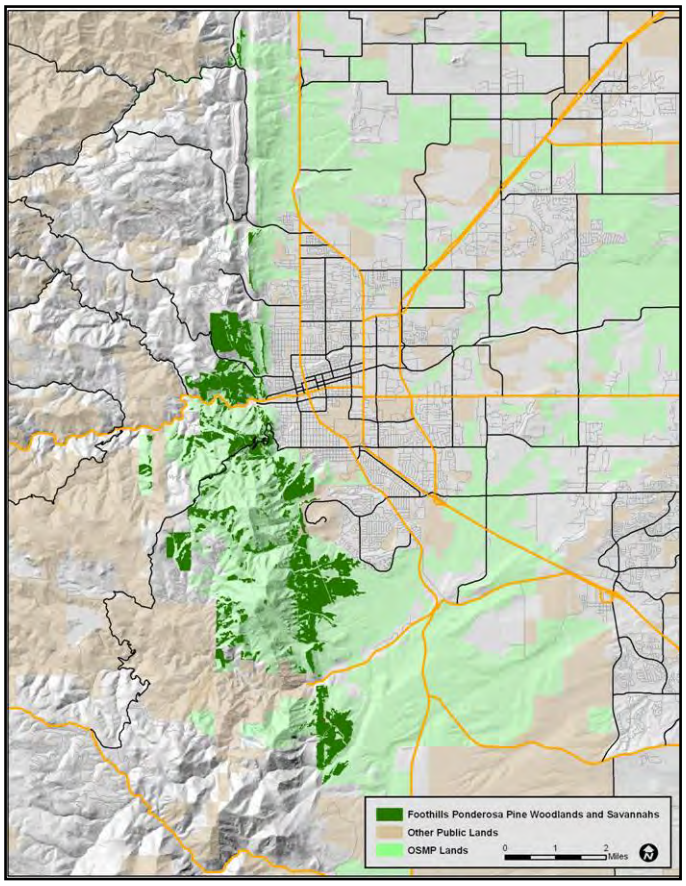
The habitat analysis in the West TSA was done in two steps. The first simply identified all potential suitable habitat based on the environmental variables in the model (all the model inputs and variables are described in Appendix A). A minimum patch size of 10 ha (25 acres) was applied to the model and areas smaller than this were removed from highly suitable habitat. ***Nine percent (9%) of the entire WTSA is potential highly suitable Abert's habitat*** *(Map 6). The second step was to incorporate existing trail and road influence into the model to map the current habitat conditions. A 6 meter (20 ft) buffer was put on voice and sight designated trails to account for people and dogs leaving the trail corridor and a 50 m (164 ft) buffer was put on roads to account for road disturbance. All designated and undesignated trails were used to split potential habitat blocks. Patches of potentially highly suitable habitat smaller than 10 hectares (25 acres) were removed from consideration; patches greater than 10 hectares remained highly suitable. The effect of trails on the model was to reduce the amount of highly suitable Abert's habitat from nine percent of the WTSA to* ***five percent (5%) of the West TSA is currently highly suitable Abert's habitat*** *(Map 7).*

Ecological Processes

Throughout their range, ponderosa pine forests are maintained and shaped by fire. Fire regimes in ponderosa forests tend to vary based on elevation and can range from very frequent fires of low severity at lower elevations to more mixed severity or even stand replacing fires at higher elevations (Kaufmann et al. 2006, Veblen 2004). In the lower elevations of the OSMP ponderosa target, analysis of fire scars has shown this area historically experienced high frequency, low intensity fires that

maintained open forest conditions (Veblen 1996, Sherriff and Veblen 2007). Below about 6,800 ft., ponderosa stands during and prior to the 19th century experienced mean fire return intervals of about 10 to 30 years (Kaufmann et al. 2006). These frequent fires killed a majority of the ponderosa regeneration and favored older, more fire resistant trees. The result was open stands of large trees and an understory dominated by grasses, shrubs and forbs. Frequent fires also resulted in transient canopy openings and perpetual low fuel loads reinforcing the pattern of low intensity fires.

Beginning in the late 19th and early 20th century fire went from being a frequent and regular occurrence to being almost completely excluded from the ponderosa pine system. More than 100 years of fire suppression has led to a dramatic shift in forest structure, especially in the low elevation ponderosa stands that make up the foothills ponderosa target. Fire suppression as well as the ground disturbance associated with historic grazing, mining, and logging has led to many years of favorable conditions for ponderosa establishment. The ease of access to low elevation stands also allowed for historic logging and the removal of larger and older trees which has resulted in less structural diversity. In comparison to historic conditions, ponderosa pine stands across the Front Range are denser, have fewer large trees and snags, and are more homogenous in tree age and size (Veblen and Donnegan 2005).



Like fire, another regular disturbance factor in the ponderosa target is insects and disease. Many of these biotic factors in ponderosa forests are native and cause limited mortality across the landscape in endemic levels. However, variables like drought or forest density can lead to larger epidemic outbreaks that can kill large portions of forest and change forest structures dramatically. Currently, the ponderosa target is facing fire suppressed, overly dense conditions that could lead to large bark beetle outbreaks in the near future. While a widespread outbreak of something like mountain pine beetles would cause a large amount of mortality in ponderosa forests it would also have ecological benefits. Beetles or other insects or pathogens can create diversity in tree ages and spacing, create snags and down trees that are important wildlife habitat, and open the canopy which can create a more diverse understory.

Conservation Target: Cliffs and Talus

Summary Statistics:

Total acres of the target in the entire OSMP system (fee properties): **660 acres**
Percentage of all OSMP vegetation in the target: **1.9%**
Total acres of the target in the West TSA: **544 acres**
Percentage of the target in the West TSA: **82.4%**

Miles of OSMP designated trails in the target: **1.7 miles**
Miles of undesignated trails in the target: **1.8 miles**
Number of mapped climbing formations in the target: **132**

Background

Cliffs and talus are one of the smallest conservation targets in the TSA but they provide a habitat not found elsewhere. Despite the relatively small area of cliffs and talus this target consists of some of the most recognizable features in the mountain backdrop and have an ecological importance far greater than their extent would suggest. The Flatirons and the surrounding rock faces are *the* features that identify Boulder's natural setting.

The majority of this target occurs at higher elevations on the system west of the Mesa Trail and the Dakota Hogback. The most recognizable and obvious cliff features, including the Flatirons, are sedimentary sandstone rock from the Triassic, Permian, and Pennsylvanian periods (325 to 190 m. y. old) and include Lykins, Lyons, and Fountain formations. Smaller rocky cliffs and ledges can be found to the east of the Flatirons along the Dakota Ridge Hogback. This younger sedimentary rock dates to the Jurrassic and Cretaceous periods (190 to 65 m. y. old). Some of the oldest rock in the target area makes up the high peak tops and large talus fields. These areas are composed of igneous rocks of the Precambrian period (1,700 m. y. old) (Bilodeau et al. 1987).

Vegetation Composition (Attribute)

In the cliff and talus target the predominant cover is rock with a very small percentage, usually less than 20%, vegetation. Open cliff faces and large rocks tend to be excessively drained and vegetation favors relatively moist crevices and shelves in the rock (Bunin 1985). The sparse vegetation on the rocky substrate of this target is typically composed of shrubs such as wax currant (*Ribes cereum*), Rocky Mountain maple and waxflower. Tree cover is often sparse but Douglas fir, ponderosa pine and Rocky Mountain juniper can get established in cracks and crevices. In addition to common species, cliffs and talus can also support a suite of rare and sensitive species. Ferns and fern allies such as grassfern (*Asplenium septentrionale*), Wright's cliff brake (*Pellaea wrightiana*), and western polypody (Polypodium saximontanum) are only found on OSMP in the small crevices in rocks and cliffs. Weatherby's spikemoss (*Selaginella weatherbiana*) is a member of the club-moss family that is relatively common on rocky faces on OSMP but is ranked as vulnerable to extirpation or extinction both at the state level and globally.

Current Conditions:

- There are currently 5 known populations of rare plant species with a total of 7 subpopulations
- 44% of highly suitable potential falcon nest sites in the TSA are within an existing seasonal protection area

Indicator: Number of populations and subpopulations of local suite of rare species and communities -

Within the cliffs and talus target area four species were used to evaluate the rare plant indicator. Wright's cliffbrake (Pellaea wrightiana), grassfern (Asplenium septentrionale), Weatherby's spikemoss (Selaginella weatherbiana), and Western polypody (Polypodium saximontanum) are all commonly found in rock crevices and are all ranked as imperiled or vulnerable to extirpation across the state by CNHP. Across the TSA ***there are currently five known populations of rare plants with a total of seven subpopulations and no known occurrences of rare plant communities*** *within the cliffs and talus target. The known occurrences of rare plant subpopulations and communities have been generalized on Map 3.*

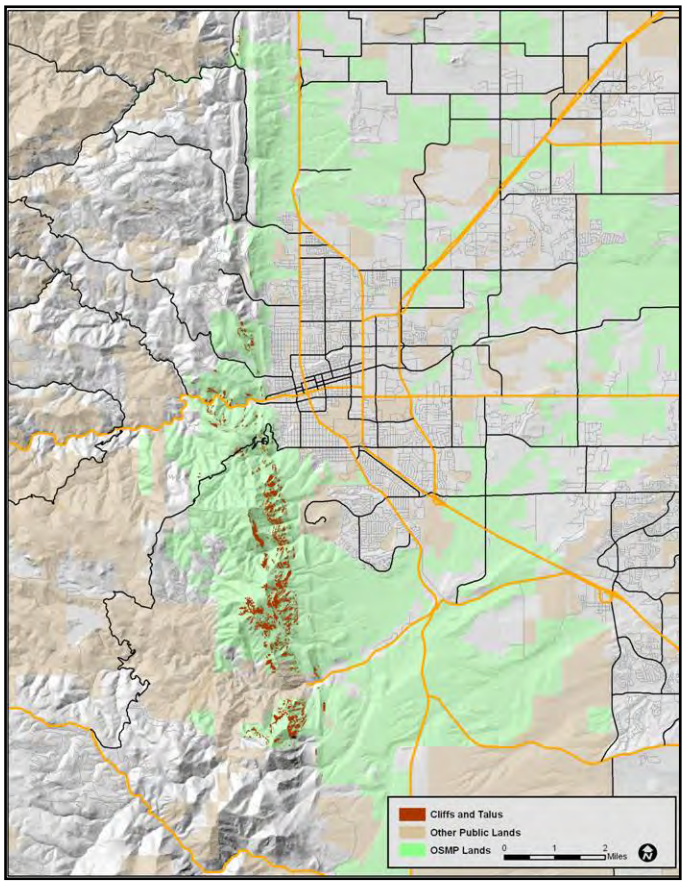
Wildlife and Habitat Effectiveness (Attribute)

The rock formations of the cliff and talus target provide some of the best habitat in the state for cliff-dependent wildlife species. Cliff nesting raptors like the Peregrine Falcon, Prairie Falcon, and Golden Eagle take advantage of the diverse cliff faces and nearby open spaces for nesting and hunting. OSMP cliffs support some of the highest densities of raptor nests in the state and consistently fledge young. The combination of large, tall cliffs, the proximity to open grasslands for hunting, and the annual disturbance protection measures established by OSMP create ideal conditions for cliff nesting raptors' success.

In addition to raptors, mammals of varying sizes use the cliff and talus target area across the OSMP system. Small caves and rock crevices provide ideal habitat and cool, protected areas for bat maternity and

bachelor roosts and hibernation sites. Townsend's big-eared bats (*Corynorhinus townsedii*) and fringed myotis (*Myotis thysonodes*) are two bat species that roost and hibernate in OSMP cliffs and rock faces. Both species are identified as species of conservation concern by CNHP. Larger mammals, such as bears and mountain lions, may also den or hibernate in caves or rocky outcrops in the cliff and talus target.

Indicator: <u>Percent of highly suitable falcon nest sites protected</u>-
The cliff and talus target in the West TSA provides some of the best nesting habitat along the Front Range for both Prairie and Peregrine Falcons. Known falcon nest sites are protected seasonally by restricting seasonal access to decrease pressure on these species during key breeding and nesting periods. Suitable nest sites are cliffs with the steepest slopes and most southerly aspect. While falcons were chosen as the taxa of focus, Golden Eagles will sometimes choose nest sites with similar landscape characteristics (i.e., aspect, slope, etc.). All the data that was greater than one standard deviation above the mean was categorized as "highly" suitable. Specific variables used in the development of the habitat suitability model can be found in Appendix A.. Currently, ***44% of highly suitable potential falcon nest sites in the TSA are within an existing seasonal protection area*** *(Map 8).*



The dramatic rock formations of OSMP provide habitat for a wide variety of plants and animals as well as a unique recreational experience for climbers. With over 450 climbing formations and boulders in the WTSA, OSMP's cliffs have become a destination for climbers world-wide. In order to conserve critical raptor habitat, portions of the cliff and talus target are seasonally closed to protect nesting raptors and colonies of bats. There are a total of 14 protection areas in the mountain backdrop areas of OSMP and closures are in effect from February through July for raptors and April through October for bats.

Conservation Target: Foothills and Montane Riparian

Summary Statistics:

Total acres of the target in the entire OSMP system (fee properties): **269 acres**
Percentage of all OSMP vegetation in the target: **0.8%**
Total acres of the target in the West TSA: **241 acres**
Percentage of the target in the West TSA: **89.6%**

Miles of OSMP designated trails in the target: **4.1 miles**
Miles of undesignated trails in the target: **2.1 miles**

Background

Riparian woodlands and shrublands are known hotspots of biodiversity and support a disproportionate number of vertebrate species (Knopf 1985, Ohmart and Anderson 1982, Stromberg 1993). Riparian areas in the West TSA are particularly rich (Jones 1990) with a diverse flora and fauna, including many rare species. The Foothills and Montane Riparian Conservation Target is one of the smaller targets in the TSA, making up less than three percent of the land area. System-wide, 89% of this target falls within the West TSA.

Numerous streams and drainages cross the study area including Boulder Creek, South Boulder Creek, Bear Canyon Creek, Panther Canyon, Lost Gulch, Fern Canyon, Shadow Canyon, Long Canyon, Gregory Canyon, Greenman Canyon and Bluebell Canyon. These streams are joined by many smaller un-named tributaries with intermittent and ephemeral flow creating a complex network of riparian areas throughout the TSA.

Vegetation Composition (Attribute)

The diverse physiography in the West TSA supports diverse riparian vegetation. Stands of river birch (*Betula occidentalis*) occur at high elevations in a number of drainages including Bear, Long and Panther Canyons. In the sheltered channel bottoms hazelnut (*Corylus cornuta*) and alder (*Alnus incana*) frequently form a closed—almost impenetrable canopy.

In drainages with relatively cool, north facing exposures at low elevation, dense thickets of chokecherry (*Prunus virginiana*) are found. In these channel bottoms narrowleaf cottonwoods (*Populus angustifolia*) form an open canopy with blue-stem willow (*Salix irrorata*) overstory and graminoids populating the understory. South facing slopes in these

drainages are dominated by small trees and shrubs such as wax flower, chokecherry and hawthorn (*Crataegus macracantha*).

A number of plant species of special concern are found in riparian areas in the TSA. Several of these species are eastern North American disjuncts and/or relictual species that may have persisted in the cool, moist mountain refugia of the TSA following post-Pleistocene warming (Weber 1965, Hogan 1993). Broad-lipped twayblade (*Listera convallaroides*) white adder's mouth orchid (*Malaxis monophyllos*), rattlesnake fern (*Botrypus virginianus*) and carrion flower (*Smilax lasioneuron*) are typically found at high elevations in cool, north facing drainages. Two relatively rare sedges, *Carex sprengelii* and *Carex torreyi* have been documented in unnamed drainages in Bear Canyon.

The most southerly stand of paper birch (*Betula papyrifera*) in the western U.S. and the only known stand south of the Black Hills of South Dakota is found in upper Long Canyon. This occurrence likely reflects the southern extension of boreal vegetation into this region during the Pleistocene.

Current Conditions:

- 63% of this target has been mapped for weeds, of this 10.9% of the target area has a weed canopy cover greater than 6%
- There are currently 20 known populations of rare plant species with a total of 45 subpopulations
- 1% of the West TSA is potential highly suitable shrub-nesting bird habitat. When trail effects are considered- highly suitable habitat is reduced to 0.2% of the WTSA.
- Currently there are 61 feet/acre of designated trails and 30 feet/acre of undesignated trails in seasonally critical bear foraging habitat

Indicator: Percentage of target with a prevalence of management priority weed species- *A list of the management priority weed species can be found in Appendix C. Approximately 63% of the foothills and montane riparian target in the West TSA has been mapped for priority weed species. Within the mapped area,* ***10.9% of the total target area has a weed cover greater than 6%****. Flowing water in riparian areas can serve as a vector for weed seed movement across the landscape and the high moisture levels and nutrient content in the soils make it ideal habitat for a wider range of species, both native and non-native. Map 2 shows weed densities across the West TSA and areas of greater weed concentrations based on patch size, density and the proximity of other weed patches.*

Indicator: Number of populations and subpopulations of local suite of rare species and communities -
Riparian areas in the West TSA support a diverse suite of rare plants and vegetation communities. Many of these species are ranked as critically imperiled by CNHP and some represent the only occurrences in the entire state. A list of the species used to evaluate this indicator can be found in Appendix B. Across the TSA ***there are currently 20 known populations of rare plants with a total of 45 subpopulations and 116.5 acres of rare plant communities*** *within the foothills and montane riparian target. The known occurrences of rare plants and communities have been generalized on Map 3.*

Wildlife and Habitat Effectiveness (Attribute)

Although riparian areas comprise less than two percent of the land cover in Colorado, they provide habitat for approximately 80 percent of birds, mammals, herptiles and fish (Knopf 1985). Many are species that depend almost entirely on these streamside and aquatic habitats for their survival. Wetlands in the TSA provide habitat for many animals including bears, mountain lions, songbirds, raptors, mule deer, elk, small mammals and herptiles.

The Preble's meadow jumping mouse is found in a number of drainages in the West TSA including Boulder Creek, South Boulder Creek, Bear Creek Canyon, Long Canyon and Gregory Canyon. As the Colorado Front Range has undergone rapid human development, Preble's habitat has been greatly impacted. This habitat loss and fragmentation led to the Federal listing of the mouse as threatened under the Endangered Species Act in 1998.

Northern leopard frogs occupy a variety of wetland and riparian types throughout Colorado. In the West TSA, potential habitat for the northern leopard frog includes South Boulder Creek and a few historic stock ponds. Populations of northern leopard frogs are declining throughout their western ranges. While population declines are not well understood, several factors have likely contributed including habitat loss and fragmentation, disease, pesticide use, and predation and competition by non-native fish and frogs. They are classified as a Sensitive Species by the U.S. Forest Service and Bureau of Land Management and a Species of Special Concern by the Colorado Division of Wildlife.

Riparian areas in the West TSA provide important breeding, nesting and foraging habitat for a variety of neo-tropical migratory songbirds. Yellow-breasted Chats (*Icteria virens*), Lazuli Buntings (*Passerina amoena*) and Gray Catbirds (*Dumetella carolinensis*) are just a few of the species that require healthy riparian areas for their habitat needs.

Indicator: Percentage of West TSA with highly suitable shrub-nesting bird habitat- *Shrub-nesting birds use areas of dense vegetation and shrub cover found along riparian areas during the breeding season. Riparian vegetation provides essential habitat for this suite of bird species and human disturbance can cause flushing, nest failure, or lower nest densities for shrub-nesting birds (Miller et. al., 2003). Suitable habitat for shrub-nesting birds consists of areas on the system with large blocks of riparian vegetation within close proximity of drainages and other continuous habitat blocks. Specific variables used in the development of the habitat suitability model can be found in Appendix A.*

The habitat analysis in the West TSA was done in two steps. The first simply identified all potential suitable habitat based on the environmental variables in the model. Analysis showed that ***one percent (1%) of the entire West TSA is potential highly suitable shrub-nesting bird habitat*** *(Map 9). The second step was to incorporate existing trail and road influence into the model to map the current habitat conditions. A 50 meter buffer was removed from each side of trails and roads to account for flushing distances associated with trail use (Miller et. al. 1998). An additional 6 meter (20 foot) buffer was added to voice and sight trails to account for people and dogs leaving the trail tread. The effect of trails on the model was to reduce the amount of highly suitable shrub-nesting bird habitat from 1% of the WTSA to* ***0.2% of the WTSA is currently highly suitable shrub-nesting bird habitat*** *(Map 10).*

Indicator: Trail density in critical bear foraging habitat-
Riparian areas in the West TSA provide essential habitat for black bears. In the fall, berry producing shrublands provide critical feeding areas allowing black bears to put on sufficient weight to bear young. The dense vegetation in riparian areas also provides cover for concealment, escape, and travel across the landscape. Areas of high human use may alter bear behavior shifting bear use from largely diurnal to nocturnal and may reduce bear use in areas with limited cover (Berry 1996; Beecham and Rohlman 1994). Human related impacts could decrease the effectiveness of riparian areas for essential bear fall feeding.

Critical bear foraging habitat consists of areas on the system dominated by berry producing shrubs, areas with dense shrub cover, and a close proximity to stream corridors for movement. Specific variables used in the development of the habitat suitability model can be found in Appendix A. Trail densities were calculated based on trail regulations in the fall to account for seasonal restrictions (many of these seasonal restrictions are in place in areas where bears feed every season). ***Currently there are 61 feet/acre of designated trails and 30 feet/acre of undesignated trails in seasonally critical bear foraging habitat****. A further breakdown of trail densities is available on Map 11.*

Ecological Processes

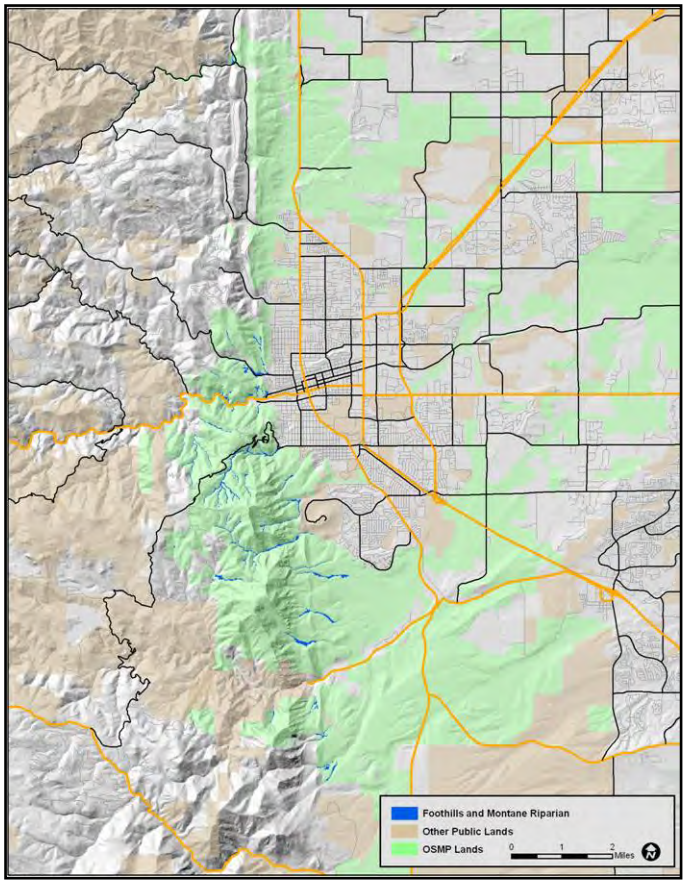
Like many snowmelt dominated systems in the west, peak stream discharges on Boulder Creek and South Boulder Creek occur in late May or June (Scott et al. 1993). Peak discharges and flooding can also occur as a result of intense localized summer thunderstorms. The natural hydrologic regime of these streams has been altered by numerous diversions and storage facilities that exist along much of their lengths including Gross Reservoir and Barker Reservoir, mainstem impoundments on South Boulder Creek and Boulder Creek, respectively.

The hydrology of the smaller riparian drainages in the TSA is complicated and difficult to characterize due to a lack of long-term hydrologic data. However, several generalizations can be made based on studies by D'Amico (1998) and Gerhardt and Johnson (1999).

Hydrology in most of the smaller drainages is largely driven by precipitation. Channels often remain dry for much of the summer, only flowing for brief periods after rain storms. This produces erratic flows with sudden sharp peaks and long periods when surface flow is absent and subsurface flow predominates.

Groundwater recharge and discharge rates are highly variable along stream reaches probably due to heterogeneity and fractures in the underlying bedrock. Streams can typically be seen flowing at one location, dry a short distance downstream and flowing again further downstream. Groundwater recharge is also rapid after storm events. Course soils and shallow bedrock allow for high infiltration rates.

Many streams in the West TSA do not exhibit typical riverine flow characteristics. Based on observations by Gerhardt and Johnson (1999), they do not "gain" or "lose" flow in a predictable pattern along their lengths. For example, in Bear Canyon, stream flow either decreased or remained constant along a study reach even though lateral input from adjacent springs and tributaries was prevalent.



Riparian areas in the TSA are influenced by a variety of other physical factors including soil type, elevation, exposure, slope and bedrock. Hydrology is influenced by or influences many of these factors and has been shown to be an important determinant of wetland and riparian structure and function.

A number of human activities have occurred in the TSA including livestock grazing and timber harvesting. While these anthropogenic disturbances no longer occur, their influence on the structure and function of the target likely still exists. In addition, fire suppression in the past century has increased tree density, interception and transpiration, resulting in decreased streamflow and overall size of riparian drainages along the Colorado Front Range (M. Kaufman, pers. comm.). Current forest management activities aimed at returning tree densities to historic ranges of variability may increase streamflow to historic levels where water diversion or impoundment has not significantly altered flows.

Sand and gravel from winter sanding operations on Flagstaff Road has affected several riparian drainages in the TSA, filling sections of Long Canyon and upper Gregory Canyon with sediment. Sedimentation of streams has been shown to affect channel dynamics (Malanson 1987), plant species regeneration (Cavalcanti and Lockaby 2006), and aquatic macroinvertebrate habitat and diversity (Wood and Armitage 1997, Wood et al. 2005).

All major drainages in the TSA have trails immediately adjacent to or directly within the riparian vegetation for much of their lengths. This pattern has implications for a number of ecosystem functions including wildlife habitat, sedimentation, soil compaction and erosion, and water quality. Trails planning in riparian areas must account for regulatory requirements in place to protect these systems. New trail construction

including reroutes or maintenance on existing trails in riparian areas may require additional clearances or permits. Map 12 displays areas on the system that are potential regulatory wetlands according to the City or Preble's Jumping Mouse occupied range according to the Colorado Division of Wildlife.

Conservation Target: Foothills and Montane Forest Openings

Summary Statistics:

Total acres of the target in the entire OSMP system (fee properties): **1,146 acres**
Percentage of all OSMP vegetation in the target: **3.3%**
Total acres of the target in the West TSA: **960 acres**
Percentage of the target in the West TSA: **85.6%**

Miles of OSMP designated trails in the target: **8.7 miles**
Miles of undesignated trails in the target: **6.7 miles**

Background

Forest openings on the OSMP system are a diverse mix of patch sizes and vegetation composition. They range from the larger ecotonal meadows at the grassland/forest edge to small open patches surrounded by trees in the forest interior. The grasslands and upland shrublands of this target provide habitat for a wide range of distinctive wildlife and plants.

This target spans the range of elevations in the forested part of OSMP. Forest openings are found from the Shanahan and Chautauqua areas at 5,700 feet to the west-side of the peaks at about 8,000 feet. Forest openings occur on a variety of soil types but tend to favor more gravelly or loamy sands on slopes of 5 to 20 percent. The most common soil types for this target are the Peyton and Juget soils series. Both of these soil types are gravelly and well drained and tend to have low to moderate water availability. The coarse texture allows for good root penetration and vegetation is often necessary to prevent erosion (Moreland and Moreland 1975).

Vegetation Composition (Attribute)

The forest openings target is made up of a diversity of vegetation types. This target includes upland shrublands, grasslands and areas of mixed

grasses, shrubs and trees. In general, these areas have a tree cover of less than 12%. Areas defined as shrublands have a cover of shrubs greater than 25%. The most common vegetation types in this target are big bluestem grasslands, and chokecherry, smooth sumac (*Rhus glabra*), buckbrush (*Ceanothus fendleri*) and Oregon-grape (*Mahonia repens*) shrublands. In addition to some of the more common vegetation types this target contains plant associations that are rare at both the state and global level. Vegetation types like the big bluestem communities tend to be locally abundant because of conservation efforts and locally favorable environmental factors but are globally imperiled due to human development and habitat conversion. Plant associations that include Parry's oatgrass (*Danthonia parryi*), mountain muhly/ needle and thread (*Muhlenbergia montana/ Hesperostipa comata*), and snowberry (*Symphoricarpos occidentalis*) shrublands are also considered by Colorado Natural Heritage Program as imperiled or vulnerable at the state and global scale.

A portion of the forest openings target in the TSA consists of ecotonal openings along the forest/grassland edge. These areas tend to be a mix of open ponderosa pine savannahs and large, open xeric tallgrass meadows. Many of these openings support a mix of both higher elevation species and Great Plains species. Most of the rare plants found within this target are species commonly associated with the Great Plains. Birds-foot violet (*Viola pedatifida*), dwarf leadplant (*Amorpha nana*), and frostweed (*Crocanthemum bicknellii*) are most commonly found in plains ecosystems and, in the TSA, most often occur along the very edge of grasslands and forests.

Current Conditions:

- There are currently 5 known populations of rare plant species with a total of 45 subpopulations
- 60% of this target is mapped for weeds, of this 12.6% of the target area has a weed canopy cover greater than 6%
- Potential high suitability wild turkey habitat covers 4% of the West TSA. When trail effects are considered- highly suitable habitat is reduced to 1% of the WTSA.

Indicator: Percentage of target with a prevalence of management priority weed species- *A list of the management priority weed species can be found in Appendix C. Approximately 60% of the foothills and montane forest opening target in the West TSA has been mapped for priority weed species. Within the TSA,* ***12.6% of this mapped area has a weed cover greater than 6%****. The relatively large area of the target with a prevalence of weeds can probably be attributed to the open growing conditions and historic disturbance. Many of the forest openings, especially at low elevations, were historically grazed and in some cases seeding with non-native grasses occurred for restoration. Map 2 shows weed densities across the West TSA and areas of greater weed concentrations based on patch size, density and the proximity of other weed patches.*

Indicator: Number of populations and subpopulations of local suite of rare species and communities -
Within the forest openings target area three species were used to evaluate the rare plant indicator. Dwarf-leadplant (Amorpha nana), birds-foot violet (Viola pedatifida), and frostweed (Crocanthemum bicknellii) are all commonly found in forest openings and are all ranked as imperiled across the state by CNHP. Across the TSA ***there are currently five known populations of rare plants with a total of 45 subpopulations and 200 acres of rare plant communities*** *within the foothills and montane forest openings target. The known occurrences of rare plants and communities have been generalized on Map 3.*

Wildlife and Habitat Effectiveness (Attribute)

A wide range of wildlife species use forest openings for all or some of their lives. Upland shrublands are especially important and extremely rich avian habitat (Jones 1990). Nesting species include Gray Catbird, Lazuli Bunting, Virginia's Warbler and many others. These shrublands also provide food for bears and deer and cover for small mammals. Grassland openings are also important forage areas for deer and Wild Turkey and the edges between forests and grassland opening are essential for deer bedding, turkey roosts, and elk cover.

Indicator: Percentage of West TSA with highly suitable brood-rearing wild turkey habitat-

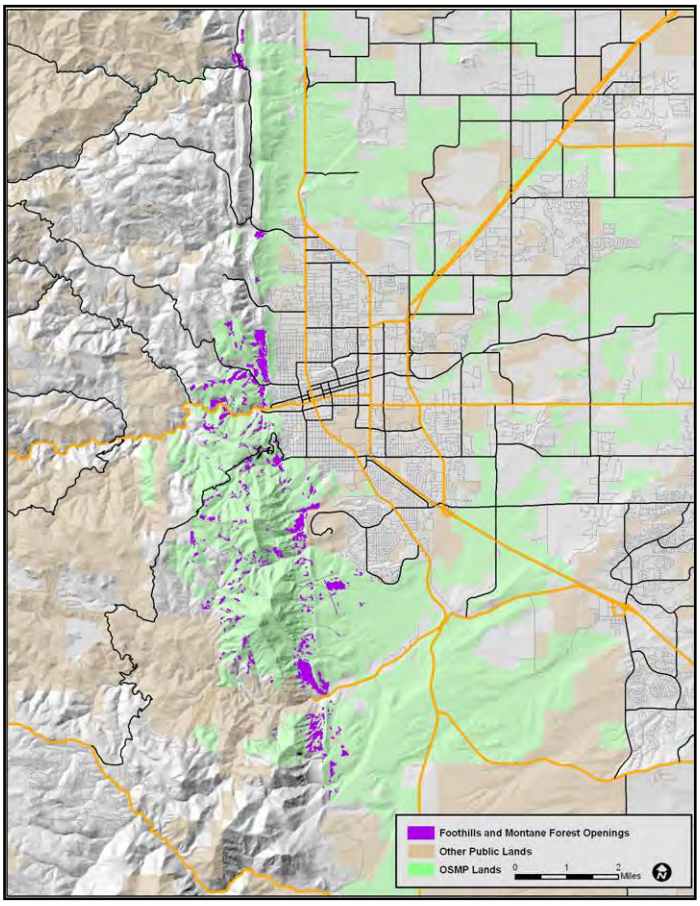
Effective habitat for Merriam's wild turkeys includes a combination of mature, open forests adjacent to forest openings. Patches of forest openings are essential to wild turkeys for foraging and successful reproduction and brood-rearing. Young turkey poults spend much of their time feeding in forest openings because they require a diet rich in insects. Wild turkeys and other galliformes can be sensitive to human use at their nesting sites (Lutz and Crawford, 1987; Rumble 1992; Thiel et al. 2007; M. Rumble pers. comm.) and to disturbance by dogs (Miller and Leopold, 1992). Highly suitable brood-rearing turkey habitat focuses on loafing and feeding habitat as well as this habitat's proximity to optimal roosting habitat which is represented by stands of large, mature ponderosa pines.

The habitat analysis in the West TSA was done in two steps. The first simply identified all potential suitable habitat based on the environmental variables in the model. All the data that was greater than one standard deviation above the mean was categorized as "highly" suitable (the variables used in the models are described in Appendix A). A minimum patch size of 7 ha (approx. 17 acres) was applied to the model and areas smaller than this were removed from the highly suitable habitat. ***Four percent (4%) of the entire WTSA is potential highly suitable brood-rearing wild turkey habitat*** *(Map 13). The second step was to incorporate existing trail and road influence into the model to map the current habitat conditions. A 31 meter buffer was added to voice and sight designated trails to account for people and dogs leaving the trail corridor(6 meters) and the flushing distance observed for similar species (25 meters according to Theil et al. 2007). A 50 meter buffer was put on roads to account for road disturbance. All designated and undesignated trails were used to split potential habitat blocks. Patches greater than 7 hectares (17 acres) (area suitable for breeding and raising young) remained highly suitable. With trail effects added to the model,* ***one percent (1%) of the WTSA is currently highly suitable wild turkey breeding habitat*** *(Map 14).*

Ecological Processes

Historically, forest openings were patches that shifted their size, shape and position in response to fire. As patches were burned, early successional grasses and shrubs moved in and as time went on they were replaced by later successional woody species (Keane et. al. 2002). In areas with frequent fire regimes these open patches were probably larger and were maintained by frequent surface fires over long periods. These shifting patches created a heterogeneous landscape and a diversity of habitats. During the late 19th century and early 20th century shifts in grazing and policies of fire exclusion led to a dramatic shift in patch dynamics.

The shift was especially dramatic in lower montane areas like the ones found on OSMP. These were areas of frequent low intensity fire that maintained open ponderosa stands and extensive grasslands and shrublands (Veblen and Donnegan 2005). In addition to low intensity burns, occasional patches of high severity fire resulted in canopy openings and dense shrub regeneration or grass growth. Without these frequent fire events tree establishment has slowly encroached into openings and replaced grasslands and shrublands with a tree overstory. Overall, on OSMP and across the Front Range there are fewer smaller forest openings today than there were when fires burned on a natural cycle.



Fire probably isn't the only disturbance that has shaped forest openings on OSMP. A history of grazing has had an impact on forest opening size and composition. Grazing may have promoted tree encroachment in lower montane grassland patches, both by reducing competition from grasses and forbs and by reducing fuels for fires. Heavy grazing can also expose bare mineral soil which is ideal for tree seedling establishment. Ranchers probably removed trees to improve grazing conditions, artificially creating patches on the landscape. Historic aerial photos show areas that may have been cleared for grazing. Some remain open today.

Based on historic aerial photos of Boulder County, forest openings are generally smaller and less common in the TSA compared to historic conditions. Fire suppression and grazing have led to a conversion to tree cover and, in many cases, the remaining forest openings now have a different composition of grasses than historically. Historic grazing and seeding related to forest or grazing operations have led to many of the current forest openings being dominated by non-native grass species like smooth brome (*Bromopsis inermis*), timothy (*Phleum pratense*) and other European pasture grasses. This composition shift makes the remaining forest openings dominated by native grasses like big bluestem, needle grasses, and mountain muhly that much rarer.

OSMP Grassland Ecosystem Conservation Targets

Summary Statistics:

Total acres of the target in the entire OSMP system (fee properties): **23,734 acres**
Percentage of all OSMP vegetation in grassland targets: **69%**
Total acres of grassland targets in the West TSA: **1,975 acres**
Percentage of the West TSA in grassland targets: **18.5%**

Miles of OSMP designated trails in West TSA grasslands: **15.0 miles**
Miles of undesignated trails in West TSA grasslands: **10.8 miles**

Approximately 17% of the West TSA falls within the scope of the OSMP Grassland Ecosystem Management Plan (Grassland Plan) (Map 1). In general, the grassland area in the WTSA (also referred to as Tallgrass West), includes representative areas of six grassland targets listed in table 1 below. In addition to having a mix of targets and vegetation types the Grassland Plan identifies a number of other key characteristics of this area. More in-depth target descriptions and viability analysis are available in the draft Grassland Plan (City of Boulder 2009) and will be used in the development of the West TSA plan.

Table 1: Grassland targets within the WTSA boundary

Grassland Target	Acres in the WTSA
Mesic Big Bluestem Prairie	**68**
Mixedgrass Prairie Mosaic	**427**
Plains/ Foothills Transitional Riparian	**212**
Wetlands	**108**
Xeric Tallgrass Prairie	**1,122**
Black-tailed Prairie Dog and Associated Species	**38**

Tallgrass West is one of the larger contiguous habitat blocks on the OSMP system. Larger habitat blocks have several advantages over smaller blocks including increased habitat diversity, greater plant and animal species richness, and a greater diversity of food plants and prey species. A habitat block is defined as contiguous habitat owned and managed by OSMP and not split by public roads.

Within the large habitat blocks in the grassland planning area, information on conservation and restoration potential was compiled to identify best opportunities for conservation on the system. Tallgrass West was identified as an area of best opportunity for conservation and restoration of the upland grassland mosaic. A portion of the West TSA grasslands along the South Boulder Creek drainage was also identified as a best opportunity for restoration of mesic bluestem prairie. As a large habitat block, Tallgrass West maintains habitat for interior grassland species such as Grasshopper Sparrows. Because of this and the diverse grassland habitat structure, this area was also identified as important bird habitat in the Grassland Plan. The Tallgrass West best opportunity areas also contain good examples of characteristic plant communities as well as the presence of rare/sensitive vegetation and a relatively low incidence of priority weeds.

In addition to the indicators outlined in this report, OSMP has developed a list of indicators for the grassland portions of the system that are outlined in the OSMP Grassland Ecosystem Management Plan. While not a system-wide indicator, OSMP has also developed a habitat suitability model for Grasshopper Sparrows in the grassland portions of the WTSA. Unlike the grassland indicators that are designed to assess grassland health as a whole, the Grasshopper Sparrow habitat model is meant to be an area specific tool to evaluate habitat effectiveness. Highly suitable Grasshopper Sparrow habitat represents large patches of mixed/tallgrass prairie far from a forest edge. The specific model inputs are outlined in Appendix A.

Similar to the other habitat models outlined in this report the habitat analysis for Grasshopper Sparrows was done in two steps. The first simply identified all potential suitable habitat based on the environmental variables in the model. Analysis shows that ***6% of the West TSA is potential highly suitable Grasshopper Sparrow habitat*** *(Map 15). The second step was to incorporate existing trail and road influence into the model to map the current habitat conditions. Two rankings were used to account for the proximity of suitable habitat to urban edges and roads and proximity to trails. Based on descriptions in Slater (2004) and Bock et al (1999), Grasshopper Sparrows prefer large patches of interior habitat greater than 200 meters from disturbances or edges. Suitable habitat areas within 200 meters of a road or urban edge were given a lower value. Areas within 100 meters of a designated or undesignated trail were also ranked lower. Patches of potentially highly suitable habitat smaller than 30 hectares were removed from consideration; patches greater than 30 hectares remained highly suitable. The effect of trails on the model was to reduce the amount of highly suitable Grasshopper Sparrow habitat from 6% of the WTSA to* ***2% of the WTSA is currently highly suitable Grasshopper Sparrow habitat*** *(Map 16).*

The West TSA process will work to use the grassland targets, attributes and indicators to inform the strategies developed in the West TSA plan. The grassland attributes and indicators selected for use in the WTSA planning process are a subset of all of the indicators used to assess the viability of the conservation targets in the Grassland Plan. The list of attributes and indicators utilized in the West TSA area may change slightly with the final version of the plan. Attributes that were selected are those for which attaining an acceptable, or viable, rating *could* affect

visitor use. For example, to attain an acceptable rating for the "habitat effectiveness" attribute of the mixedgrass prairie mosaic, visitor use *may* be directed away from the central portions of large habitat blocks. In latter stages, the West TSA plan will integrate strategies and management recommendations from the Grassland Plan.

The following table displays the current system-wide indicator ratings for grassland targets included in the West TSA. These ratings apply to the targets on a system-wide scale. The current viability status of the West TSA grasslands has not been assessed using these indicators. The rationale and justification for each indicator are included in Detailed Viability Assessment appendix of the Grassland Plan (City of Boulder 2009).

Table 2: Current grassland indicator viability rankings for targets in the West TSA

Target: **Mixedgrass Prairie Mosaic**		
Key Attribute	**Indicator**	**Rating**
Animal Species Composition	Percent of target with acceptable bird conservation score	Fair
Habitat Effectiveness	Proportion of habitat blocks over 100 hectares with singing male grasshopper sparrows	Not Rated
Vegetation Composition	Percent of target with prevalence of exotic species	Poor
Target: **Xeric Tallgrass Prairie**		
Animal Species Composition	Percent of target with acceptable bird conservation score	Fair
Vegetation Composition	Percent of target with prevalence of exotic species	Fair
Vegetation Composition	**Size of dwarf leadplant (*Amorpha nana*) populations**	**Good**
Vegetation Composition	**Size of prairie violet (*Viola pedatifida*) populations**	**Good**
Target: **Mesic Big Bluestem Prairie**		
Animal Species Composition	Species richness of sensitive breeding birds	Not Rated
Vegetation Composition	Percent of target with prevalence of exotic species	Poor
Target: **Wetlands**		
Connectivity	Buffer width (vegetated area within 100m of the wetland)	Fair
Vegetation Composition	Percent of target with prevalence of exotic species	Poor
Target: **Plains/ Foothills Transitional Riparian**		
Connectivity	Buffer width (vegetated area within 100m of a creek)	Fair
Habitat Structure	Physical instream and riparian habitat metric	Not Rated
Vegetation	Percent of target with prevalence of exotic species	Poor

Note: indicators in **bold** are considered within the acceptable range of variation. Indicators with a rating of "Not Rated" currently lack sufficient data to set a viability rating.

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Glossary of Terms

Accipiters: Hawks that inhabit deeply wooded areas. They have short rounded wings and long rudder-like tails which allow them to maneuver among the trees. Accipiters on OSMP include: Sharp-shinned hawk, Cooper's hawk, and Northern Goshawk.

Aspect: The direction a slope faces.

Attributes: Define key qualities or essential components of the targets, which, if they are not present or are severely compromised, result in unacceptable conditions or loss of the target.

Aspect: The full range of natural variety and variability within and among living organisms, and the ecological and environmental complexes in which they occur. It encompasses multiple levels of organization, including genes, species, communities and ecosystems.

Basal Area: The area of the cross section of a tree trunk near its base, usually 4 and ½ feet above the ground. Basal area is a way to measure how much of a site is occupied by trees. The term basal area is often used to describe the collective average basal area of an acre of forest.

Canopy: The part of any stand of trees represented by the tree crowns (usually refers to the uppermost layer of foliage).

Disjunct Species: Species that occur in two or more widely separated geographic areas.

Ecosystem: The dynamic complex of organisms and their environment contained within a specified area during a specified time. Systemic elements include interactions and feedbacks between components.

Ecotones / Ecotonal: A transitional zone between two biological communities containing the characteristics of each.

Endemic: a species that is native to or confined to a certain region; constantly present in a greater or less degree in one place

Epidemic: extremely prevalent, widespread

Ephemeral: Lasting a very short time; seasonal.

Extirpation: To remove or destroy totally from an area

Fire Regime: The characteristics of fire in a given ecosystem, such as the frequency, predictability, intensity, and seasonality of fire.

Foothills: The Foothills Zone has an elevational range between 6,000-8,000 feet in the east slope of the Front Range in Colorado. Geographically defined as gradual increases in hilly areas at the base of a mountain range. They are generally larger than hills, but not as tall as nearby mountains. Also referenced as the Lower Montane Zone.

Forbs: Herbaceous flowering plants that are not graminoids (grasses, sedges and rushes), especially plants growing in a field, prairie, or meadow.

Graminoid: grasses and grass like plants such as sedges and rushes

Habitat Connectivity: Patches of habitat across the landscape that are uninterrupted by barriers to movement.

Habitat Effectiveness: An area that meets a range of required characteristics, including environmental factors and lack of disturbance, and supports all stages of a species lifecycle.

Herptiles: A term used to refer to reptiles and amphibians as a group.

Indicators: Quantitative and qualitative measures of the attributes; they are what we measure to track conditions of the attributes.

Interior Habitat: Habitat some distance away from an edge, which is usually more ecologically productive due to edge effects and habitat fragmentation. Examples:
-Forest: Interior habitat = 200-400 meters (m) from forest edge (Robbins et al. 1989)

Management Priority Weed Species: Species of non-native plants that pose a threat to native species, ecosystems or overall habitat integrity. Priority is set as part of the integrated pest management program and is based on size of the population and threat to natural systems.

Montane: The Montane Zone has an elevational range between 8,000-10,000 feet in the east slope of the Front Range in Colorado. Of, relating to, growing in, or being the biogeographic zone of relatively moist cool upland slopes below timberline dominated by large coniferous trees. Also referenced as the Upper Montane Zone.

Mesic: Characterized by, relating to, or requiring a moderate amount of moisture.

Non-Native Species: Also called alien or exotic species, these species have been introduced, by various means, into areas where they were not originally found.

Overstory: The higher vegetation layer in a forest, consisting of the upper canopy layer of trees.

Patch: An area of homogenous vegetation, in structure and composition.

Poult: A young fowl, as of the turkey, grouse, or other similar bird

Refugia: A small, isolated area that has escaped the extreme changes undergone by the surrounding area, as during a period of glaciation, allowing the survival of plants and animals from an earlier period.

Relictual Species: Species that have survived a given place while disappearing elsewhere.

Riparian Areas: Areas along streams and rivers, including related vegetation communities.

Snag: A standing dead tree. Snags are important as habitat for a variety of wildlife species and their prey.

Stand: A homogonous group of trees that occupy a specific area and are similar in species, age, and condition.

Strategy: A systematic long-term plan to deploy a sequence of actions toward achieving one of more goals and associated set of management objectives.

Talus: Broken rock piles found on mountain slopes and at the base of cliffs.

Targets: Define what we care about (the big picture). Targets define what we are planning for—those resources that we are trying to protect, provide, and manage.

Understory: The lower vegetation layer in a forest found beneath the tree canopy. Includes grasses, forbs, trees, and woody shrubs growing beneath an overstory in a stand of trees.

Xeric: Characterized by, relating to, or requiring only a small amount of moisture.

Appendix A: Wildlife Resources

Habitat Suitability Models

Top: Abert's squirrel

Middle: Northern Goshawk

Bottom: Black bear

For each of the natural resource forest targets in the TSA a representative or "umbrella" wildlife species was selected as an indicator. In general, the species selected have habitat needs within the specific target that also apply to a much broader suite of wildlife species. The indicator species were selected because there is sufficient baseline data to accurately model habitat needs on the system, there is a range of research on those habitat needs so the models could be appropriately refined, and the indicators are species that are sensitive to change due to visitor use.

Ideally OSMP staff would monitor and sample many of the nested wildlife targets (rare or sensitive species that occur within the targets) on a regular basis across the entire system. While this could help direct some management decisions, the time necessary and the resources required to conduct these types of projects make monitoring of many nested species unfeasible. Tools like habitat models are being used as an efficient means to identify the most important areas on the system for natural resources and inform broad scale management. Habitat models have obvious limitations but they allow staff to get a system-wide perspective on resource values, provide an easily measured value of the status of habitat and inform future follow-up when finer scale management decisions are necessary.

All of the habitat models were built using existing, system-wide GIS data. Datasets used include vegetation mapping, forest overstory inventories, stream data, digital elevation models, and existing trails infrastructure. Each model was run in two phases. The first identified all potentially suitable habitat for a species based solely on environmental characteristics. This potential habitat value represents the greatest amount of habitat that could be expected on the system given only environmental variables. The potential value could be changed through habitat manipulation like thinning or restoration but those types of management techniques are outside the scope of the TSA process.

The second phase of modeling attempted to account for impacts to wildlife and habitat related to visitor use and gives a current habitat value based on existing infrastructure and regulations. Existing literature and research was reviewed to identify human impacts related to each of the indicator species. In some cases specific management recommendations were outlined in the literature and in others staff used best professional judgment based on similar species' flushing distances, breeding success, or using other general conservation biology concepts.

One of the greatest limitations in this phase of the modeling is a lack of accurate visitation data on all trails, both designated and undesignated. In general, OSMP knows the areas that see heavier visitation on a qualitative level, but it's impossible to compare or categorize trail visitation accurately across the entire TSA. It is also difficult to predict use levels that may exist on the system in the future. Information like this could help refine the models and allow for variation in how visitation impacts are applied. This is especially true for undesignated trails that may get very heavy visitation or only infrequent visits.

The products of the habitat suitability models are intended to be just one tool for making management decisions. Ultimately, both the potential and current habitat acreages will be used to set desired future conditions realizing increasing habitat to its full potential is unlikely and the current condition is a guide to where management may need to focus. Highly suitable habitat will help inform where impacts may be focused and where the most effective management for natural resource protection could occur. This will help guide the department in finding a balance between visitor access and natural resource protection.

Northern Goshawk (Map 4 & Map 5)

Northern Goshawks were chosen as a wildlife indicator for the mixed conifer natural resource target. Goshawks are relatively infrequent visitors to the OSMP system but are known to nest in the upper elevations of the county; therefore, the OSMP system may provide suitable nesting habitat for this species. Goshawk nesting habitat usually consists of older, mature forest with a high density of large trees and high canopy closure (Reynolds et al., 1982; Greenwald et al., 2005). This type of dense, mature forest structure supports a wide range of other nested targets in the TSA including Cooper's Hawks, Northern Pygmy Owl, Flammulated Owls, and Williamson's Sapsucker.

Staff defined highly suitable habitat as areas that could support nesting Goshawks. These forest patches are dominated by dense forest canopies with large trees. The model also accounted for areas of mature forest, areas with high snag densities for perches, and northerly aspects with relatively gentle slopes. The highly suitable habitat also had to meet a minimum patch size to remain highly suitable. For Goshawks, patches smaller than 10 ha (approx. 25 acres) were eliminated prior to the trail effects modeling. Any patches that did not meet this minimum patch size were not considered highly suitable habitat in the indicator calculations but are displayed on the maps. The 10 ha cut-off was based on literature (Reynolds et al. 1992; Reynolds and Joy 1998) and expert opinion (R.T. Reynolds, personal communication: February 2009)

Northern Goshawks have shown sensitivity to human activity near their nesting sites. In this model as well as a number of the other models a 50 m buffer was used along roads to account for disturbance from the road and passing traffic. This is a conservative estimate based on research that suggests road effects can impact a wide range of wildlife species and other ecological functions and the effects can extend outward from the road itself for up to 600 m (Forman and Deblinger 2000). Voice and sight trails as well as undesignated trails outside of HCAs were buffered by 6 m (20 ft.) to account for the width of the VMP-approved trail corridor. Forest patches were delineated using trails (and their buffers, if applied) and roads.

Table 3: Habitat suitability model inputs for Northern Goshawk

Variable	*Attributes*	*Ranks*	*Weights*
Preferred Forest Habitat Alliances	Douglas Fir Vegetation Alliances	9	1
	Ponderosa Pine - Douglas-fir Forest Alliance, Quaking Aspen - Douglas-fir Forest Alliance	9	1
	Lodgepole Pine Forest Alliance, Ponderosa Pine Forest Alliance, Quaking Aspen Forest Alliance	8	1
	Douglas-fir Woodland Alliance, Douglas-fir Temporarily Flooded Woodland Alliance	7	1
	Ponderosa Pine - Douglas-fir Woodland Alliance	6	1
	Ponderosa Pine Woodland Alliance, Ponderosa Pine Temporarily Flooded Woodland Alliance	5	1
	Narrowleaf Cottonwood Temporarily Flooded Forest Alliance	4	1
	Ponderosa Pine Wooded Mixed Herbaceous Alliance (Savannah), Ponderosa Pine Tallgrass Savannah Herbaceous Alliance, Box-elder Temporarily Flooded Forest Alliance	3	1
	Paper Birch Forest Alliance, Netleaf Hackberry Woodland Alliance, Water Birch Seasonally Flooded Shrubland Alliance	2	1
Topography	Aspect (degrees)	0 - 45, 315 - 360 = 9 45 - 135 = 7 225 - 315 = 5 135 - 225 = 3	1
	Slope (percent)	0 - 10, 20 - 35 = 9 10 - 20 = 7 35 - 50 = 5 > 50 = 0	1
Forest Stand Structure	Average Tree Diameter (inches)	> 17 = 9 13 - 17 = 5 9 - 13 = 3 0 - 9 = 0	1
	Mature Forest Stands (Stands with trees over 200 years old or an average stand age of 150 years)	8	1
	High Snag Forest Stands (Stands with 3 or more snags per acre)	5	1
	Average Basal Area (sq. ft./acre)	110 - 190 = 9 190 - 281, 80 - 110 = 5 7 - 80 = 3 0 - 7 = 0	1
Minimum Patch Size (applied before and after trail effects modeling)			
Only patches >= 10 hectares remain highly suitable			
Trail & Road Impacts			
Remove 20 feet on each side of V&S designated trails and undesignated trails outside an HCA Remove 50 meters on each side of roads Split polygons by all other designated trails and undesignated trails			

Abert's Squirrel (Map 6 & Map 7)

Abert's squirrels are the indicator species selected for the ponderosa pine target because they require patches of mature ponderosa pine in a mosaic of uneven-aged stand structures. This type of woodland represents an overstory structure that provides habitat for many wildlife species, both common and rare.

Highly suitable Abert's squirrel habitat represents areas on the system dominated by ponderosa pine with moderate tree densities and large, mature trees. Many areas identified by the model often have characteristics of mature forest stands with trees approaching old-growth. Mature, open ponderosa pine stands are limited across the Front Range and across their entire range. Historic fire suppression, grazing, and timber harvesting have led to much denser stands with large trees that are severely stressed by competition or have been removed altogether. In comparison to historic conditions, ponderosa pine stands across the Front Range are denser, have fewer large trees and snags, and are more homogenous in tree age and size (Veblen and Donnegan 2005).

Abert's are highly dependent on ponderosa pine stands for diet and nesting throughout the year. They feed almost exclusively on inner bark, seeds, and terminal buds of ponderosa and nest in clumps of large ponderosa trees (Fitzgerald et al., 1994). The habitat suitability model for this species accounted for the preference for larger, ponderosa trees. The model also factored in tree density (some interconnecting crowns are important for movement and protection from predators) and habitat block size (according to Fitzgerald et al. (1994) the mean home range for Abert's is about 10 hectares or approximately 25 acres). Habitat had to meet the minimum patch size of 10 hectares to remain highly suitable. This patch size is based on the average home range size of Abert's squirrels. The patch size filter was applied before trail effects were analyzed. In other words, patches of highly suitable habitat smaller than 10 ha don't factor into the indicator values of potential highly suitable habitat or highly suitable habitat with trail effect but they are displayed on the maps.

Trail impacts for this species were developed using existing research done across the US and in Boulder County. Research has shown impacts to Abert's and other small mammals related to dog activity on trails. Dogs can impact wildlife behaviors and distributions and small mammals are less active in areas visited by dogs (Sime, 1999; Lenth et al., 2008). Recreational trails that allow dogs can see a reduction in small mammal activity near the trail (Lenth et al., 2008). For these reasons a 20 foot buffer was removed from highly suitable Abert's habitat along voice and

sight regulated trails. A 20 foot buffer width was chosen because that is commonly used as the enforceable area of the "trail corridor" when dogs are not required on leash, but a voice and sight restriction exists.

Trails, both designated and undesignated, as well as roads were used to split highly suitable habitat into patches. Remaining patches smaller than the 20 hectare (approximately 50 acres) maximum home range of Abert's (Fitzgerald et al. 1994) were removed from the highly suitable habitat. While one trail in a suitable habitat may or may not be a direct barrier to Abert's movement the patch size variable will help identify where trails occur in highly suitable habitat and where trails management could improve habitat for wildlife.

Table 4: Habitat suitability model inputs for Abert's squirrel

Variable	*Attributes*	*Ranks*	*Weights*
Preferred Forest Vegetation Alliances	Ponderosa Pine Forest Alliance, Ponderosa Pine Woodland Alliance	9	2
	Ponderosa Pine - Douglas-fir Forest Alliance, Ponderosa Pine - Douglas-fir Woodland Alliance	5	2
	Ponderosa Pine - Quaking Aspen Forest Alliance, Ponderosa Pine Temporarily Flooded Woodland Alliance, Ponderosa Pine Tallgrass Savannah Herbaceous Alliance, Ponderosa Pine Mixed Grass Savannah Herbaceous Alliance	3	2
Tree Size	Mean Tree Diameter of Ponderosa Pine Stands (inches)	> 15 = 9 9 - 15 = 7 7 - 9 = 5 4 - 7 = 3 0 - 4 = 1	1
Tree Density	Trees per acre over 5" in diameter	150 - 300 = 9 99 - 150 = 7 0 - 99 or > 300 = 0	1
Patch size	Preferred Forest Habitat Block Size (hectares)	<2= 0 2-10= 3 10-15= 6 15-20= 9	1
Topography	Elevation (ft)	6000 - 8528 = 9 5456 - 5999 = 6	1
Minimum Patch Size (applied before and after trail effects modeling)			
Only patches >= 10 hectares remain highly suitable			
Trail & Road Impacts			
Remove 20 feet on each side of V&S designated trails and undesignated trails outside an HCA Split polygons by all other designated trails and undesignated trails Remove 50 meters on each side of roads			

Prairie Falcon (Map 8)

Prairie falcons were chosen as an indicator wildlife species for the cliffs and talus target in the West TSA. Prairie and peregrine falcons have very similar nesting habitat requirements so this model applies to both of these cliff-nesting species. On OSMP, some golden eagle pairs have also chosen sites with similar landscape characteristics. Cliff-nesting raptors require diverse habitats for foraging and nesting. This model focuses on nesting habitat provided by the dramatic rock faces of the TSA. The close

proximity of these cliff faces to open grasslands to the east provides ideal breeding conditions for prairie and peregrine falcons.

Highly suitable falcon habitat focuses exclusively on cliffs and exposed rock faces as defined by the OSMP vegetation mapping. South facing ledges appear to be favored for nest sites (Enderson 1964) so higher ranks were given to south aspects derived from digital elevation models. Areas on the rock face with steep slopes are also favored for nesting locations, perhaps for protection from predators (BLM 1979).

The focus of this indicator is highly suitable nest sites that are protected throughout the TSA. Prairie and Pergrine Falcons require areas of limited disturbance to be successful and activities like rock climbing can cause disturbances that result in nest failure or abandonment (Richardson and Miller, 1997). OSMP has a number of seasonal raptor closures designed to protect existing nest locations during sensitive times of the year. Current closure boundaries were used to determine the percentage of suitable habitat that is currently protected.

Table 5: Habitat suitability model inputs for cliff nesting raptors

Variable	*Attributes*	*Ranks*	*Weights*
Topography of Nesting Habitat	Aspect (degrees)	138 – 180 (SE) = 9 180 – 270 (SW) = 7 22.5 – 138 (E), 270 - 337.5 (NW) = 5 0 - 22.5 (N), 337.5 – 360 (N) = 3	1
	Slope (degrees)	>= 60 = 9 50 - 60 = 7 40 - 50 = 5 30 - 40 = 3 0 - 30 = 0	1
Nesting Habitat Alliances	Cliffs and Talus vegetation alliance	9	1
Protection			
Total % of highly suitable that falls within existing seasonal closures			

Shrub-nesting birds (Map 9 & Map 10)

This model accounts for a suite of bird species that depend on the heavy shrub cover provided by the foothills and montane riparian target. Species like Gray Catbirds, Blue-gray Gnatcatchers, Yellow-breasted Chats, Black-headed Grosbeaks, Lazuli Bunting and Blue Grosbeaks are all nested targets that depend on riparian shrublands for nesting habitat. Shrub-nesters require areas of dense vegetation and tend to nest one to three meters above the ground (Harrison, 1979).

Shrub-nesting bird habitat in the TSA represents areas dominated by riparian shrubland vegetation. Larger shrub patches create more effective bird habitat and each patch was ranked based on overall patch size. In addition to patch size, shrublands within 75 meters of a stream were ranked higher than those beyond 75 meters. Interconnected patches within

stream corridors provide nesting habitat but also provide movement corridors across the landscape and connect blocks of habitat together. In addition, larger complexes of connected shrub habitat provide high quality foraging areas and increase the chances of multiple nesting species.

A number of studies have been conducted on both OSMP lands and in other areas that look at the impacts of trails on birds. Miller et al. (1998, 2001) found that grassland and forest bird species were more abundant away from trails and the abundance increased as the distance from trails increased. A study of riparian areas in Boulder County (Miller et al. 2003) showed that trail use affected riparian bird densities. Trail impacts were accounted for in this model by removing areas directly adjacent to existing trails. An area of 50 meters was removed from highly suitable habitat on both sides of existing trails. This was based on the 75 – 100 m area adjacent to trails where bird densities showed a decrease in the Miller study for grassland nesting birds. The number was reduced to account for differences in grassland and shrub habitats. An additional 20 feet was removed along trails with voice and sight regulations to account for dogs and people leaving the trail corridor.

Table 6: Habitat suitability model inputs for shrub-nesting birds

Variable	*Attributes*	*Ranks*	*Weights*
Habitat Block size (acres) created from merging these vegetation alliances	Prairie Cordgrass Temporarily Flooded Herbaceous Alliance, Western Wheatgrass Temporarily Flooded Herbaceous Alliance, Foxtail Barley Temporarily Flooded Herbaceous Alliance,Green Ash - (American Elm) Temporarily Flooded Forest Alliance, Quaking Aspen Temporarily Flooded Forest Alliance, Narrowleaf Cottonwood Temporarily Flooded Forest Alliance, Ponderosa Pine Temporarily Flooded Woodland Alliance, Douglas-fir Temporarily Flooded Woodland Alliance, Eastern Cottonwood Temporarily Flooded Woodland Alliance, Narrowleaf Cottonwood Temporarily Flooded Woodland, Box-elder Temporarily Flooded Woodland Alliance, Peachleaf Willow Temporarily Flooded Woodland Alliance, American Plum Shrubland Alliance, Crack Willow (introduced) Temporarily Flooded Woodland Alliance, Desert False Indigo Temporarily Flooded Shrubland Alliance, Non-Native Dominated Temporarily Flooded Woodland, Choke Cherry Shrubland Alliance, Wax Currant Shrubland Alliance, Skunkbush Intermittently Flooded Shrubland Alliance, (Coyote Willow, Sandbar Willow) Temporarily Flooded Shrubland Alliance, Rocky Mountain Maple Temporarily Flooded Shrubland Alliance, (Black Hawthorn, Fleshy Hawthorn) Temporarily Flooded Shrubland Alliance, Woods' Rose Temporarily Flooded Shrubland Alliance, Western Snowberry Temporarily Flooded Shrubland Alliance, Bluestem Willow Temporarily Flooded Shrubland Alliance, Water Birch Seasonally Flooded Shrubland Alliance	100 – 900 = 9 30 - 100 = 6 10 - 30 = 3 2 - 10 = 1	1
Riparian habitat blocks near other riparian habitat blocks	Riparian corridor habitat blocks (created from above vegetation alliances) >= 2 acres and <=75m from a perennial or intermittent stream	5	1
Trail & Road Impacts			
	remove 20ft + 50m on each side of V&S designated trails remove 50m on each side of all other trails and roads		

Black Bear (Map 11)

Black Bears are one of two wildlife species chosen to identify highly suitable riparian wildlife habitat but represents the only terrestrial, wide-ranging large mammal indicator for the TSA. Black bears are one of the many species that use riparian areas for travel and seasonal feeding. Black bears are known to occur throughout the foothills and mountainous areas of Boulder County but riparian drainages provide essential seasonal feeding areas. Unsworth et al. (1989) found that bears fed and traveled in

riparian areas significantly more than steep slopes and exposed areas. In the fall, berry producing shrublands provide feeding areas allowing bears to put on sufficient weight to bear young and provide for the necessary pre-denning nutritional needs.

Critical bear foraging habitat on OSMP represents areas of the system within close proximity to streams and riparian vegetation that provide cover for movement and connections across the landscape. The habitat model also gave more weight to areas dominated by chokecherry, hawthorn and American plum; berry producing shrubs that are ideal food for black bears and dominate their scat content in fall (Berry, 1996; Johnson, 2000).

Trails and associated visitor activities in bear habitat may alter bear behavior without changing distributions. Bears in natural habitats are largely diurnal, while those in areas with heavy human activity were more nocturnal (Ayres et al., 1986), and human activity may reduce bear activity in areas of low vegetation cover (Berry, 1996). Black bears are less likely to be found < 50 m from secondary (dirt) roads (Unsworth et al., 1989), which means highly traveled, paved roads may have a more dramatic impact. No habitat was removed from the models based on existing trails; rather, existing trail densities in highly suitable habitat were calculated by trail category (such as voice and sight, undesignated, leash required, etc.). Each trails regulatory category was determined based on fall trail regulations to account for regulations currently in place for wildlife protection.

Table 7: Habitat suitability model inputs for black bear

Variable	*Attributes*	*Ranks*	*Weights*
Forest Vegetation	All forest and woodland vegetation alliances	1	1
High Berry Producing Shrubs	Choke Cherry Shrubland Alliance, Black Hawthorn/Fleshy Hawthorn Temporarily Flooded Shrubland Alliance, American Plum Shrubland Alliance	9	6
Riparian and Shrubland Vegetation	High quality habitat alliances (ERO defined): Prairie Cordgrass Temporarily Flooded Herbaceous Alliance, Western Wheatgrass Temporarily Flooded Herbaceous Alliance, Foxtail Barley Temporarily Flooded Herbaceous Alliance, Green Ash - (American Elm) Temporarily Flooded Forest Alliance, Box-elder Temporarily Flooded Forest Alliance, Quaking Aspen Temporarily Flooded Forest Alliance, Narrowleaf Cottonwood Temporarily Flooded Forest Alliance, Ponderosa Pine Temporarily Flooded Woodland Alliance, Douglas-fir Temporarily Flooded Woodland Alliance, Eastern Cottonwood Temporarily Flooded Woodland Alliance, Narrowleaf Cottonwood Temporarily Flooded Woodland, Box-elder Temporarily Flooded Woodland Alliance, Peachleaf Willow Temporarily Flooded Woodland Alliance, Crack Willow (introduced) Temporarily Flooded Woodland Alliance, Desert False Indigo Temporarily Flooded Shrubland Alliance, Non-Native Dominated Temporarily Flooded Woodland, Wax Currant Shrubland Alliance, Skunkbush Intermittently Flooded Shrubland Alliance, Coyote Willow, Sandbar Willow Temporarily Flooded Shrubland Alliance, Rocky Mountain Maple Temporarily Flooded Shrubland Alliance, Woods' Rose Temporarily Flooded Shrubland Alliance, Western Snowberry Temporarily Flooded Shrubland Alliance, Bluestem Willow Temporarily Flooded Shrubland Alliance, Water Birch Seasonally Flooded Shrubland Alliance	5	3
Movement Corridors	Distance from Perennial and Intermittent Streams (feet)	0 - 34 = 9 34 - 98 = 6 98 - 164 = 4 164 - 230 = 3 230 - 295 = 2 295 - 500 = 1 > 500 = 0	2
Trail & Road Impacts			
Calculate trail density by trail category in the fall to account for seasonal restrictions (leash, no dogs, V&S, undesignated, roads)			

Wild Turkey (Map 13 & Map 14)

Forest openings are essential habitat for Wild Turkey foraging and brood rearing. The forest openings target in the WTSA provides ideal habitat for turkeys as well as species that use grassland/ forest ecotones such as mule deer, elk, and many bird species. In particular, forest openings supply Wild Turkey hens rearing young the necessary food (i.e., insects) and escape cover to minimize predation. The local subspecies in Colorado, Merriam's Wild Turkey, is most often associated with forest openings within close proximity to mature forest patches with large, old trees that provide roost sites (Hoffman, 1968).

The Wild Turkey model accounts for both roosting sites (mature ponderosa forests) as well as feeding and loafing areas (openings) and ultimately identifies optimal forest openings based on the distance from the opening to suitable forest stands. For foraging habitat, higher ranks were given to openings closer to forest edges. These edges provide cover and protection for hens with poults which are less likely to stray beyond 50 meters from an edge and prefer areas within 25 meters (Hoffman et al. 1993). Roosting areas were identified in the model by ranking open ponderosa pine stands with large trees and an eastern aspect higher than other forest types. Areas where highly suitable foraging areas and highly suitable roosting areas occur in close proximity represent overall highly suitable Wild Turkey habitat. A minimum patch size of 7 hectares was applied to this model to eliminate habitat that is less desirable for hens with poults. This conservative value was based on literature (Rumble and Anderson 1993), expert opinion (M.A. Rumble, personal communication: June 2009), and staff knowledge of areas with brood hen use in the WTSA. The areas that did not exceed the patch size threshold were not considered highly suitable habitat but were displayed on the maps in red.

Increased use of trails in Wild Turkey habitat could lead to decreased turkey use or abandonment of an area (Wright and Speake, 1977) and turkeys are sensitive to disturbance at their nest sites (Lutz and Crawford, 1987). As a ground-nesting species, turkey populations can also be sensitive to dogs (Miller and Leopold, 1992). To account for the potential impacts of trail use, the turkey model integrated existing information on trails and roads. In this model as well as a number of the other models a 50 m buffer was used along roads to account for disturbance from the road and passing traffic. This is a conservative estimate based on research that suggests road effects can impact a wide range of wildlife species and other ecological functions and the effects can extend outward from the road itself for up to 600 m (Forman and Deblinger 2000). A buffer of 31 m was removed from highly suitable turkey habitat along trails with voice and sight regulations. This buffer was removed to account for dogs off-leash and people leaving the trail tread (6 m) and a 25 m flushing distance that

has been observed in a similar species, Capercaillie Grouse (*Tetrao urogallus*) (Thiel et al. 2007).

Table 8: Habitat suitability model inputs for Wild Turkey

Variable	*Attributes*	*Ranks*	*Weights*
Feeding and Loafing Habitat Created by Buffer Zones	Areas within 25 meters of grassland/ forest ecotones or forest openings	9	1
	Areas between 25 and 50 meters from grassland/ forest ecotones or forest openings	6	1
Topography	Slope of preferred habitat and feeding/loafing buffer zones	0 - 40 = 9 40 - 50 = 3 50 - 60 = 1 > 60 = 0	1
	Aspect of preferred habitat and feeding/loafing buffer zones	67.5 - 157.5 = 5 157.5 - 292.5 = 3 -1 - 67.5 = 2 -1, or 292.5 - 360 = 1	1
	% Slope of Foothills & Montane Forest Openings	0 - 40 = 9 40 - 50 = 3 50 - 60 = 1 > 60 = 0	2.5
Preferred Forest Vegetation Alliances	Ponderosa Pine Forest Alliance, Ponderosa Pine Woodland Alliance	9	1
	Ponderosa Pine Tallgrass Savannah Herbaceous Alliance, Ponderosa Pine Mixed Grass Savannah Herbaceous Alliance	7	1
	Ponderosa Pine - Douglas-fir Forest Alliance, Ponderosa Pine - Douglas-fir Woodland Alliance, Ponderosa Pine - Quaking Aspen Forest Alliance	5	1
	Douglas-fir Temporarily Flooded Woodland Alliance, Douglas Fir Forest Alliance, Quaking Aspen Forest Alliance, Quaking Aspen Temporarily Flooded Forest Alliance, Quaking Aspen - Douglas-fir Forest Alliance, Douglas-fir Woodland Alliance, Quaking Aspen Woodland Alliance (no polygons in this alliance)	3	1
Patch size	Preferred Habitat Block Size (hectares)	<2= 0 2-10= 3 10-20= 6 >20= 9	1
Distance to Roosting/ Foraging Habitat	Nearness of High Value Forest habitat to Forest Openings (feet)	0 - 25 = 9 25 - 50 = 6 50 - 100 = 3 > 100 = 0	2.5
Forest Stand Structure	Average Tree Diameter (inches)	> 15 = 9 9 - 15 = 7 7 - 9 = 5 4 - 7 = 3 0 - 4 = 1	1
	Average Basal Area (sq. ft./acre)	40 - 80 = 9 80 - 120 = 7 120 - 230 = 5 0 - 40, 230 - 281 = 3	1
Minimum Patch Size (applied before and after trail effects modeling)			
Only patches >= 7 hectares remain highly suitable			
Trail & Road Impacts			
Remove 6m + 25m on each side of V&S designated trails and undesignated trails outside of HCAs Split polygons by other designated trails and undesignated trails in HCAs Remove 50 meters on each side of roads			

Grasshopper Sparrow (Map 15 & Map 16)

The grassland portions of the West TSA provide habitat for a diverse mix of wildlife species. Although Grasshopper Sparrows are just one of the many bird and animal species that use this area, they were selected as an indicator species for the WTSA because of their need for large intact habitat blocks and their sensitivity to habitat fragmentation.

Although their average defended territory size is ≤2 ha (Dechant et al. 2003), the estimated minimum size requirement [defined as the area at which the probability of observing a species is 50% of its maximum (Robbins et al. 1989)] of Grasshopper Sparrows was 134 ha in mixed-grass habitats of Canada (Davis 2004) and 100 ha for grassland barrens in Maine (Vickery et al. 1994). Further, Wyoming Partners in Flight Best Management Practices recommends keeping grassland blocks >100 ha intact to benefit area-sensitive birds (Wyoming PIF 2002).

Within Boulder County, Thompson and Strauch (1986) found several breeding pairs of Grasshopper Sparrows on open space land and determined that the species is a regular breeder in the county. Breeding bird surveys in the Tallgrass West Area of the WTSA between 2005 and 2008 recorded the presence of Grasshopper Sparrow and the presence of females and singing males during surveys are assumed to represent breeding activity.

Highly suitable Grasshopper Sparrow habitat in the WTSA represents areas dominated by large patches of mixed or tall grass. Grasshopper Sparrows tend to avoid edges, which seem to be more vulnerable to predation and parasitism, and thus affect reproductive success (Delisle and Savidge 1996, Denchant et al. 2003).

Studies of grassland bird responses to recreational use have found that near trails, grassland nesting birds are less likely to nest, less abundant, and experience lower nesting success (Miller et al. 1998). Further, Bock et al. (1999) found this species to be significantly more abundant in interior grasslands than those near development.

Because of this, recreational trails were buffered in 50 m segments up to 100 m (i.e., two segments) and habitat quality was scored higher with increasing distance from the trail. Human development was buffered up to 200 m (i.e., four segments) and scored using similar methods.

A minimum patch size of 30 ha (~75 ac) was applied to this model to account for the area-sensitive nature of this species. Although most sources recommend conserving a ≥ 100 ha patch when managing for Grasshopper Sparrows, we chose a conservative threshold because

Tallgrass West represents much less acreage than studied / managed in these sources (Vickery et al. 1994, Wyoming PIF 2002, Davis 2004).

Table 9: Habitat suitability model inputs for Grasshopper Sparrow

Variable	*Attributes*	*Ranks*	*Weights*
Preferred Vegetation Alliances	Ill-scented Sumac / Big Bluestem Xeric Tallgrass Shrub Savannah, Big Bluestem Colorado Front Range Xeric Tallgrass Herbaceous Vegetation, Ill-scented Sumac Intermittently Flooded Shrubland, Big Bluestem - Little Bluestem Western Great Plains Herbaceous Vegetation, Big Bluestem - Prairie Dropseed Western Foothills Herbaceous Vegetation, Western Wheatgrass Herbaceous Vegetation, Western Wheatgrass - Blue Grama Herbaceous Vegetation, Western Wheatgrass - Blue Grama - Threadleaf Sedge Herbaceous Vegetation, Western Wheatgrass - Green Needlegrass Herbaceous Vegetation, Little Bluestem - Sideoats Grama Western Great Plains Herbaceous Vegetation, Mountain Muhly Herbaceous Vegetation, Mountain Muhly - Needle-and-Thread Herbaceous Vegetation, Needle-and-Thread Colorado Front Range Herbaceous Vegetation, Green Needlegrass Herbaceous Vegetation, Parry's Oatgrass Herbaceous Vegetation, Woolly Sedge Herbaceous Vegetation, Western Wheatgrass - Needle-and-Thread Central Mixedgrass Herbaceous Vegetation, Needle-and-Thread - Blue Grama - Threadleaf Sedge Herbaceous Vegetation, Smooth Brome Cultivated Grass Hay, Yucca / Big Bluestem Xeric Tallgrass Shrub Savannah, Yucca / Needle-and-Thread Mixedgrass Shrub Savannah	9	3
	Three-leaved Sumac Upland Shrubland, Snakeweed Dwarf-shrubland Alliance, Prairie Cordgrass Temporarily Flooded Herbaceous Alliance, Baltic Rush Seasonally Flooded Herbaceous Alliance	4	3
Patch size	Acres of contiguous preferred vegetation	0-2= 1 2-8= 3 8-30= 5 30-100= 7 100-1500= 9	1
Grassland/ Forest edge	Distance (feet) from a forest stand	0-75= -7 75-150= -5 150-225= -3 225-300= -1	1
Minimum Patch Size (applied before and after trail effects modeling)			
Only patches >= 30 hectares remain highly suitable			
Trail & Road Impacts			
Habitat edges	Distance (feet) from urban edges and roads	0-150= -8 150-300= -6 300-450= -3 450-600= -1	1
Fragmentation edges	Distance (feet) from designated and undesignated trails	0-150= -6 150-300= -3	1

On-going OSMP Wildlife Studies and Monitoring

There are a number of on-going monitoring studies conducted by OSMP staff within the West TSA boundaries. All of these projects have been designed and implemented as a part of an existing management plan or to address a particularly rare or sensitive species or suite of species that occurs on the system. While many of these projects are not designed to specifically look at the impacts of trails or human use, they can inform the trail study area process. These studies can provide relatively current and discrete occurrence data for many nested target species and provide baseline information on species richness and abundance.

The following section provides short descriptions for the most current monitoring being conducted within the West TSA boundary. Monitoring sites are displayed on Map 17.

Forest Birds & Brown-headed Cowbird Monitoring

Background and Methods

In 1999, OSMP developed the Forest Ecosystem Management Plan to address the biologically degraded and fire-prone condition of coniferous forest and woodland areas on its lands. As mandated in the Plan, OSMP forestry staff began mechanically thinning Ponderosa pine (*Pinus ponderosa*) stands in 1999. Two primary goals were identified in the Plan: reduce risk of catastrophic wildfires while maintaining or improving ecosystem health and function.

Utilizing an adaptive management approach to forest stand restoration, OSMP staff developed a list of vegetative and wildlife variables believed to be key indicators of the effectiveness of restoration treatments. One such response variable was the abundance of forest-nesting songbirds as well as stand occupancy by Brown-headed Cowbirds (*Molothrus ater*). Brown-headed Cowbirds parasitize native songbird nests, reducing the overall populations of songbirds. They are edge specialists with increased activity along trails and natural openings.

To learn more about the effects of forest restoration on the abundance of landbirds in local Ponderosa pine forests and woodlands, OSMP used fixed-radius point counts to survey 17 control plots (i.e., not thinned) and 20 thinned forest plots three times each summer in 2007 and 2008. Boulder County Parks and Open Space also surveyed 10 plots in Ponderosa forests on Heil Ranch to expand sample size and improve inference (referred to as point count study below). Spot mapping was used to survey 2 control (forest conditions not requiring restoration treatment), 2 thin (slated for thinning treatment) and 2 burn +thin (slated for thinning and burning) in 2000-2001 (baseline data) and again in 2006 (following thinning treatment of 2 thin+burn plots).

Point Count Study Methodology: All points were ≥100 m from grassland/forest edge, points in untreated stands were ≥100 m from thinned stands, and all points were separated by ≥225 m. Surveys began at sunrise and continued until 1030. In order to account for possible differences in bird detectability in thinned vs. unthinned stands, only birds detected within 50 meters of plot center were analyzed. Each survey was 20 minutes in duration and consisted of two parts. The first part was a passive auditory survey (10 minute duration); this was followed by broadcasting recorded female cowbird chatter and male flight whistle calls with 10 – 15 second quiet intervals (10 minute duration). Staff calibrated the playback equipment such that broadcasts were detectable to approximately 75 m from plot center. OSMP staff employed broadcasting

(i.e., call playback) as a technique to increase the probability of cowbird detection in forest stands.

Spot Mapping Study Methodology: Spot mapping was completed according to standard spot mapping methodology, including using a 50 x 50 m grid system where all gridlines were walked 3 times during the early morning of the breeding season (June 1- July 15) and all bird activity was recorded on spatially explicit datasheets. Following field data collection, data was examined on an individual species level to assign territorial boundaries to the study sites. This information yielded a minimum number of territories for each species on each study plot. Additional data collection and analysis will be performed once all treatment (burning) is complete on the treatment plots.

Results and Discussion

Point Count Study: Staff detected significantly more bird species and more individuals per visit during surveys in thinned plots than in control plots (Figure 1). Numerically, staff detected 85% (n = 46) of forest bird species at greater numbers in thinned plots than in control plots (Table 10). Chipping Sparrows (*Spizella passerine*) and Plumbeous Vireos (*Vireo plumbeus)* were significantly more abundant in thinned plots (Figure 2). Both species are associated with open park-like forest stands and would seem to benefit from thinning events, which decrease canopy cover, as they consume insects on the ground or gleen insects from the foliage. Using our data as a guide, other species that may have benefited from opening of the forest canopy are Dusky Flycatcher (*Empidonax oberholseri*) and Pine Sisken (*Carduelis pinus*), both of which use open forests extensively.

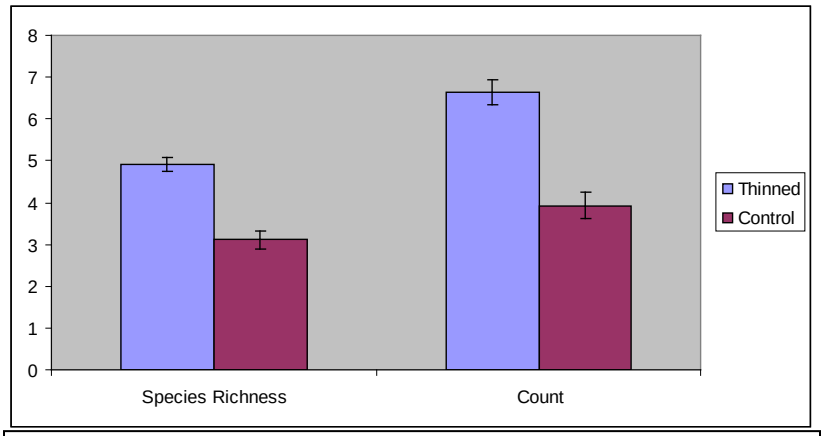


Figure 1. Mean (±SE) native species richness and count of individual native birds detected using passive auditory surveys within a 50 meter radius of control (n = 17) and thinned (n = 20) plots in Ponderosa pine forests on OSMP during 2007-08. Significantly more species and individuals were detected in thinned plots than in control plots ($p < 0.0001$).

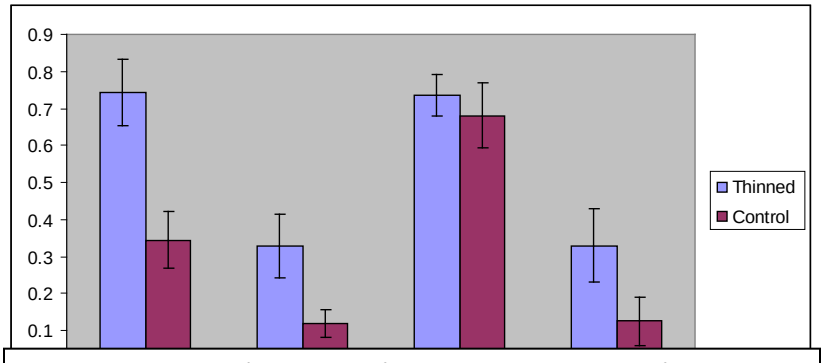


Figure 2. Mean abundance (±SE) for selected species of passerines detected within a 50 m radius of control (n = 17) and thinned (n = 20) plots in Ponderosa pine forests on OSMP during 2007-08. Chipping Sparrows (*Spizella passerine*, CHSP), Brown-headed Cowbirds (*Molothrus ater*, BHCO) and Plumbeous Vireos (*Vireo plumbeus*, PLVI) were significantly more abundant in thinned stands than in control stands ($p < 0.05$). Pygmy Nuthatches (*Sitta pygmaea*, PYNU) were not significantly more abundant in thinned stands ($p > 0.05$). Brown-headed Cowbird abundance was calculated using results from broadcast surveys as well as passive auditory surveys; other species' abundances were calculated using passive auditory surveys.

Brown-headed Cowbirds were significantly more abundant in thinned stands than in control stands (Figure 2). To date, little information is available describing

potential response of cowbirds to forest restoration. Cowbirds are: 1.) aggressive nest parasites, whose effect on host bird species has increased as sedentary domestic cattle have replaced wide-ranging buffalo herds; 2.) host-generalists with the potential to severely depress nesting success of forest bird species, most of whom have no evolved defense against nest parasitism; 3.) edge-specialists and have been documented using roads, powerlines, and other forest openings to access the nests of interior-nesting species.

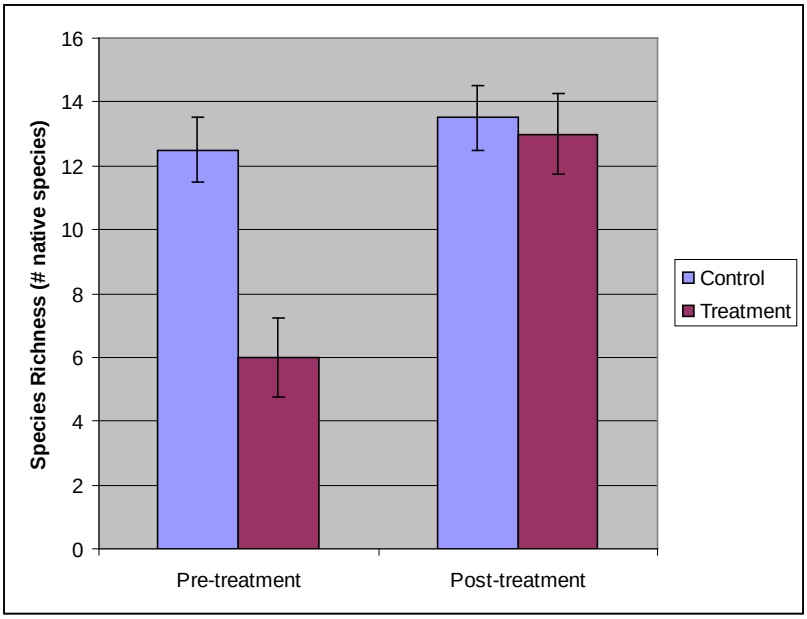


Figure 3. Mean native species richness (± SE) of native birds detected using spot mapping on control (untreated) plots (n = 2) and treatment Plots (n = 2) before (2000-2001) and after (2006) thinning of treatment plots. Species richness differed significantly before treatment (p= 0.04) but not following treatment (p= 0.25)

It is not clear whether forest restoration activities are reducing canopy cover to an extent that facilitates cowbird movement and parasitic behavior, or whether other factors, such as proximity to urban areas, or host abundance, act independently or cumulatively to affect cowbird abundance in these stands. Interestingly, staff detected more Plumbeous Vireos and Chipping Sparrows in thinned plots than in control plots and these are two species that cowbirds regularly parasitize. Finally, it is not known if cowbird abundance translates into depressed host nesting success in these particular forest stands (although this has been shown elsewhere). Future work in thinned and control forest stands should include research into the effects of forest restoration on cowbird parasitism rates, and host nesting success and productivity.

Spot Mapping Study: Because no burning has taken place on the treatment plots, results from this study are preliminary. However, in addition to 2 years of baseline data on all plots, we were able to collect one year of data on plots that were thinned as well as two control plots. Data collection on all plots and final analysis of the data will occur once treatment is complete on all treatment plots.

We found that species richness shifted dramatically in the two thinned plots in comparison to the control plots (Figure 3). Before treatment, species richness was significantly lower in untreated plots than in control plots (p= 0.04) and following thinning in treatment plots, species richness was similar between treatment and control plots (p= 0.25). This suggests that thinning has been successful in creating a habitat more like the control

plots which provide habitat for a wider range of species. Additional comparison will be made following treatment of all treatment plots and the implementation of controlled burns on burn treatment plots.

Table 10: Birds detected using passive auditory surveys within 50 meters of plot center for control (n =17) and thinned (n = 20) plots in Ponderosa pine forests on OSMP during 2007-08.

Common Name	Scientific Name	Control	Thinned
American Crow	*Corvus brachyrhynchos*	1	
American Goldfinch	*Carduelis tristis*	1	1
American Kestrel	*Falco sparverius*		1
American Robin	*Turdus migratorius*	16	55
Barn Swallow	*Hirundo rustica*		1
Blue-gray Gnatcatcher	***Polioptila caerulea***		3
Brown-headed Cowbird	*Molothrus ater*	5	6
Black-headed Grosbeak	*Pheucticus melanocephalus*		1
Blue Jay	*Cyanocitta cristata*		3
Broad-tailed Hummingbird	*Selasphorus platycercus*	34	58
Cassin's Finch	*Carpodacus cassinii*	1	2
Cedar Waxwing	*Bombycilla cedrorum*		3
Chipping Sparrow	*Spizella passerina*	37	108
Cordilleran Flycatcher	*Empidonax occidentalis*	1	1
Common Grackle	*Quiscalus quiscula*		5
Cooper's Hawk	***Accipiter cooperii***		2
Common Raven	*Corvus corax*	2	1
Dark-eyed Junco	*Junco hyemalis*	25	18
Dusky Flycatcher	*Empidonax oberholseri*	4	46
Eastern Bluebird	*Sialia sialis*	1	3
Hammond's Flycatcher	*Empidonax hammondii*	2	4
Hairy Woodpecker	*Picoides villosus*	7	23
Hermit Thrush	*Catharus guttatus*		1
House Finch	*Carpodacus mexicanus*	1	9
House Wren	*Troglodytes aedon*	10	39
Lazuli Bunting	***Passerina amoena***		2
Lesser Goldfinch	*Carduelis psaltria*	12	38
Long-eared Owl	***Asio otus***	3	
Mallard	*Anas platyrhynchos*	4	
Mountain Bluebird	***Sialia currucoides***		2
Mountain Chickadee	*Poecile gambeli*	28	48
Mourning Dove	*Zenaida macroura*	19	35
Northern Flicker	*Colaptes auratus*		4
Olive-sided Flycatcher	***Contopus cooperi***		1
Pine Siskin	*Carduelis pinus*	13	61
Plumbeous Vireo	*Vireo plumbeus*	10	50
Pygmy Nuthatch	***Sitta pygmaea***	75	109
Red-breasted Nuthatch	*Sitta canadensis*		5
Red Crossbill	*Loxia curvirostra*	10	28
Rock Wren	*Salpinctes obsoletus*	1	
Red-tailed Hawk	*Buteo jamaicensis*		1
Spotted Towhee	*Pipilo maculatus*	7	25

Steller's Jay	*Cyanocitta stelleri*	10	6
Townsend's Solitaire	*Myadestes townsendi*	8	3
Violet-green Swallow	*Tachycineta thalassina*		30
Virginia's Warbler	***Vermivora virginiae***	1	
Warbling Vireo	*Vireo gilvus*	1	1
White-breasted Nuthatch	*Sitta carolinensis*	6	24
Western Bluebird	***Sialia mexicana***	3	13
Western Tanager	***Piranga ludoviciana***	17	30
Western Wood-Pewee	*Contopus sordidulus*	11	37
Wilson's Warbler	*Wilsonia pusilla*		1
Yellow-breasted Chat	*Icteria virens*		1
Yellow-rumped Warbler	*Dendroica coronata*	7	19

*** Species in bold are nested targets**

Accipiter Surveys

Background and Methods

As part of the initial stages of the West TSA process a list of nested targets was created to identify rare and sensitive species that occur in the forests of OSMP. The Northern Goshawk is considered a sensitive species by the US Forest Service and vulnerable ("S3B") by the Colorado Natural Heritage Program. OSMP identified this species as a nested target and indicator species in the West TSA Plan. Thus, it is important for OSMP to locate potential breeding areas for recreational management plans such as Trails Study Areas. While some Cooper's Hawks and Sharp-shinned Hawks have shown an ability to adapt to human use, to fully protect these birds, actions should be taken to route human use away from known nesting sites. Accipiter surveys have not been conducted in the mountain backdrop since 1989. Therefore, current information on the presence and distribution of these species was the focus of 2008 surveys in the TSA.

The accipiter surveys followed methodologies described in Woodbridge and Hargis (2006) and Kennedy and Stahlecker (1993). Call stations were located 200 m apart along each transect and simultaneous surveys were conducted no closer than two transect widths apart to avoid identifying broadcasts from other surveyors. To elicit an accipiter response, staff broadcasted the Northern Goshawk juvenile begging call as well as the adult wail call using Sony SRS-A27 amplified speakers set to broadcast 110 dB at 1 meter distance. Staff did not survey under conditions such as high winds (greater than 15 mph) or rain that reduced ability to detect accipiter responses. Surveys began half an hour before sunrise and ceased half an hour before sunset.

When staff detected an accipiter, they attempted to locate the accipiter visually and determine the species and age (adult versus juvenile) of the responding individual. Staff also recorded compass bearing of any individual leaving the station to aid in locating potential nests.

Results and Discussion

OSMP staff surveyed six drainages at least once from 25 July to 5 August in 2008. Staff surveyed Gregory Canyon, Flagstaff, and Panther Canyon twice and Lost Gulch, North Draw, and Aspen Canyon once (Map 17). The latter areas were only surveyed once because ERO performed the other survey as part of the West TSA inventory process.

OSMP staff (as well as ERO) conducted accipiter surveys during late July and early August. This surveying timeframe was chosen to improve detectability of successful accipiter breeding attempts (juveniles and fledglings will often respond to broadcasts if present in the area). Staff detected two adult and two juvenile Cooper's Hawks and one juvenile Northern Goshawk during broadcast surveys in 2008. In Lost Gulch, staff located two Cooper's Hawk nests where successful breeding had taken place. In Aspen Canyon, staff observed two Cooper's Hawk fledglings close to a nesting site, although the use of this nest could not be confirmed. A juvenile Northern Goshawk responded to broadcasts at two stations in the Flagstaff study area on 27 July, but this individual was not detected during a subsequent survey. Thus, this individual may not have been resident or breeding but rather simply moving through the area.

While surveys conducted during late summer can detect successful accipiter nesting attempts, they do not provide any information on non-successful breeders. To learn more about the site choice and distribution of these individuals, dawn acoustical surveys (conducted in spring) are recommended. Increasing the number of dawn acoustical surveys may provide a more complete view of accipiter use of OSMP forests as well as identify some of the causes of nesting failures. Because it was evident that most of the successful breeding areas were located in areas with low human use, locating nesting attempts may help OSMP to manage for these species more effectively in the future.

Forest Owl Surveys

Background and Methods

The Flammulated owl is cavity-nesting species dependent on snags and mature mixed-conifer forest. It is considered a management indicator species for the US Forest Service and has been identified as a species of interest for future revisions of OSMP's Forest Ecosystem Management

Plan and a nested target in OSMP forests. Although Boulder County Audubon occasionally surveys for Flammulated Owls in Long Canyon, this species has not been formally surveyed for in OSMP forests for 20 years.

The forest owl surveys followed methods outlined by Cilimberg (2007). Staff used a stratified random sampling design to place call stations in good owl habitat. Broadcast stations (i.e., points) were located ≤ 500 m from each other, depending on terrain. Staff spent 10 minutes listening and calling for owls at each point. Surveying time was separated into five sections: two minutes of silent listening, 1 minute of broadcast calling, 3 minutes of post-broadcast listening, 1 minute calling, 3 minutes listening. For the 1 minute of broadcasting, staff played 15 seconds of a Flammulated Owl call series with caller pointed in each cardinal direction. Surveys were not conducted in poor weather (high wind, continuous rain, etc.). Surveys began approximately 15 minutes after published sunset and continued until the requisite stations had been surveyed.

Results and Discussion

In 2008, staff surveyed 26 stations in four drainages on three survey nights from 30 July to 13 August (Map 17). Staff detected Flammulated Owls on all three survey nights and recorded owl responses at eight stations. However, it was noted that one bird may have been detected at two stations and thus should only be counted once. Surveys in Gregory, Aspen/Shadow, and Panther Canyons produced three, three, and one Flammulated Owl responses, respectively. Staff also detected a Long-eared Owl in Shadow Canyon on 31 July.

Flammulated owl responses to con-specific playback may not be a reliable indicator of breeding because males will still call even if they have not found a mate. In some instances, the female will also respond, which increases the probability that breeding activity exists. This indicated one pair nesting in Shadow Canyon for the past three years, although a nest site has not been located. OSMP's forests are snag-deficient and this may be a limiting factor in Flammulated Owl abundance and distribution. To alleviate this, the revised FEMP should include measures to create more snags, as well as explore the possibility of installing artificial nest boxes in good owl habitat.

Cliff-nesting Raptor Monitoring

Background and Methods

Along the Front Range, cliff-nesting raptors are being adversely affected by habitat loss and disturbance to nesting sites and foraging areas. OSMP

manages for three cliff-nesting raptor species — Golden Eagle, Peregrine Falcon, and Prairie Falcon. All three of these species are either considered sensitive by federal agencies or rare by local organizations. In addition, all three species are protected by the Federal Migratory Bird Treaty Act and Golden Eagles are protected by the Federal Eagle Protection Act. OSMP staff identified these species as nested targets in the West TSA Plan and chose Prairie Falcons as a wildlife indicator species in the planning process. To minimize disturbance to these breeding birds, OSMP has established seasonal access restrictions to cliffs that are chosen as nest sites (Map 17).

Restrictions have been in effect since the mid 1980s and have generally been recognized and supported by OSMP visitors. Instituting these protective measures at nesting sites as well as managing for natural areas, which provide foraging opportunities for raptors, has helped OSMP maintain the densest breeding population of cliff-nesting raptors along the Front Range. The development of a volunteer raptor monitoring program in the 1990s has helped to record accurate data on breeding success and productivity and the program currently stands out as one of OSMP's most successful volunteer efforts.

Nest sites are monitored throughout the season using spotting scopes and binoculars to determine nesting success and productivity. Nestlings are assumed to be fledged after attaining 80% of their fledging age. This age differs between species. Closures are lifted when monitoring indicates that the fledglings have left the nest and are no longer susceptible to disturbance.

Results and Discussion

In 2008, there were seven nesting attempts by three species. All breeding attempts were successful. However, one nesting territory remained occupied without a nesting attempt (3rd Flatiron, occupied by Peregrine Falcons). In total, three Prairie Falcon pairs produced 15 fledglings, two Golden Eagle pairs fledged three young, and two Peregrine Falcon pairs fledged three young.

During the same year, 49 volunteers logged 587 site visits equaling ≥ 1,800 hrs of volunteer raptor monitoring. One new Golden Eagle nesting site was confirmed in 2008 and fledged one nestling. An additional Golden Eagle nesting site was suspected and this area was protected seasonally in 2009.

Known breeding attempts by cliff-nesting raptors on OSMP were distributed with similar density as those in the internationally-recognized Snake River Birds of Prey National Conservation Area (SRBOPNCA) in

southern Idaho. On the Snake River, Golden Eagles and Prairie Falcons nested as dense as 1 pair per 5-8 km and 1 pair per 2 km of river, respectively. On OSMP property in 2008, eagles and falcons nested as dense as 1 pair / 4 km and 1 pair / 2 km, respectively.

From 2000-2008, cliff-nesting raptors on OSMP have experienced high nesting success and productivity levels (Table 11), especially those choosing sites within the West TSA (Table 12). As a comparison, Steenhof (1998) recorded a 64% nesting success rate and 2.5 fledglings per nesting attempt during a long-term study (n = 573 broods) of Prairie Falcons in the SRBOPNCA. Kochert et al. (2002) calculated a 60% nesting success rate, which yielded 1.6 fledglings per attempt during a 23 year long study on Golden Eagles in the SRBOPNCA. White et al. (2002) collated breeding data on Peregrine Falcons from 6 US states and found a 75% nesting success rate and 1.5 fledglings per nesting attempt.

Importantly, breeding parameters (nesting success and productivity) of these three species on OSMP exceeds those published elsewhere in protected and semi-protected natural areas. Management actions aimed to protect nesting raptors as well as their foraging areas should be continued in the future to maintain these reproductive levels.

Table 11. Mean nesting success and productivity (# of fledglings / nesting attempt [n]) for cliff-nesting raptor species on OSMP from 2000-2008.

	2000-2008		
	n	Nesting Success (%)	Productivity
Prairie Falcon	34	88	3.15
Peregrine Falcon	19	84	2.32
Golden Eagle	18	78	1.05

Table 12. Breeding parameters for three cliff-nesting raptor species by site in the West Trail Study Area of OSMP, 2000-2008.

Site	2000-2008			
	Species	n	Nesting Success (%)	Productivity
Gregory Amphiteater	Falcon	3	67	2.67
Bear Creek Spire	Falcon	9	100	4.22
Fern Canyon	Falcon	9	78	2.11
Flagstaff	Eagle	1	100	1
Mickey Mouse Wall	Falcon	8	88	2
Mt. Sanitas	Falcon	6	100	4.17
Shadow	Falcon	11	91	2.73
Skunk	Eagle	8	100	1.38
3rd Flatiron	Falcon	7	71	2.14

Northern Leopard Frog Monitoring

Background and Methods

The decline of northern leopard frogs (*Rana pipiens*) has been documented throughout the Western United States and Canada (Smith and Keinath, 2007). Despite the lack of federal protection status, many states in the Western U.S. have listed the northern leopard frog as endangered or of special concern. The Colorado Division of Wildlife has listed this frog as a "species of special concern".

Leopard frog populations on City of Boulder Open Space and Mountain Parks (OSMP) property face similar threats that affect many other Western U.S. populations. The most apparent threats are habitat loss and destruction, disease, and predation from non-native species. Habitat degradation can arise from: reduced shoreline vegetation and shoreline erosion by cattle, dogs and humans, and grassy vegetation reduction from competition with Russian olive and cattails. Further threats to northern leopard frog populations include bullfrogs and introduced predaceous fish such as trout, largemouth bass, common carp, and sunfish. These species prey on leopard frog larvae, eggs, and adults, as well as compete with leopard frogs for resources.

To learn more about the abundance and distribution of this frog and others on OSMP, staff and volunteers began to survey wetlands and other wet areas throughout the grasslands and foothills in spring 2006 using visual encounter surveys. Upon arriving at a survey site, the individual established a starting point to begin the survey. The surveyor would then slowly walk the perimeter of the wetland, searching for and recording any amphibian species that were found. Special attention was paid to areas of high quality habitat (low emergent vegetation or floating algae mats) during the survey. Staff and/or volunteers surveyed the site three times, evenly spaced, throughout the season. Volunteers that were involved with the visual encounter surveys were given a morning of field training to aid in the visual identification of local amphibian species. After the survey was complete, all equipment including footwear was disinfected using a 10% bleach solution to minimize the potential for spreading disease between wetlands surveyed.

Results and Discussion

In the West TSA, eight sites were surveyed for Northern Leopard Frogs from 2006-2008 (Map 17). Leopard frogs were observed at one of these sites in 2006 and two of these sites in 2007 (Table 13). Because some of these sites were not sampled every year, determining trends is difficult. The northern leopard frog is a nested target in the draft Grassland

Ecosystem Management Plan and thus this species will continue to be monitored as funding allows. Sites where Northern Leopard frogs are observed should be protected in accordance to strategies outlined in the Grassland Plan.

Table 13: Results of visual encounter surveys for Northern Leopard Frogs in the West TSA. Recorded as presence (1) or absence (0), sites with NA were not sampled in the associated year.

Site Name	2006	2007	2008
Middle/North Fork Junction	NA	0	0
Bluestem Connector	NA	1	0
W. of Lehigh Connector	NA	1	0
N. Watertank	NA	0	0
Neuhauser Pond	1	0	0
Bear Canyon Creek	NA	NA	0
Gregory Canyon Creek	NA	NA	0
Sunshine Canyon	0	NA	NA

Bat Monitoring

Background and Methods

Bats are among the most intensely feared and relentlessly persecuted animals on earth. In North America, nearly 40 percent of all bat species are included on state or federal threatened, endangered, or sensitive species lists or are candidates for listing. Vandalism and repeated disturbance in roosting caves are primary causes for these declines (Western Bat Working Group).

In partnership with the Colorado Division of Wildlife and the Colorado Bat Society, the OSMP bat monitoring program began in 1995 and is overseen by volunteer services, ecological resources staff, and ranger naturalists. There are three main components of the program involving volunteer monitoring efforts, collaboration with professional researchers, and protection efforts through seasonal wildlife closures. On average 20-40 volunteers spend 400 hours/year conducting auditory and visual counts at water holes. Volunteers also perform exit counts at other known roost sites such as the Amphitheatre rock formation. Volunteers and staff monitor wildlife closures for 2 imperiled species, the Fringed Myotis (*Myotis thysonodes*) at Der Zerkle and the Townsend's Big Eared Bat (*Corynorhinus townsedii*) at Harmon and Mallory Caves.

Water Hole Trend Surveys: Bat monitors venture out at dusk to ponds for two hour surveys. They perform auditory and visual population counts for two consecutive nights a month, June through September at 41 possible locations across OSMP property, 7 of which are in the WTSA. Repeated

yearly surveys at traditional sites provide us with trend information and possible warning of changes in activity. However, because not all of the sites were sampled every year, determining trends is difficult for some locations.

Roost surveys: Each year, bat monitors visit 4 known bat roosts of verified species to count actual numbers of bats as they exit roost sites. Seasonal closures of sensitive areas for imperiled maternity colonies are the direct result of observation, monitoring and research. The Department has a good working relationship with climbing and hiking advocacy groups who help ensure that these closures are respected. The cooperation of the public, and the work of volunteer monitors, helps us to protect the bats while they are raising their young.

Results and Discussion

The 2008 sampling of water sources for bats on OSMP properties gives us a 13 year record of data for many of these sites. In 2008, the ratio of captures of adult females (39) and adult males (35) was very close to 50:50. The number of subadults captured (first-year young nearing adulthood) was 12, with 11 of these being females. Generally speaking, our records have been showing a decline in the female/male sex ratio over the years and it was encouraging to see this even ratio in 2008. However, the numbers of nonreproductive females in the Boulder County foothills remains high. Sampling in 2007 marked the highest incidence of nonreproductive females captured in any single season over the last 13 years (52%). 2008 marked the second highest incidence of nonreproductive females with 44%.

In both 2007 and 2008, the *Eptesicus fuscus* (big brown bat) maternity colony abandoned their rock-crevice roost on the ampitheater and the colony fractured into several different roost sites including under a large boulder (R. Adams, pers. comm.).

Table 14: Range of total bats sampled during sampling years at watering holes located in the West TSA

Water Hole Trend Sites	Years Sampled	Range for # of Bats Sampled
Abbey Pond	1996-97,2004	3-268
Bear Pool	1995-96,2004,07,08	1-305
Flagstaff Summit	1995	1-350
Gregory Canyon	1995-96,2001,07,08	0-23
Sanitas Valley	1995,97-99,2008	0-48
Shanahan Pond	1996-97,2003-04,07-08	0-423
Stockton Cabin Pool	1997,2003-04,08	2-765

Table 15: Range of total bats sampled during sampling years at roosting sites located in the West TSA

Roost Sites	Years Sampled	Range for # of Bats Sampled
Amphitheater	2001-04,06-08	2-60
Der Zerkle	2004,06-08	2-266
Harmon Cave	2004,07-08	0-220
Mallory Cave	2004,06-08	3-112

Tallgrass West Bird Monitoring

Background and Methods

Tallgrass West (area of grassland habitat west of Hwy 93 between Shanahan Ridge to north and Eldorado Springs Drive to south) is an area of regional importance characterized by locally rare big bluestem communities that provide habitat for many grassland nesting birds species of conservation concern. This area contains three designated recreational trails and was part of a long term grazing lease for 20 years. To maximize health of the vegetation and wildlife communities, the grazing regime was re-examined and modified in 2005. Following the expiration of the long-term lease in 2006, a new, experimental four-year grazing rotation was put in place. To track changes associated with this grazing change, we began a monitoring project in 2005 to capture the responses of the bird community.

We first stratified the study area on three variables: plant community, grazing regime, and proximity to recreational trails. Plant community categories included riparian, upland, and forest edge. In each of these areas we randomly located points in areas that are grazed, or ungrazed (under the new grazing regime) and near trail (within 50m) and distant from trails (greater than 200m)- recreational stratification is not included in below discussions as sample size is low and changes to recreational use have been minimal over the study period. We established a total of 22 transects distributed among these treatments:

	Riparian		Upland		Forest Edge	
	Near	Far	Near	Far	Near	Far
Grazed	1	1	3	3	3	2
Ungrazed		1	4	3	4	6

Wildlife transects were 200 m long, at least 200 m apart, and either ran parallel to a trail (all near trail transects) or at a 45˚ angle from roads and property lines (far from trail category).

We surveyed birds along each transect twice during each of four breeding seasons (early-June to mid-July, 2005-2008). We used distance sampling (Buckland et al. 1993), which provides estimates of bird densities without assuming all birds have an equal probability of detection or that every bird present during the survey is detected. We recorded all bird species seen or heard along the transect and estimated their distance to the nearest meter, calibrated with a laser rangefinder (Bushnell Corporation, Overland Park, Kansas). We also measured the sighting angle from the transect line with

a large protractor. Sampling occurred between sunrise and 3 hours after sunrise and was not conducted in inclement weather.

Results and Discussion

Due to the preliminary status of the data, full analysis using program DISTANCE has not been completed. For the purposes of this summary, species richness was measured and defined as number of native species. In addition, for examination of grassland specialist species (Grasshopper Sparrow, Lark Sparrow, Savannah Sparrow, Vesper Sparrow, Western Meadowlark), we calculated relative abundance as defined by average number of individuals of each species per transect within a given treatment.

Following completion of the study period (summer 2009 for grazing regime focus), data will be analyzed using the program DISTANCE (Thomas et al. 1998) to generate estimates of bird density (birds per hectare) in each treatment category. First for all species and then for grassland specialists (Grasshopper Sparrow, Lark Sparrow, Vesper Sparrow, Western Meadowlark), we will model a detection function, based on exact distance values, with the robust models suggested by Buckland et al. (2001). We will select the best model based on Akaike's information criterion corrected for small sample sizes (AICc) (Burnham & Anderson 2002) and by inspecting probability density functions and χ^2 goodness-of-fit statistics (Buckland et al. 1993). We will then obtain density estimates in each treatment by re-running the best model for the species of interest and stratifying by treatment. We will perform pair wise comparisons of specific density estimates of interest with a *z* test (Ott & Longnecker 2001). We have established an α of 0.05 *a priori* for all analyses to minimize Type I error.

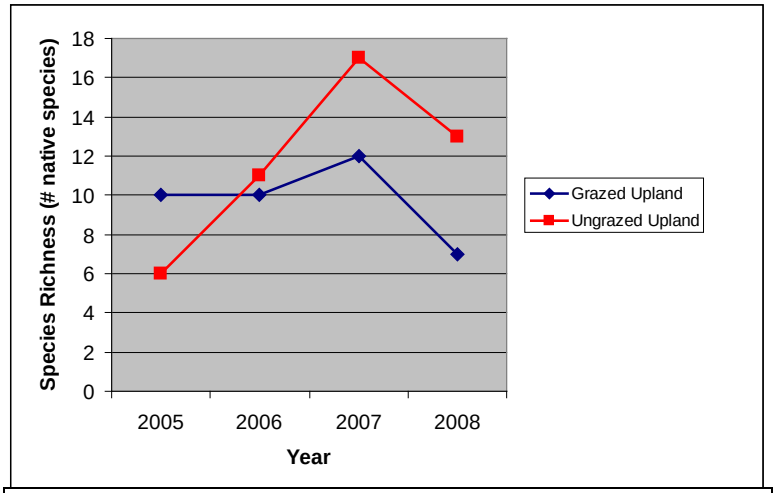


Figure 4. Species richness on grazed and ungrazed upland plots between 2005 and 2008 on Tallgrass West.

Over the four years of study completed, we detected 51 species of birds at our Tallgrass West study sites. Of these, 49 were native and five are considered grassland specialists. Both grazed and ungrazed transects had 41 species detected (grazed = 40 native, ungrazed = 39 native). However, the species detected differed between the two treatments (Table 16). All five grassland specialists were detected at grazed transects and all but Savannah Sparrow were detected at ungrazed transects. Numbers of

detections for Lark Sparrows and Savannah Sparrows were too low to allow further analysis.

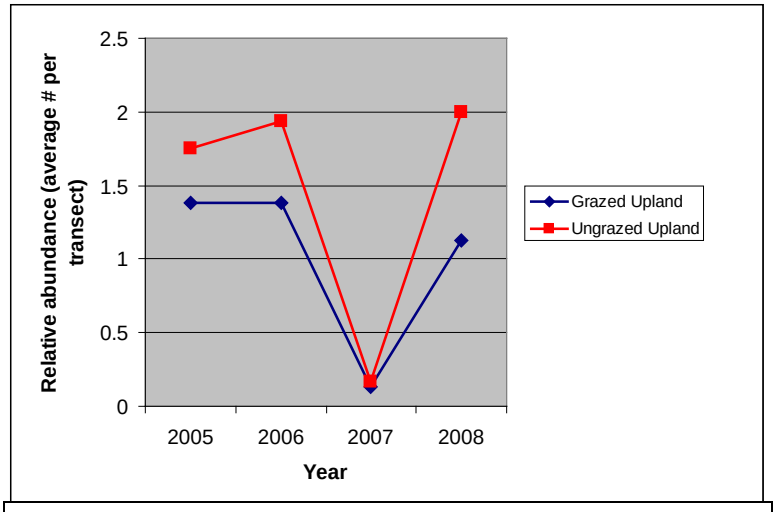


Figure 5. Relative abundance of Grasshopper Sparrows on grazed and ungrazed upland plots between 2005-2008 on Tallgrass West.

Trends when all habitat types were pooled to examine grazed vs. ungrazed transects showed large annual variation and no detectable difference between treatments. This annual variation seems to be responsible for most if not all of the variation in the data. However, examination of grazed upland transects and ungrazed upland transects shows a detectable although not statistically significant (p = .44) trend toward increases in species richness on ungrazed upland plots (Figure 4). Similarly, examinations of individual grassland specialist species show an increasing trend on ungrazed upland transects as compared to grazed upland transects. Of the three species examined, (Grasshopper Sparrow- Figure 5, Vesper Sparrow- Figure 6 and Western Meadowlark- Figure 7), only Grasshopper Sparrow showed a marginally significant difference between grazed upland and ungrazed upland transects (p = .077) (Figure 5). It should be noted that ungrazed upland plots had more Grasshopper Sparrow detections prior to a shift in grazing regime (2005). As discussed in relation to combined analysis of all three habitat types, annual variation within the species numbers was quite high, making it difficult to detect any significant trends in response to grazing changes.

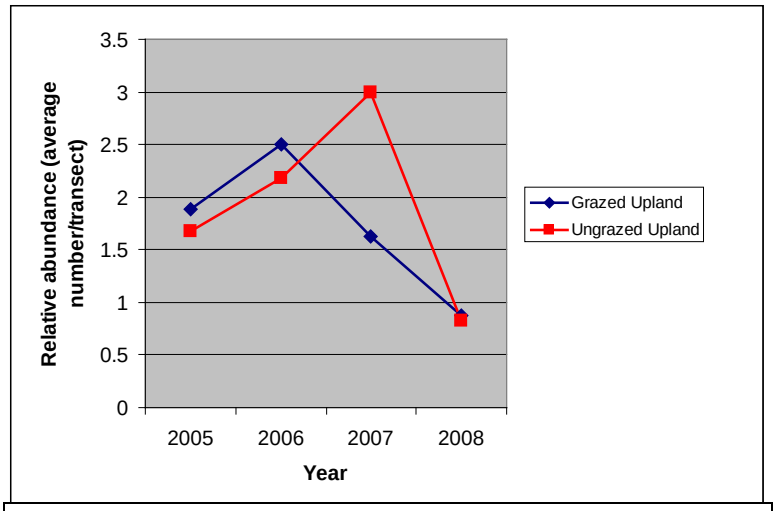


Figure 6. Relative abundance of Vesper Sparrows on grazed and ungrazed upland plots between 2005-2008 on Tallgrass West.

Trends related to shifts in grazing regime were weak, although when we focused on upland habitats only, indications of increased species richness and abundance of grassland specialists existed, although significance in these trends was only detected for Grasshopper Sparrow. Low sample sizes make it difficult to detect significance with 4 summers of data (3 since changes in grazing took place). We will re-analyze the data using more sensitive statistical tests and metrics (density) following completion of the full study (2009).

Annual variation in numbers of individuals within a species suggest that changes from year-to-year unrelated to grazing management of the area may make it difficult to detect trends over a relatively short study timeframe (4 years). Longer-term datasets may be necessary to detect any trends above the annual variation that exists. In addition, it is likely that habitat changes resulting from grazing regime shifts are likely to take some time to affect meaningful changes to the vegetation community and nesting habitat available to ground nesting birds. As a result, following completion of the initial study phase (2009), we will continue to monitor birds in the area on a periodic basis (perhaps every 2-3 years if feasible) to examine longer term trends in numbers resulting from changes in grazing and potential future shifts in recreation.

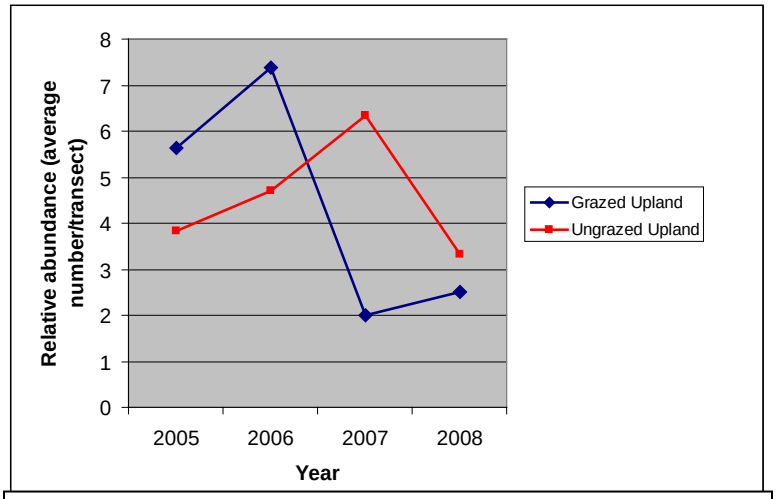


Figure 7. Relative abundance of Western Meadowlarks on grazed and ungrazed upland plots between 2005-2008 on Tallgrass West.

Recreation (near vs. far from trail) will be included as a variable in future analysis of the data. This may provide additional insight to the bird community present, and their response to grazing changes. In addition, our data provide a bird community baseline that compliments previous studies done in the area (Bock et al. 1999, Bock 2000, Bock unpublished data, Haire et al. 2000) that can be used to detect future changes in the bird community related to habitat management, grazing management and recreational use.

Table 16. Common name, scientific name and presence/absence of birds detected using distance sampling along transects in grassland habitats of tallgrass west on OSMP during 2005-08.

Common Name	*Scientific Name*	Grazed Transects	Ungrazed Transects	Grazed Upland	Ungrazed Upland
American Goldfinch	*Carduelis tristis*	X	X		X
American Kestrel	*Falco sparverius*	X	X	X	X
American Crow	*Corvus brachyrhynchos*	X		X	
American Robin	*Turdus migratorius*	X	X	X	X
Barn Swallow	*Hirundo rustica*	X	X	X	X
Black-billed Magpie	*Pica pica*	X	X	X	X
Black-capped Chickadee	*Parus atricapillus*	X			
Blue-gray Gnatcatcher	*Polioptila caerulea*	X	X		X
Brown-headed Cowbird	*Molothrus ater*	X	X	X	X
Brewer's Blackbird	*Euphagus cyanocephalus*	X	X	X	X
Blue Jay	*Cyanocitta cristata*	X		X	
Broad-tailed Hummingbird	*Selasphorus platycercus*	X	X		X
Chipping Sparrow	*Spizella passerina*	X	X	X	X
Cliff Swallow	*Hirundo pyrrhonota*	X	X	X	
Common Grackle	*Quiscalus quiscula*	X	X	X	
Common Nighthawk	*Chordeiles minor*	X	X	X	X
Common Raven	*Corvus corax*	X	X		
Downy Woodpecker	*Picoides pubescens*		X		
European Starling*	*Sturnus vulgaris*	X	X	X	X
Grasshoppper Sparrow**	*Ammodramus savannarum*	X	X	X	X

Great-Horned Owl	*Bubo virginianus*		X		X
House Finch	*Carpodacus mexicanus*	X	X		X
Lark Sparrow**	*Chondestes grammacus*	X	X		X
Lesser Goldfinch	*Carduelis psaltria*	X	X		
Mourning Dove	*Zenaida macroura*	X	X		X
Mountain Chickadee	*Poecile gambeli*	X	X		
Northern Flicker	*Colaptes auratus*		X		X
Plumbeous Vireo	*Vireo plumbeus*	X			
Pygmy Nuthatch	*Sitta pygmaea*	X			
Red Crossbill	*Loxia curvirostra*	X			
Rock Dove*	*Columba livia*		X		X
Red-tailed Hawk	*Buteo jamaicensis*	X		X	
Red-winged Blackbird	*Agelaius phoeniceus*	X	X	X	
Savannah Sparrow**	*Passerculus sandwichensis*	X		X	
Spotted Towhee	*Pipilo maculatus*	X	X		X
Steller's Jay	*Cyanocitta stelleri*	X	X		
Scrub Jay	*Aphelocoma coerulescens*	X			
Swainson's Hawk	*Buteo swainsoni*		X		
Turkey Vulture	*Cathartes aura*	X	X		
Vesper Sparrow**	*Pooecetes gramineus*	X	X	X	X
White-breasted Nuthatch	*Sitta carolinensis*		X		X
Western Kingbird	*Tyrannus verticalis*	X	X	X	X
Western Meadowlark**	*Sturnella neglecta*	X	X	X	X
Western Wood-pewee	*Contopus sordidulus*	X	X		
Yellow-breasted Chat	*Icteria virens*	X	X		
Bullock's Oriole	*Icterus bullockii*	X	X		X
House Wren	*Troglodytes aedon*		X		X
Lazuli Bunting	*Passerina amoena*		X		X
Mountain Bluebird	*Sialia currucoides*		X		X
Violet-green Swallow	*Tachycineta thalassina*		X		X
Western Tanager	*Piranga ludoviciana*	X			

Species in bold are forest or grassland nested targets
* non-native species ** ground nesting grassland specialist

Appendix B: Rare Plants and Vegetation Communities

Rare and Sensitive Vegetation

Top: White adders-mouth orchid (*Malaxis monophyllos ssp. brachypoda*)

Middle: Birds-foot violet (*Viola pedatifida*)

Bottom: Dwarf leadplant (*Amorpha nana*)

One of the City of Boulder's Open Space and Mountain Parks Department (OSMP) charter purposes is the preservation of rare and sensitive native plant species. In order to achieve this objective, staff must maintain current and accurate information on the location, distribution, ecology, and conservation status of these species.

The Colorado Natural Heritage Program (CNHP) has developed state conservation status ranks (S-Ranks) to best characterize the relative rarity or endangerment of a species or community element within the state. These assessments provide an estimate of extinction risk on a scale of one to five, where S1 rankings indicate critical imperilment and S5 rankings signify the species is demonstrably secure. All pertinent factors, including abundance, distribution, short- and long-term population trends, environmental specificity and range extent, and threats may be used to assign this ranking . Likewise, OSMP Plant Ecologists used similar quantitative and qualitative factors to identify additional sensitive species.

Previously documented rare plant species locations are inventoried on a regular basis across the OSMP system using a standardized methodology. Staff has determined that all known subpopulations should be resurveyed every 5 years to best maintain accurate resource information. Surveys for additional rare plant occurrences are conducted in conjunction with routine inventories, or as part of specific projects. Newly discovered rare plant occurrences are added to the OSMP GIS rare plant database and the regular monitoring cycle.

During each rare plant field survey a GPS unit is used to record a number of characteristics about the subpopulation. The surveys are intended to provide a snapshot in time and allow staff to track occurrence size, general habitat characteristics, demographic information, and threats to each subpopulation. The following characteristics are recorded for each occurrence during the surveys:

- Species
- Dimensions of the subpopulation
- Number of individuals
- Life stage
- Plant distribution within the area
- Soil conditions
- Associated species
- Threats to the subpopulation

Rare plant communities are mapped on OSMP as part of the Vegetation Mapping project following the standards and methodology detailed in the

International Vegetation Classification system (Grossman et al. 1998). All plant communities on OSMP are mapped to a minimum mapping unit of a tenth (to a quarter) of an acre at the alliance or finer-scale association level within the classification hierarchy. Rare vegetation types are those associations that have been evaluated and subsequently ranked by CNHP as S1 to S3, indicating they are critically imperiled to vulnerable. Within the forested areas of OSMP, rare vegetation associations may not be identified because OSMP mapping is done to the alliance level, which focuses solely on the dominant or diagnostic tree species in the uppermost stratum. Additional diagnostic species in the understory strata necessary for association level classification weren't always detailed in the mapping effort. Therefore, while many of the associations listed in the forest nested target list could be expected on the OSMP system, only the rare vegetation associations in table14 have been officially mapped on the system.

Map 3 displays the rare plant and vegetation types currently mapped in the TSA. For this report, the discrete rare plant locations have been generalized to protect the resources. Individual plant points have been displayed as the polygons of the surrounding vegetation. More precise location data exists for each of the known occurrences and will be used for finer scale planning.

Table 17: Rare plant species currently inventoried in the West TSA

Common Name	Scientific Name	Ranking	Populations**	Subpopulations**	Target
Wright's cliffbrake	*Pellaea wrightiana*	**S2/G5**	**1**	**1**	Cliffs & talus
Grassfern	*Asplenium septentrionale*	**S3S4/G4G5**	**2**	**2**	Cliffs & talus
Weatherby's spikemoss	*Selaginella weatherbiana*	**S3S4/G3G4**	**1**	**1**	Cliffs & talus
Western polypody	*Polypodium saximontanum*	**S3/G3**	**1**	**3**	Cliffs & talus
			5	**7**	
Alaskan orchid	*Piperia unalascensis*	**OSMP**	**1**	**2**	Mixed conifer
Malefern	*Dryopteris filix-mas*	**OSMP**	**1**	**1**	Mixed conifer
Wood lilly	*Lilium philadelphicum*	**S3S4/G5**	**2**	**5**	Mixed conifer
Fairy slipper	*Calypso bulbosa*	**OSMP**	**2**	**3**	Mixed conifer
Pictureleaf wintergreen	*Pyrola picta*	**S3S4/G4G5**	**2**	**10**	Mixed conifer
Spring coralroot	*Corallorhiza wisteriana*	**OSMP**	**1**	**5**	Mixed conifer
			8	**26**	
Birds-foot violet*	*Viola pedatifida*	**S2/G5**	**2**	**20**	Forest openings
Dwarf leadplant*	*Amorpha nana*	**S2S3/G5**	**1**	**22**	Forest openings
Frostweed*	*Crocanthemum bicknellii*	**S2/G5**	**2**	**3**	Forest openings
			5	**45**	
Rocky Mountain sedge	*Carex saximontana*	**S1/G5**	**6**	**9**	Ponderosa pine
Narrow-leaved Milkweed*	*Asclepias stenophylla*	**S2/G4G5**	**5**	**27**	Ponderosa pine
Wavy-leaf stickleaf*	*Nuttallia sinuata*	**S2/G3**	**1**	**5**	Ponderosa pine
			12	**41**	
Sprengel's sedge	*Carex sprengelii*	**S2S3/G5**	**1**	**1**	Riparian
White adders-mouth orchid	*Malaxis monophyllos* ssp. *brachypoda*	**S1/G4**	**1**	**2**	Riparian
Broadlipped twayblade	*Listera convallarioides*	**S2/G5**	**2**	**19**	Riparian
Paper birch	*Betula papyrifera*	**S1/G5**	**1**	**1**	Riparian
Rattlesnake fern	*Botrypus virginianus* ssp. *europaeus*	**S1/G5**	**1**	**1**	Riparian
Wild sarsaparilla	*Aralia nudicaulis*	**OSMP**	**1**	**2**	Riparian
Torrey's sedge	*Carex torreyi*	**S1/G4**	**2**	**2**	Riparian
Snakeroot	*Sanicula marilandica*	**OSMP**	**3**	**3**	Riparian
Carrionflower	*Smilax lasioneuron*	**S3S4/G5**	**5**	**10**	Riparian
Wild hops	*Humulus lupulus* ssp. *americanus*	**OSMP**	**3**	**4**	Riparian
			20	**45**	

***These species primarily occur in the forest/grassland ecotone and could be considered prairie species. To account for occurrences that occur in the forest as well as in the grasslands all subpopulations in the TSA boundary have been grouped into the above targets.**

Ranking Descriptions

The Colorado Natural Heritage Program designates conservation status with a number from 1 to 5, preceded by a letter that reflects the scale of the assessment (**G= global, S= subnational**)

1= critically imperiled

2= imperiled

3= vulnerable to extirpation or extinction

4= apparently secure

5= demonstrably widespread, abundant and secure

OSMP= identified by staff or local experts as sensitive, threatened or declining at a local level or important to the overall integrity of the system (many of these species have yet to be evaluated by CNHP)

**Populations and subpopulations are grouped based on guidelines developed by NatureServe (2004). Populations are all occurrences of a species within a distance of 2 km from each other when suitable habitat is present. Subpopulations are species occurrences within a distance of 50 m

Table 18: Rare vegetation associations currently inventoried in the West TSA

Common Name	Scientific Name	Rank	Acres in the TSA	Target
Douglas-fir / Rocky Mountain Maple Forest	*Pseudotsuga menziesii / Acer glabrum Forest*	**S1/G4?**	**34.2**	Mixed conifer
Quaking Aspen / Beaked Hazelnut Forest	*Populus tremuloides / Corylus cornuta Forest*	**S1/G3**	**0.3**	Mixed conifer
			34.5	
Ponderosa Pine / Sun Sedge Woodland	*Pinus ponderosa / Carex inops ssp. heliophila Woodland*	**S2/G3G4**	**2.1**	Ponderosa Pine
			2.1	
Choke Cherry - (American Plum) Shrubland	*Prunus virginiana - (Prunus americana) Shrubland*	**S3/G4**	**11.0**	Riparian
Douglas-fir / Water Birch Woodland	*Pseudotsuga menziesii / Betula occidentalis Woodland*	**S3/G3?**	**13.9**	Riparian
Eastern Cottonwood - (Peachleaf Willow) / (Coyote Willow, Sandbar Willow) Woodland	*Populus deltoides - (Salix amygdaloides) / Salix (exigua, interior) Woodland*	**S3/G3G4**	**0.8**	Riparian
Ill-scented Sumac Intermittently Flooded Shrubland	*Rhus trilobata Intermittently Flooded Shrubland*	**S2/G2**	**10.1**	Riparian
Narrowleaf Cottonwood / Water Birch Woodland	*Populus angustifolia / Betula occidentalis Woodland*	**S3/G3**	**9.3**	Riparian
Quaking Aspen / Beaked Hazelnut Forest	*Populus tremuloides / Corylus cornuta Forest*	**S1/G3**	**46.5**	Riparian
Quaking Aspen / Rocky Mountain Maple Forest	*Populus tremuloides / Acer glabrum Forest*	**S2/G1G2**	**0.6**	Riparian
Quaking Aspen / Water Birch Forest	*Populus tremuloides / Betula occidentalis Forest*	**S2/G3**	**2.8**	Riparian
Western Snowberry Shrubland	*Symphoricarpos occidentalis Shrubland*	**S3/G4G5**	**7.5**	Riparian
			102.6	
Big Bluestem - Prairie Dropseed Western Foothills Herbaceous Vegetation	*Andropogon gerardii - Sporobolus heterolepis Western Foothills Herbaceous Vegetation*	**S1S2/G2**	**133.6**	Forest openings
Big Bluestem - Yellow Indiangrass Western Great Plains Herbaceous Vegetation	*Andropogon gerardii - Sorghastrum nutans Western Great Plains Herbaceous Vegetation*	**S1S2/G2**	**1.5**	Forest openings
Choke Cherry - (American Plum) Shrubland	*Prunus virginiana - (Prunus americana) Shrubland*	**S3/G4Q**	**13.3**	Forest openings
Ill-scented Sumac Intermittently Flooded Shrubland	*Rhus trilobata Intermittently Flooded Shrubland*	**S2/G2**	**3.4**	Forest openings
Mountain Muhly - Needle-and-Thread Herbaceous Vegetation	*Muhlenbergia montana - Hesperostipa comata Herbaceous Vegetation*	**S1S2/G1G2**	**7.4**	Forest openings
Mountain Muhly Herbaceous Vegetation	*Muhlenbergia montana Herbaceous Vegetation*	**S2? /G3G4**	**2.9**	Forest openings
Mountain-mahogany / Needle-and-Thread Shrubland	*Cercocarpus montanus / Hesperostipa comata Shrubland*	**S2/G2**	**1.3**	Forest openings
Parry's Oatgrass Herbaceous Vegetation	*Danthonia parryi Herbaceous Vegetation*	**S3/G3**	**2.7**	Forest openings
Quaking Aspen / Northern Bracken Forest	*Populus tremuloides / Pteridium aquilinum Forest*	**S3S4/G4**	**0.4**	Forest openings
Western Snowberry Shrubland	*Symphoricarpos occidentalis Shrubland*	**S3/G4G5**	**16.4**	Forest openings
			182.9	
Big Bluestem - Yellow Indiangrass Western Great Plains Herbaceous Vegetation	*Andropogon gerardii - Sorghastrum nutans Western Great Plains Herbaceous Vegetation*	S1S2/G2	**68.1**	Mesic bluestem
			68.1	
Western Wheatgrass - Green Needlegrass Herbaceous Vegetation	*Pascopyrum smithii - Nassella viridula Herbaceous Vegetation*	S2/G3G4	**15.2**	Mixed Grass
Choke Cherry - (American Plum) Shrubland	*Prunus virginiana - (Prunus americana) Shrubland*	S3/G4Q	**1.3**	Mixed Grass
			16.5	

Western Snowberry Shrubland	*Symphoricarpos occidentalis Shrubland*	S3/G4G5	**5.7**	Plains riparian
Ill-scented Sumac Intermittently Flooded Shrubland	*Rhus trilobata Intermittently Flooded Shrubland*	S2/G2	**52.7**	Plains riparian
Choke Cherry - (American Plum) Shrubland	*Prunus virginiana - (Prunus americana) Shrubland*	S3/G4Q	**5.4**	Plains riparian
Eastern Cottonwood - (Peachleaf Willow) / (Coyote Willow, Sandbar Willow) Woodland	*Populus deltoides - (Salix amygdaloides) / Salix (exigua, interior) Woodland*	S3/G3G4	**2.9**	Plains riparian
			66.7	
Emory Sedge Herbaceous Vegetation	*Carex emoryi Herbaceous Vegetation*	S2/G2?	**0.6**	Wetlands
Prairie Cordgrass Herbaceous Vegetation	*Spartina pectinata Western Herbaceous Vegetation*	S3/G3?	**7.0**	Wetlands
Nebraska Sedge Herbaceous Vegetation	*Carex nebrascensis Herbaceous Vegetation*	S3/G4	**4.7**	Wetlands
Western Snowberry Shrubland	*Symphoricarpos occidentalis Shrubland*	S3/G4G5	**2.8**	Wetlands
Clustered Field Sedge Herbaceous Vegetation	*Carex praegracilis Herbaceous Vegetation*	S2/G3G4	**2.3**	Wetlands
			17.4	
Big Bluestem - Little Bluestem Western Great Plains Herbaceous Vegetation	*Andropogon gerardii - Schizachyrium scoparium Western Great Plains Herbaceous Vegetation*	S2/G2?	**14.9**	Xeric tallgrass
Big Bluestem - Yellow Indiangrass Western Great Plains Herbaceous Vegetation	*Andropogon gerardii - Sorghastrum nutans Western Great Plains Herbaceous Vegetation*	S1S2/G2	**164.6**	Xeric tallgrass
Big Bluestem - Prairie Dropseed Western Foothills Herbaceous Vegetation	*Andropogon gerardii - Sporobolus heterolepis Western Foothills Herbaceous Vegetation*	S1S2/G2	**357.0**	Xeric tallgrass
			536.5	

***Ranking Descriptions**

The Colorado Natural Heritage Program designates conservation status with a number from 1 to 5, preceded by a letter that reflects the scale of the assessment (**G= global, S= subnational**)

1= critically imperiled
2= imperiled
3= vulnerable to extirpation or extinction
4= apparently secure
5= demostrably widespread, abundant and secure
an S or G rank followed by a "?" denotes a questionable rank because sufficient information doesn't exist

Appendix C: Priority Weed Species

Non-native Vegetation Mapping

Non-native species pose a significant threat to many natural systems in the West Trail Study Area. Weedy species can out-compete or replace native species, decrease overall native biodiversity, degrade wildlife habitat, change natural fire regimes, and decrease the overall aesthetic value of an area. The management of non-native species on OSMP lands is a key focus of the department and integrated pest management considerations factor into almost all management decisions (Table 19). A key to effective weed management is having accurate and consistent mapping of weed occurrences across the system. The "Coverage of Weeds" map in this appendix is a visual representation of weed densities in mapped areas of the West TSA.

Top: Canada thistle (*Breea arvensis*)

Middle: Jointed goatgrass (*Cylindropyrum cylindricum*)

Bottom: Myrtle spurge (*Tithymalus myrsinites*)

In 2006 staff began mapping weeds across the OSMP system using methods developed by Utah State University and referred to as Rapid Assessment Mapping or RAM. The primary objective of this project is to document the distribution and abundance of targeted invasive non-native plant species across the range of native habitats and areas of management within Boulder OSMP lands. The information from this inventory will be useful in the City's ongoing efforts to improve strategic planning and to increase the effectiveness of field operations associated with invasive plant management and conservation efforts.

Weed mapping in 2008 focused on large portions of the West Trail Study Area in anticipation of the TSA planning process. The 2008 RAM inventory was conducted between June and August. Staffing and timing restrictions limited the amount of mapping that was possible so staff focused efforts on low elevation forest stands along the forest/ grassland edge, and in areas with existing high recreation use and along existing designated and undesignated trails west of the Mesa Trail. The lower grasslands in the TSA, south of Shanahan Ridge, were mapped in 2006 in advance of planning efforts for the Grassland Management Plan. Additional portions of the forested areas of OSMP will be mapped during the 2009 field season. Much of this work will focus on the denser, mixed conifer forests that have yet to be inventoried.

Field searches were conducted at the finest scale required to be confident that 90 percent or more of all targeted invasive plant infestations 0.01 acre or larger within the inventory area were detected. Mapping consisted of walking transects from one side of a property to the other covering the entire unit. Transect swaths varied in width based on topography, vegetation cover, and target species. Widths ranged from less than 25 meters in denser riparian areas to 100 meters in open grasslands. All designated trails and some undesignated trails west of the Mesa Trail were surveyed for 50 meters on each side to get a quick assessment of weed occurrences along existing trails. Geo XT GPS units were used to navigate along inventory transects and to collect data related to each weed occurrence using a RAM specific data dictionary. For each weed patch the staff member recorded the species name, size of the infestation, and a percent cover in five categories ranging from a trace (less

than one percent) to a majority (51%-100%). Scattered patches separated by less than 50 meters were considered one distinct patch.

Map 2 displays a weighted density of all the RAM weed inventory data currently completed on the OSMP system. To account for the size of the infestation and the percent cover an importance value, or weight, was assigned to each mapped weed occurrence. The importance value was calculated as acreage multiplied by percent cover and then multiplied by a constant value to assure all cells had an integer value. The density analysis was performed using a 500 foot search radius to obtain the value of each cell in the map. The spectrum of low to high weed densities on the map represents areas with increasingly higher non-native cover and larger infestation sizes. The density could be attributed to one individual species or a combination of multiple species occurrences. It's important to note that this map displays all the RAM data collected to date. Large portions of the WTSA are still to be mapped and will be a focus in the upcoming field season. Current indicator conditions are based on the best available data and may change as additional mapping is completed.

Table 19: OSMP priority non-native species list

SPECIES			Associated Habitats											
			FOOTHILLS						PLAINS					
Designation	Common Name	Scientific Name	Forest / Woodland	Shrubland	Grassland	Riparian / Wetland / Aquatic	Forest / Grassland Interface	Grassland/ Forest Edge	Shrubland	Native Grassland	Non-Native Grassland	Restoration Areas	Riparian / Wetland / Aquatic
OSMP	Absinth wormwood	*Artemisia absinthium*	M										
OSMP	Bladder senna	*Colutea arborescens*	M	M	M		M						
B	Bouncing bet	*Saponaria officinalis*	L		L	M	M					L	L
B / OSMP	Buckthorn	*Rhamnus cathartica*	L	H		H	M						
B	Canada thistle	*Breea arvensis*	L	M	M	M	L			M	H	H	H
C	Cheat grass	*Anisantha tectorum*	M	L	H	L	L		L	M	M	M	H
B	Common tansy	*Tanacetum vulgare*											M
B	Common teasel	*Dipsacus fullonum*				M	L					H	H
OSMP	Crown vetch	*Securigera varia*			L		M						M
B / OSMP	Cut-leaf teasel	*Dipsacus laciniatus*					L						H
B	Dalmatian toadflax	*Linaria genistifolia*	L	L	M		H			H	L		L
B	Dame's rocket	*Hesperis matronalis*				H							M
B	Diffuse knapweed	*Acosta diffusa*	M	L	M	L	M		M	H	H	H	L
B	Eurasian watermilfoil	*Myriophyllum spicatum*											H
	Garlic Mustard	*Alliaria petiolata*				M							M
B	Hoary cress	*Cardaria draba*								L	H	M	M
B	Houndstongue	*Cynoglossum officinale*	L	L	L	M	L			L	L	L	L
	Japanese knotweed	*Reynoutria japonica*									M		H
C	Jointed goatgrass	*Cylindropyrum cylindricum*	H		H		H			H		H	
B	Leafy spurge	*Tithymalus uralensis*	H		H		H						
A	Mediterranean sage	*Salvia aethiopis*					**H**			**H**		**H**	
B	Musk thistle	*Carduus nutans*	L	L	L	L	L			L	M	L	L
A	Myrtle spurge	*Tithymalus myrsinites*	**H**	**H**	**H**		**H**			**H**			**H**
A	Orange hawkweed	*Hieracium aurantiacum*	**H**										
B	Oxeye daisy	*Leucanthemum vulgare*									H		H

B	Perennial pepperweed	*Cardaria latifolia*					L					L	M	M
OSMP	Perennial sweetpea	*Lathyrus latifolius*		M	H	M	M							L
A	Purple loosestrife	*Lythrum salicaria*				**H**								**H**
OSMP	Queen of the Meadow	*Filipendula ulmaria*												H
B	Russian knapweed	*Acroptilon repens*					L				H	H		
B	Russian olive	*Elaeagnus angustifolia*				H	L			H	L	L	H	
B	Scotch thistle	*Onopordum acanthium*					M			M	M	H	M	
OSMP	Smooth brome	*Bromopsis inermis*	M	M	H	H	H			L		M	H	
B+	Spotted knapweed	*Acosta maculosa*	**H**								**H**			
B	Sulfur cinquefoil	*Potentilla recta*	M	L	H	M	H			H		H	M	
OSMP	Tall oatgrass	*Arrhenatherum elatius*			H		H							
B+	Tamarisk	*Tamarix ramosissima*									**H**	**H**	**H**	
OSMP	White campion	*Melandrium dioicum*			L		L						H	
B	Yellow toadflax	*Linaria vulgaris*	M		M	H	M			M	H		M	

H	= **HIGH** priority as designated by State of CO as List A or B+
H	= **HIGH** priority per OSMP
M	= **MODERATE** priority per OSMP
L	= **LOW** priority per OSMP

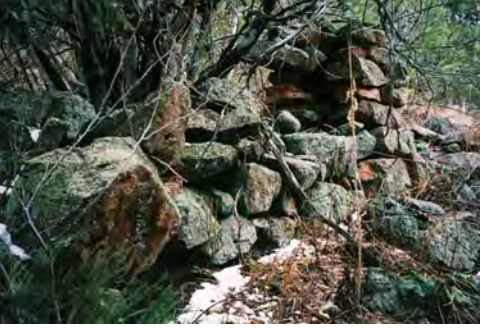
	= ignore; species not known or expected in this habitat
	= Watch out; may be on the way and we should be looking for it in these habitats

State Noxious Weed Designations

List A Species- Designated by the CO Department of Agriculture for eradication

List B Species- are species for which the Department of Ag, in consultation with the state noxious weed advisory committee, local governments, and other interested parties, develops and implements state noxious weed management plans designed to stop the continued spread of these species. Species designated as "B+" are targeted for eradication on OSMP lands.

List C Species- are species for which the Department of Ag, in consultation with the state noxious weed advisory committee, local governments, and other interested parties, will develop and implement state noxious weed management plans designed to support the efforts of local governing bodies to facilitate more effective integrated weed management on private and public lands. The goal of such plans will not be to stop the continued spread of these species but to provide additional education, research, and biological control resources to jurisdictions that choose to require management of List C species.



City of Boulder
Open Space and Mountain Parks

West Trail Study Area
Cultural Resource Inventory Report

Final Draft
August 2009

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Appendix A: Colorado Management Data Survey Form

Map 1: Historic Structures

List of Acronyms

BSOs Buildings, Structures, or Objects
BRC Boulder Revised Code
CCC Civilian Conservation Corps
COB City of Boulder
CRM Cultural Resource Management
MOU Memorandum of Understanding
NHRP National Register of Historic Places
OSMP Open Space and Mountain Parks
TSA Trail Study Area
UTC United Tribes of Colorado
VMP Visitor Master Plan

Introduction

People have lived on and enjoyed the lands of Open Space and Mountain Parks (OSMP) West TSA for thousands of years. Their stories and the evidence they've left behind are what Cultural Resources is all about. Cultural Resources promotes the study and appreciation of people through the ages and their effect on the land as well as the preservation of historic structures and archaeological sites. Cultural Resources also includes the study of paleontology, which includes organic and mineralized remains of prehistoric life. This wide variety of resources creates a fascinating backdrop for people who enjoy the lands of the West TSA. The cultural resource inventory is composed of four categories:

- Paleontological Sites and Features
- Aboriginal Archaeological Sites
- Historic Archaeological Sites
- Historic Buildings, Structures and Objects (BSOs)

The information for the aboriginal and historical archaeological sites and historic buildings, structures and objects was derived from inventories/studies done in 1993, 1995 and 1998. These inventories include

- Cultural Resource Inventory of the Contiguous Boulder Mountain Parks (95')
- Mount Sanitas and Related Parcels (98')
- Bear Creek to South Boulder Creek (93')

Plans to collect current information on the resources are underway for summer 2009. Therefore, these sections of the inventory contain only brief descriptions, and current conditions are unknown.

Paleontological sites and features include organic and mineralized remains in body or track form. A current paleontological study of the lands of West TSA is currently underway and expected to be complete by the end of August 2009. While we have little information on sites and features in the West TSA, the area represents a wide variety of geologic formations. Within this area, one can observe geologic layers from as long ago as 1.7 billion years ago (Boulder Creek Grandorite) to as young as the Hiobrera formations of Fort Hays limestone and Smoky Hills shale (circa 65 mya). Within those layers, dinosaur footprints, fossils of ripples, worm trails, mollusk and stromatolites have been found on the land that constitutes the West TSA.

Aboriginal archaeological sites include prehistoric and historic sites and artifacts which represent human activity from before history recorded to approximately1600 to 1800 A.D. The oldest artifact found within the West TSA is a Cody Complex arrowhead left by bison hunting peoples. It is between 6 and 7,000 years old. Some hunting blinds in the West TSA may be aboriginal but further research needs to be conducted before we can be certain.

Historical archaeological sites are either where BSOs once stood and are no longer extant or could be present near BSOs that are still extant. They could also be areas where human activity took place, like quarries and mines. There are several sites that are both

archaeological sites and BSOs because both exist at the site. There are some potentially interesting sites within the West TSA, including a Civilian Conservation Corps (CCC) camp, mine pits and quarries as well as homestead trash pits and dumps (known as middens to archaeologists).

Historic Buildings, Structures and Objects (BSOs) are buildings, structures and objects constructed by humans. A building is a resource created principally to shelter any forms of human activity, like a house or barn. A structure is built for purposes other than creating shelter, such as a bridge or rock wall. Historic objects could include, but are not limited to, construction which is primarily artistic in nature or small scale, like a statue or milepost. The West TSA is home to a wide variety of BSOs which tells many stories about the settlement of the area. Some examples include homestead houses that represent our agricultural history like the Dunn House near South Mesa Trailhead and the recreational buildings built by the CCC. Some BSOs are available for use by visitors, like the Sunrise Amphitheatre, constructed by the CCC in 1934 and the Stone Shelter, constructed by the Lions Club in 1933. Some BSOs stand near popular trails and present interesting interpretive opportunities, like the Dunn Homestead (circa 1874), McGilvery (ranch house/summer residence circa 1900) and Schoolmarm's Cabins (summer residence circa 1890-1900).

The inventory also addresses condition of resources and identifies resources within 100 feet of a trail. Conditions of the resources will be classified as they are in the Colorado Management Data Survey Form (Appendix A). Condition assessments are subjective decisions made by the surveyor concerning the general condition of the site. Most sites will be either architectural/structural or archaeological/paleontological. In some cases, for instance where historical archaeology exists near structures, both categories will be rated.

a. Architectural/Structural
- _____ Excellent
- _____ Good
- _____ Fair
- _____ Deteriorated
- _____ Ruins

b. Archaeological/Paleontological
- _____ Undisturbed
- _____ Light disturbance
- _____ Moderate disturbance
- _____ Heavy disturbance
- _____ Total disturbance

Precise definitions and standards for conditions are left to the surveyor on site. Many historic preservationists use the following guidelines when assessing a site's condition:

- Excellent: no repairs needed, perhaps some routine maintenance;
- Good: some minor repairs needed, cleaning and/or maintenance;
- Fair: obvious repairs needed, cleaning and maintenance;
- Deteriorated: anything that has been exposed to the elements and is inferior to the original condition – can be used with any of the terms above to describe specific conditions;
- Ruins: a structure that no longer has a use and will only be preserved "as is."

The condition of archaeological sites is generally based on the amount of loss to the scientific community due to disturbance of a site. For instance, a site with only "light

disturbance" may offer a great deal of information to the researchers, where a site with "heavy" or "total" has probably lost its ability to contribute to scientific research. Resources within 100 feet of a trail have been identified so we can determine if there is an increased risk of deterioration or disturbance of the resource. According to the Visitor Master Plan (VMP), "The 100 feet distance was selected as a "reasonable distance" within which nearby resources were most likely to be affected by visitor use. The distance was arrived at subjectively after assessing a variety of buffer widths." (Review of Cultural Resources, Visitor Plan Development, p. 4). It is hypothesized that resources within 100 feet of a trail or visitor use area are at heightened risk of damage including, but not limited to:

- Paleontological and archaeological sites may incur damage due to trail use, collection or vandalism. For instance, the Antiquities Act of 1906 was enacted because it was discovered that antiquities collectors and dealers were robbing the lands around Mesa Verde and selling their wares all over the world;
- Historic buildings, structures and objects can also be vandalized or destroyed. Most of the buildings and structures on OSMP lands have graffiti or other vandalism to varying degrees. After the Morse Well on Flagstaff Summit was vandalized the City of Boulder closed the well permanently.

Knowing the proximity of a resource to the trail can also assist in developing an interpretive plan for the system. Those resources near trails can be interpreted and enjoyed without necessitating new trails or creating social trails.

Map 1 is of Historic Structures in the West TSA and includes only BSOs. Precise archaeological site locations are not mapped, per the City of Boulder's Memorandums of Understandings with United Tribes of Colorado and State Office of Archaeology and Historic Preservation.

Target: Paleontological Sites and Features

Paleontological sites and features include organic and mineralized remains in body or track form. According to Open Space Long Range Management Policies, (COB OS 1995), paleontological resources will be protected and preserved for educational and scientific purposes in accordance with management plans and scientific research programs. Paleontological resources are also protected under Colorado Statue CRS 24-80-401-411, whereby permits approved by the State Archaeologist are required for the "investigation, excavation, gathering or removal of the natural state of any historical, prehistorical and archaeological resource within the state."

Lyons Sandstone period

Indicator: Undisturbed paleontological sites and features

Indicator Results:

Current conditions are unknown. A paleontological study/inventory of the West TSA will be complete in fall 2009.

Target: Aboriginal Archaeological Sites

Summary Statistics:

Total known aboriginal sites on the system (fee properties): 1
Total known aboriginal sites within 100 feet of visitor infrastructure: 1
(The 100-foot distance was selected as a "reasonable distance" within which nearby resources were most likely to be affected by visitor use.)
Total known aboriginal isolated finds on the system: 13
**From surveys conducted in 1993, 1995 and 1998*

Aboriginal sites include sites and artifacts such as gaming walls and arrowheads. All prehistoric and aboriginal archaeological sites, isolated finds and artifacts are protected by the Memorandum of Understanding (MOU) between OSMP and the United Tribes of Colorado (UTC) adopted in 2002. Further protection of these resources is provided by Colorado Statute CRS 24-80-401-41. They are also protected by City of Boulder Revised Code 5-4-2 which prohibits removal or damage of public property. According to the MOUs with State Office of Historic and Archaeology and United Tribes of Colorado, the locations of aboriginal prehistoric archaeological sites are protected information and cannot be divulged to the public. However, the following information is available. Numbers assigned to sites are "State Site Numbers" assigned by the Colorado Historical Society Office or Archaeology and Historic Preservation.

Bear Creek to South Boulder Creek
Latest inventory completed 1993
5BL3882 One (1) site and **three (3) isolated finds** in the Bear Creek to South Boulder Creek project area are aboriginal prehistoric resources. A lack of diagnostic artifacts prevents their assignment to specific temporal periods. A small corner-notched point is likely from the Ceramic Period, ca. A.D. 1 to 1540, or the Protohistoric/Historic Period, ca A.D. 1600 to 1800. One point dates to the Cody Complex of the Paleo-Indian Period, ca. 6000-7000 B.C. and is particularly interesting in view of its antiquity. There is a distinct possibility that isolated finds identified as hunting blinds may be aboriginal in origin, but further research, including test excavations, must be conducted before determination can be made. Moderate disturbance. Within 100 feet of visitor infrastructure.

OSMP lands were home to aboriginal peoples like Cheyenne and Southern Arapahoe

Contiguous Boulder Mountain Parks
Latest survey conducted 1995
Nine (9) isolated finds in the Boulder Mountain Parks project area were found.

58L4953 is a biface fragment made from a smooth steel-grey chert with white amorphous inclusions. This very fragmented artifact may have been burned or heat treated. The fragment measures 13 mm wide, 17 mm long and 3 mm thick.

5BL4954 is a Late Prehistoric projectile point made from red chert with dark irregular inclusions. The point measures 13.1 mm across the base, 18.2 mm long, and 3.2 mm thick. The base of the point is underground.

5BL4959 is a projectile point made from white mottled chert with macrocrystalline inclusions. This appears to be an archaic point predating A.D. 500.

5BL4962 is a scraper made from a rootbeer-yellow chert with discrete macrocrystalline inclusions. The distal edge of the dorsal surface has been modified.

5BL4960, 5BL4961, 5BL4987 and **5BL4994** are tertiary lithic flakes between1 and 4 cm across. Material types include pink and white chert, red banded quartzite, and red chert. Isolated find BL54960 appears to have been modified or utilized.

5BL5004 is a projectile point located by park visitor in September 1991. The artifact has been identified as a Hog Back Corner-notched point.

Mount Sanitas and Related Parcels
Latest survey conducted 1998
5BL4238 One (1) isolated find, consisting of three fragments of groundstone. All are of pink tabular sandstone (probably Lyons formation) and all show grinding on one side only.

(Target: Aboriginal Archaeological Sites)

Attribute: Lack of human disturbance
Deliberate actions taken by humans, including looting, vandalism and construction can degrade or demolish a site. Depending upon the level of destruction, the potential for scientific research of a site or artifacts can be limited or/and destroyed completely.
Undisturbed: no disturbance
Light disturbance: some partial disturbance has occurred but site is basically in tact
Moderate disturbance: site is partially lost to science but scientific research can still occur
Heavy disturbance: most scientific research potential has been lost
Total: all potential for scientific research has been lost

Indicator: Percentage of sites and isolated finds in undisturbed condition
It is preferable that sites and finds are not disturbed by humans as disturbances degrade resources and deny future generations the opportunity to conduct educational and scientific research. Therefore, the indicator for this target will be the percentage of sites and finds which remain in "undisturbed" condition. Disturbance includes deliberate actions such as looting and construction of trails which may potentially destroy resources and/or expose sites to looting and vandalism.

Indicator results:

Current conditions are unknown. A study of the Aboriginal Archaeological Sites in the West TSA will be complete by fall 2009.

Target: Historic Archaeological Sites

Summary Statistics:

Total historic archaeological sites: 29
Total historic archaeological sites within 100 feet of visitor infrastructure: 17
(The 100-foot distance was selected as a "reasonable distance" within which nearby resources were most likely to be affected by visitor use.)
**From surveys conducted 1993, 1995 and 1998*

Historic archaeological sites are manifestations of Euro-American settlement within the West TSA. Such sites which have revealed or are likely to reveal important information about our history are scattered throughout the West TSA. It is possible that new sites, features and isolated finds would be discovered during trail improvement or construction.

According to the COB Open Space Long Range Management Policies, archaeological resources will be left undisturbed unless removal of artifacts or digging in the site is justified by the need for protection. The location of historical archaeological resources is protected in the 2003 MOU between OSMP and the State Office of Archaeology and Historic Preservation. The inventory list below is based on reports completed in (1993, 1995, and 1998). Numbers assigned to sites are "State Site Numbers" assigned by the Colorado Historical Society Office or Archaeology and Historic Preservation.

Mount Sanitas and Related Parcels
Survey conducted 1998
5BL4171 Historic habitation, no condition recorded: Within 100 feet of visitor infrastructure (Sanitas Valley Trail)

5BL4178 Historic artifacts and features, no condition recorded: Within 100 feet of visitor infrastructure (Sanitas Valley Trail)

5BL4179 Historic artifacts and features, no condition recorded: Within 100 feet of visitor infrastructure (along Silver Lake Ditch)

5BL4177 Partially reclaimed trash dump, Heavy disturbance: Within 100 feet of visitor infrastructure (north portion near Mt. Sanitas Trailhead shelter)

Contiguous Boulder Mountain Parks
Survey conducted 1995
5BL4930 Civilian Conservation Corps Camp, Heavy disturbance: Within 100 feet of visitor infrastructure. (Baseline Trail runs through it)

5BL4931 Mesa Skip Slope, Heavy disturbance.

5BL4937 Historic Artifact Scatter, Total disturbance.

5BL4950 Sawmill Site, Ruined condition.

5BL4951 Historic Scatter, Ruined condition.

5BL4981 Mine Pits and Features, Heavy disturbance.

5BL5005 Historic Walls and Foundation, Moderate disturbance.

5BL4933 (Settlers Park Quarry), **5BL4936** (Woods Bergheim Quarry), **5BL4943** (Anderson Quarry) and **5BL4949** (Third Flatirons Quarry) are potentially contributing elements to a non-contiguous historic district based on sandstone quarrying. Their role in sandstone quarrying in relation to other quarries along the Front Range would have to be ascertained. The sites were deemed not eligible for inclusion on the National Register of Historic Places (NHRP) as their structural or associational integrity has been impaired or destroyed or do not appear to contain archaeological deposits sufficient to yield data important to study of history. All in Ruined condition. All within 100 feet of visitor infrastructure**.**

Three (3) sites in the area have some slight archaeological potential and should be protected from looting or other disturbance.
5BL4945 Gregory Canyon Homesite, Ruined condition.
5BL4946 Upper Bear Canyon Cabin, Ruined condition.
5BL4947 Lower Bear Canyon Cabin, Ruined condition.

Bear Creek to South Boulder Creek Project Area
Survey conducted 1993

5BL3895 small historic site consisting of remains of one structure and one feature. Function of site remains unknown due to the absence of artifacts or identifiable features. Heavy disturbance.

Civilian Conservation Corps Camp, Baseline and 6th, circa 1935

5BL3896 historic trash dump located on the grade of the Denver and Interurban Railroad (5BL400). Site consists of small scatter of historic artifacts and broken sandstone slabs. The Denver and Interurban Railroad (5BL400) was in operation between 1908 and 1926 and assuming material has not been redeposited, the site probably dates to sometime soon after the abandonment of the line. Light disturbance. Within 100 feet of visitor infrastructure (south of South Boulder Creek Trail).

5BL3897 is a historic home site, consisting of stone and cement dugout building, well and rock and cement alignments. Heavy disturbance. Within 100 feet of visitor infrastructure (south of South Boulder Creek Trail).

5BL 2719 Dugout associated with the Goodhue Ditch which was constructed in the 1860s. Dugout building appears to have been excavated into the bank of the ditch. No condition recorded.

5BL3898 Schoolmarm's Cabin, a historic home site consisting of ruins of cabin and other associated structures and features. This site also contains an historic building and structure. Moderate disturbance. Within 100 feet of visitor infrastructure (Mesa Trail).

5BL3899 Brammeier Home Site consists of ruins of log cabin and associated stone fences and buildings. Site is bisected by recreational trail. Site also contains historic structure. Moderate disturbance. Within 100 feet of visitor infrastructure (Big Bluestem Trail).

5BL3900 is a historic home site consisting of a dugout structure, depressions, fences and foundations. Heavy disturbance.

5BL3901 enigmatic historic site consisting of three stone walled structures. A recreational trail passes nearby to the south of the site. Heavy disturbance. Within 100 feet of visitor infrastructure (adjacent to South Shanahan Trail).

5BL3902 possible historic rock shelter with associated rock alignments. This site is located above the McGilvery Cabin (5BL3459) and may have been built by children from this cabin. Light disturbance. Within 100 feet of visitor infrastructure (Shadow Canyon Trail).

5BL3903 rock shelter with stone walls built under overhanging boulder. There are at least two chambers within the enclosed space that show signs of human occupation, including modern trash, shelves, fireplace and a ledge inside the shelter. Moderate disturbance. Within 100 feet of visitor infrastructure (Shadow Canyon Trail).

5BL3905 is a sandstone quarry connected to 5BL3904. Light disturbance. Within 100 feet of visitor infrastructure (west of Mesa Trail at junction with Big Bluestem Trail).

(Target: Historic Archaeological Sites)

Attribute: Lack of human disturbance
Deliberate actions taken by humans, including looting, vandalism and construction can degrade or demolish a site. Depending upon the level of destruction, the potential for scientific research of a site or artifacts can be limited or/and destroyed completely.
Undisturbed: no disturbance
Light disturbance: some partial disturbance has occurred but site is basically in tact
Moderate disturbance: site is partially lost to science but scientific research can still occur
Heavy disturbance: most scientific research potential has been lost
Total: all potential for scientific research has been lost

Indicator: Percent of undisturbed historical archaeological sites
This target will be measured by the percent of sites in undisturbed condition, as described in the COB Open Space Long Range Management Policies. Disturbance includes deliberate actions such as looting and construction of trails which may potentially destroy resources and/or expose sites to looting or vandalism.

Indicator Results:

Current conditions are unknown. Current condition assessments are estimated to be complete during Fall 2009.

Target: Historic Buildings, Structures and Objects

Summary Statistics:

Total historic buildings: 26 surveyed:
Condition: Good 14; Deteriorated 4; Ruins 13
Total historic structures: 29 surveyed:
Condition: Excellent 1; Good 7; Fair 3; Deteriorated 7; Ruins 7; No condition listed: 3
Total historic objects: 1 surveyed; Excellent condition
Total BSOs within 100 feet of visitor infrastructure or part of visitor infrastructure: 45
(100 feet is a buffer distance selected as a "reasonable distance" within which nearby resources were most likely to be affected by visitor use.)

**From surveys conducted in 1993, 1995 and 1998*

Historic buildings, structures, objects (BSOs) are cultural resources constructed by humans that are currently extant (present on the system). They can reveal a great deal about past human activity and the environment. A building is a resource created principally to shelter any forms of human activity, such as a house. A structure is built for purposes other than creating shelter, such as a bridge or rock wall. Historic objects could include, but are not limited to, construction which is primarily artistic in nature or small scale, such as a statue or milepost. Lands in the West TSA have provided a backdrop for construction since before the Homestead Act of 1862. It is home to a wide variety of historic BSOs including rock walls built in 1893, summer cabins built at the turn of the century and recreational shelters constructed by the Civilian Conservation Corps (CCC) in the 1930s. These vestiges of our past serve as educational tools as well as aesthetic backdrops for visitors who recreate on OSMP. Such a variety of buildings, structures and objects also will require a variety of preservation decisions and techniques to enhance the West TSA visitor experience.

The following inventory information has been collected from surveys conducted in 1993, 1995 and 1998. Numbers assigned to sites are "State Site Numbers" assigned by the Colorado Historical Society Office or Archaeology and Historic Preservation.

Historic Buildings: Bear Creek to South Boulder Creek
Survey conducted 1993

5BL3459 McGilvery Cabin: Log dwelling (circa 1870-1885) with later frame addition (circa 1917). Frame addition faced with board and batten siding. Associated structures include corral, outhouse and midden pile. Deteriorated condition. Within 100 feet of visitor infrastructure (Shadow Canyon Trail).

5BL3812 Stockton Cabin Site: cabin (circa 1890-1910), one room frame dwelling. Associated structure: one outhouse. Deteriorated condition**.** Within 100 feet of visitor infrastructure (Shadow Canyon Trail).

5BL3863 Doudy-DeBacker-Dunn Homestead: Standing house in good shape, modern roof covers the roof built in 1880s. Within 100 feet of visitor infrastructure (South Mesa Trailhead).

5BL3864 DeBacker-Blake-Hedgecock Homestead: Nine (9) buildings in good condition:

Building 1: log barn, constructed 1859;
Building 2: two room building, vertical planks and square cut nails. One room is a granary, another a blacksmith shop. Circa 1890.
Building 3: Chicken coop, dressed stone and cement, rough cut lumber. The date "1892" is incised in stone on the building. Good condition.
Building 4: milk house/summer kitchen of dressed stone and cement, "1896" incised in stone. Good condition;
Building 5: ice house, coursed dressed stone and cement. Built 1896 (incised on building). Good condition;
Building 6 and 7: include portions of large stone barn built 1913, burned down 1958. Building 6 rocked wall garage, undressed stone. Building 7 is hayshed diary barn, built 1913. Good condition;
Building 8: calf shed abutting building 8 on west. Probably built 1913. Good ` condition;
Building 9: house, 1 ½ story brick building built 1918, dormer and room added 1958. Good condition.

5BL3880 Rodeo Rider's Camp: only stone walls and foundation and low rock walls are extant. Circa 1920-1940. In ruined condition. Within 100 feet of visitor infrastructure (North Fork Shanahan Trail).

5BL3883 Manchester Family Homesite: Only stone foundations and low rock walls remain. Circa 1906-1912. Ruined condition. Within 100 feet of visitor infrastructure (Big Bluestem Trail).

5BL3884 Unnamed site related to agriculture, period of significance, 1860-1920. Ruined condition. Within 100 feet of social trail (social trail north of Big Bluestem Trail).

5BL3885 Unnamed site related to agriculture, only stone foundations and low rock walls remain. Wood corral still standing and serviceable. Site ranges from good (corrals) to ruined (buildings) condition. Period of significance 1860-1920. Within 100 feet of visitor infrastructure (Big Bluestem Trail).

5BL3886 Unnamed site related to agriculture. Three structures, all in ruined condition. Period of significance1860-1889. Within 100 feet of visitor infrastructure (north of South Boulder Creek Trail).

5BL3887 Unnamed site related to agriculture: Three structures, all in ruined condition. Period of significance 1860-1920. Within 100 feet of visitor infrastructure (on two-track road south of Big Bluestem Trail).

5BL3895 Unnamed site related to agriculture: One structure and one feature in ruined condition. Period of significance possibly 1860s. Within 100 feet of visitor infrastructure (south of South Boulder Creek Trail).

5BL3897 Unnamed site related to agriculture. Possible homesite with two structures and an open well. Building 1 is dugout constructed of cement and stone partially excavated in the bank of Goodhue Ditch. Possibly circa 1806s. Structure 1 rectangular alignment of local rock and cement. Feature 1 is open well. All recorded in "deteriorated" condition. Within 100 feet of visitor infrastructure (south of South Boulder Creek Trail).

5BL3898 Schoolmarm's Cabin, circa 1920s. Site consists of three fallen structures, three rock alignments representing fences or walls, an open but dry well or cistern, light scatter of historic trash and possible remains of an outhouse. All in ruined or deteriorated condition. Within 100 feet of visitor infrastructure (along Mesa Trail). This resource is also identified in the previous Historical Archaeology section.

5BL3899 Brammeier Home Site, circa 1895 to 1902. Consists of cabin and associated fences and buildings. Structure 1 is collapsed log cabin. Structure 2 collapsed log and stone structure. Structure 3 stone walls made of local field cobbles with no mortar apparent. Wooden doro frame leans inward to south end. North wall has collapsed inward. Structure is heavily overgrown with sumac. Structure 4 collapsed or never completed. Structure 5 walls of sandstone cobbles, collapsed. Feature 1 short rock fence or wall. Feature 2 rock alignment. Feature 3 short rock alignment. Feature 4 walls constructed of rounded cobbles and sandstone slabs. Feature 5 rock wall. Within 100 feet of visitor infrastructure (Big Bluestem Trail). This resource is also identified in the previous Historical Archaeology section.

Historic structures: Bear Creek to South Boulder Creek
Inventory completed 1993

5BL3865 South Boulder Foothills Ditch, circa 1883. Abandoned 1988. Ditch began on South Boulder Creek and appears to have been filler ditch for Viele Lake. Fair condition. Within 100 feet of visitor infrastructure (Homestead, Towhee, Mesa, South Boulder Creek, Big Bluestem Trails all cross Ditch).

5BL3866 Lafayette Water Pipeline. Pipeline rights-of-way granted 1928. Pipeline is still active. Three relief hatches are present in the South Mesa Trailhead project area. Good condition;

5BL3925 Bear Canyon Trail. Trail passes through the Bear Canyon Creek valley between Green Mountain and Bear Peak. Valley is fairly steep. Trail ends at Flagstaff

Road near Kossler Lake. Originally built in 1861 or 1862. It was constructed to provide access to the newly opened gold mines at Central City and Black Hawk. Good condition;

5BL3927 Shadow Canyon Trail. Trail starts from two places on the Mesa Trail. These two forks join in Shadow Canyon. The trail follows the canyon up to a saddle between South Boulder and Bear Peaks. The southern fork of the trail is an old road bed that leads up to the Stockton Cabin. Good condition. Built sometime prior to 1928.

5BL3926 Fern Canyon Trail. Trail starts from the Mesa Trail on a saddle of the Dakota Hogback. It contours over to Fern Canyon, then moves up the canyon to a saddle below the summit of Bear Peak. It then follows the north ridge to the summit. It was originally part of a transportation network before being used as a recreational trail. Built prior to 1926. Good condition.

5BL3924 Mesa Trail. Trail connects Chautauqua Park to Eldorado Springs, circa 1923. Trail incorporated a number of older roads and trails. About 200 cairns were built along the trail. Many cairns, both standing and toppled , were noted along the trail during the survey, many of these had sufficient lichen growth to suggest they may have been built circa 1923. Good condition.

5BL3881 Unnamed single small stone enclosure. Period of significance 1920-1940. Ruined condition. Within 100 feet of visitor infrastructure (North Fork Shanahan Trail).

5BL3900 Unnamed structures, circa 1900. Structure 1 rock alignment, deteriorated condition. Structure 2 series of rock alignments possibly representing building foundations ruined condition. Within 100 feet of visitor infrastructure (between Mesa Trail and Big Bluestem Trail).

5BL3901 Unnamed structures, only rock walls are present, some standing. No roof or fallen wall rubble noted. Ruined condition. Within 100 feet of visitor infrastructure (adjacent to South Shanahan Trail).

5BL3902 Unnamed structure, small rock shelter with only rock alignments present with various degrees of deterioration. May be associated with McGilvery Cabin, possibly built by McGilvery children. Within 100 feet of visitor infrastructure (north of Shadow Canyon Trail). This resource is also identified in the previous Historical Archaeology section.

5BL3903 Rockshelter with stone walls built under overhanging boulder. There are at least two chambers within the enclosed space that show signs of human occupation, including modern trash, shelves, fireplace and a ledge inside the shelter. Fair condition. Within 100 feet of visitor infrastructure (extension of Big Bluestem Trail). This resource is also identified in the previous Historical Archaeology section.

Historic Buildings: Mount Sanitas and Related Parcels: None recorded

Historic Structures: Mount Sanitas and Related Parcels
S*urvey completed 1998*

5BL4175 Tomlinson/McCoy Lime Kiln and Quarry: limestone quarry trench excavated into the hillside with earthen mounds piled on both sides. This is the historic location of lime kin, remnants of which can still be found against steep slope below and northeast of the quarry area. Period of significance 1898-1910. Both in Deteriorated condition. Within 100 feet of visitor infrastructure (along View Point Trail).

5BL6199.2 Boulder Colorado Sanitarium Dairy: The Sanitarium Dairy was a part of the Boulder Sanitarium complex, built by Seventh Day Adventists in 1895-97. Within 100 feet of visitor infrastructure (Mapleton Center parking lot).

5BL6199.3 Boulder Colorado Sanitarium Cistern: cistern related to Boulder-Colorado Sanitarium built 1895-97 by the Seventh Day Adventists. The cistern is constructed of cut sandstone with cement mortar walls. Deteriorated condition. Within 100 feet of visitor infrastructure (Mapleton Center parking lot near access trail).

5BL4172 Shinkle Quarry: abandoned sandstone quarry, site consists of two areas. Area A is on the west side of hogback. Area B is on the east side of the hogback outcrop, slightly north of Area A cut. Period of significance 1895-1920. Moderate disturbance. Within 100 feet of visitor infrastructure (Sanitas Valley Trail).

5BL4182 Red Rocks Reservoir and Town of Boulder Ditch: The old ditch, actually a buried 8 inch cast iron pipeline, is still visible and easily traced. Extends along hillside above the north bank of Boulder Creek. The ditch supplied water to the Red Rocks Reservoir which was located south of Red Rocks about halfway between the Farmers and Silver Lake Ditches. Red Rocks Reservoir was abandoned circa 1906. Location of the reservoir was developed as the Glen Crosley Silver Fox Farm in the 1940s (nothing remains of it today). The buried pipeline is still present and although disturbed in a few small sections, the stacked stone retaining walls are still present in a few locations. Deteriorated condition. Within 100 feet of visitor infrastructure (north of Settlers Park with ditch extending to west).

5BL4173 Mount Sanitas Sandstone Quarries: site contains series of abandoned sandstone quarry cuts, interconnecting roads and other features. Ruined condition. Within 100 feet of visitor infrastructure (East Ridge Trail crosses site, Sanitas Valley Trail is site's eastern boundary).

5BL4183 Dakota Ridge Trail. Main portion of trail is a dirt track, with stacked stone foundation or retaining walls in a few places. It starts at a two-tracked road in the Sanitas Valley and trends first to the southeast as it climbs Dakota Ridge Hogback. The trail was constructed in 1915 by Colorado Mountain Club or University of Colorado Hiking Club and was used by tuberculosis patients at Sanitarium. A southern extension of the trail

runs along the Dakota hogback just west of the hospital complex. It contains three structures. Construction date of structures is unknown, but apparently built for use by Sanitarium patients.

5BL4183.1 Dakota Ridge Stone Shelter: sub-rectangular Dakota sandstone hut with cement mortar. Shelter and hearths may have been used for "steak frys," cookouts which were popular in the early 20th century. No condition listed. Structure was extant in 2008. Within 100 feet of visitor infrastructure.

5BL4183.2 Dakota Ridge Arch: feature is constructed of rough Dakota sandstone with cement mortar similar to other nearby features. It is built onto a natural outcrop. Two pillars form the arch and are sitting on bedrock at the ground surface. No condition listed. Structure was extant in 2008. Within 100 feet of visitor infrastructure.

5BL4183.3 Dakota Ridge Footbridge: the bridge is constructed of uncut sandstone with cement mortar and provides access across the Silver Lake Ditch. The benches have a sitting height of 1 foot. Tabular stones serve as backs for the bench, extending 1.6 feet above the seats. A series of stone steps extend from the bridge to the east towards the former sanitarium building. No condition listed. Structure was extant in 2008. Within 100 feet of visitor infrastructure.

Contiguous Boulder Mountain Parks
Survey completed 1995

Historic Buildings:

5BL4942 Panorama Park Shelter/Halfway House: stone shelter house and adjoining patio. Original Panorama Park Shelter was constructed by Boulder Lions club and then reconstructed by CCC between 1933 and 1935. Good condition. Within 100 feet of visitor infrastructure (Flagstaff Road).

5BL4939 Flagstaff Shelter House: gable roofed, granite structure with two fireplaces, mantels are from sandstone flags. Constructed in 1933 by Boulder Lions club. Good condition. Part of visitor infrastructure.

5BL4935 Green Mountain Lodge: side gable granite building with façade gable over front door, stone slab patio and stone steps. Walkway extends around building. Built by CCC in 1935. Good condition. Within 100 feet of visitor infrastructure (Gregory Canyon, Range, Long Canyon Trails).

5BL4934 Bluebell Picnic Shelter: stone shelter and adjoining patio. Fireplace has sandstone plaque embedded carved with the legend "Erected by Boulder Lions Club." The shelter was originally built in 1923 by the Boulder Lions Club. Several modifications have occurred since its original construction, including possibly the fireplace. Timing of modifications are not known precisely, but are likely to be made by the CCC prior to 1935. Good condition. Within 100 feet of infrastructure (Many trails converge at this spot. An amphitheater built here 1997).

Historic Structures:

5BL4944 Flagstaff Mountain/Kossler Lake Road: The road begins at the western terminus of Baseline Road, at the mouth of Gregory Canyon, ascends the eastern flank of Flagstaff Mountain and follows the broad ridge between Long Canyon and Lost Gulch. A ¾ mile section built in 1906 which terminated at Panorama Park was the first established part of Flagstaff Road. A 1931 map shows the road extending all the way to Kossler Lake. The CCC undertook reconstruction of the road in 1935. Because the road has been constructed, upgraded and modified repeatedly during the past 89 years, different segments of the modern roadway are dated to different periods. Several sections of the original grade are still in use, but much of the roadbed has been modified. Good condition. Visitor infrastructure.

5BL4952 Boulder Mountain Park Historic Trails Network:

Pre-1925 Trails include Tenderfoot, Green Canyon, Foothills, Green Mountain, Saddle Rock, Bear Canyon/Green Mountain, Royal Arch/Green Canyon, Woods-Bergheim/Royal Arch/Green Mountain, Royal Arch, Amphitheater, Split Rock, South Boulder Peak/Bear Peak West Ridge.

Pre-1965 Trails include: Chapman Drive, Old Flagstaff, Artist Point, Plains Overlook, May's Point, Boy Scout, Range View, Gregory Canyon, H.L. Greenman, Green Mountain West Ridge, Ranger, Bluebell Nature, Enchanted Mesa, Bluebell-Baird;

Pre-1994 Trails include: Panorama, Ute, Green Bear, Third Flatiron, McClintock Nature, Skunk Canyon, Mallory Cave.

Trails are well maintained considering they receive heavy recreational use. Some trails are no longer used and are not maintained. Good condition. Part of visitor infrastructure.

5BL5005 Settlers Park Foundation: site consists of stone walls and an apparent foundation. A wall of granite slabs set in cement mortar parallels the concrete trail and Farmers Ditch. History of buildings is unknown. They may have had something to do with a famous fruit and vegetable gardens in the 1880s or with the sandstone quarry which is directly north of the site. Ruined condition.

5BL4941 Enchanted Mesa Road: site consists of graded roadbed and a stone and concrete bridge. The Road begins immediately south of the Chautauqua Park Amphitheater and runs south along the northern side of Bluebell Canyon. Where the road turns east and crosses Bluebell Creek, a stone and cement bridge has been constructed. This bridge was reputed to have been constructed by the CCC, but the precise date of construction is unknown. The original road was likely a quarry or logging road. Deteriorated condition, the bridge is collapsing. Visitor infrastructure.

5BL4940 Sunrise Circle Amphitheater and Flagstaff Memorial: This complex is located on the eastern end of the summit of Flagstaff Mountain. It consists of a stone and concrete monument and an adjacent semicircular amphitheater. The Memorial, on the western end of the complex, is a rectangular fieldstone and concrete block to which a

steel flagpole has been attached. The amphitheater consists of a circular central arena or fire pit, around which a semicircular stage and two tiers of bench seating have been constructed. The elevated stage is located on the eastern side of the fire pit and is accessed by stone steps from both the east and west sides. The entire complex has been constructed from random rubble masonry consisting of granite fieldstone cobbles and cement. Seating is constructed of heavy wooden planks. The amphitheater was constructed between 1933 and 1934 by the CCC. The amphitheater is located in a "natural amphitheater" which had been cleared of debris by local residents during the spring of 1933 as part of the Reconstruction Finance Corporation relief program. Good condition. Visitor infrastructure.

5BL4938 Morse Well on Flagstaff Mountain: site is on summit of Flagstaff Mountain and consists of decorative stone and concrete well head and associated concentric retaining walls, access ramps and stone benches. Original construction of well appears to be circa 1929 with improvements made to the well by the CCC in 1935. During the 1940s the City of Boulder provided a mechanical pump for the well; this pump had originally been located in Chautauqua. Subsequently the well was condemned and the pump destroyed by vandals. Fair condition. Visitor infrastructure.

5BL4936 Woods-Bergheim Quarry: site is located on the east facing ridge separating Bluebell and Skunk Canyons. It consists of large interconnected complex of quarry operations and access roads. The complex of quarries was owned and operated by Jonas Bergheim and Frank P. Wood. A variety of historic buildings in the Boulder area made use of Woods-Bergheim sandstone, including the 1907 Lennartz home at 655 Arapahoe Street. Ruined condition. Within 100 feet of visitor infrastructure. (Enchanted Mesa Trail)

5BL4932 Sunshine Lake Reservoir: the site is located at the mouth of Sunshine Canyon Road and consists of an earthen dam, dam output control structure, spillway, inlet control facilities and a small stone quarry. The reservoir was proposed in 1886 when the Red Rocks Reservoir no longer met the demand for city water. Construction was complete in 1891. Deteriorated condition.

5BL4170 Chapman Drive: grated, unpaved segment of the road known as Chapman Drive, which crosses portion of project area. It was built in 1935 by the Civilian Conservation Corps. Chapman Drive ascends the "backside" or west facing slope of Flagstaff Mountain. Chapman Drive is 20 to 24 feet wide and well cut into the uphill side. The corners of some of the switchbacks appear to be banked. Constructed features along the length of the road include rock retaining walls, drainage culverts, bridges and cattle guards. Excellent condition. Visitor infrastructure.

Historic Objects: Boulder Mountain Parks

5BL4935 Green Mountain Lodge: a modified spring located at the base of a broad slope south of the structure has been modified to provide drinking water. Spring has been contained within a stone and concrete basin. An inscription in the overflow indicates that the spring modifications were made in 1964. Good condition. Within 100 feet of visitor infrastructure. (Range, Long Canyon Trails)

(Target: Historic Buildings, Structures and Objects)

Attribute: The condition of the BSOs with national, state and local significance
Conditions are rated as:
Excellent: no repairs needed, routine maintenance recommended
Good: some minor repairs needed, cleaning and maintenance
Fair: obvious repairs needed, cleaning and maintenance
Poor: extensive repairs needed, possibly requiring replacement, cleaning and maintenance
Deteriorated: anything that has been exposed to the elements and is inferior to the original condition – can be used with any of the terms above to describe specific conditions
Ruins: a structure that no longer has a use and will only be preserved "as is."

Indicator: The number of high priority BSOs in "Excellent" to "Good" condition as categorized on the Colorado Cultural Resource Survey Management form in the cases where those conditions are desirable and feasible. Each resource will be evaluated separately on its own historic merits and condition. It is likely that it will not be feasible for all of the resources near trails to be preserved in "Excellent" or "Good" condition. Cases in which "Excellent" and "Good" are not feasible, the most appropriate preservation techniques will be employed for the individual property as outlined in the COB Open Space Cultural Resource Guidelines. The actual target number of BSOs in "Excellent" to "Good" condition has not yet been determined. The number will be set after current conditions are assessed during the planning process.

Indicator Results:
Current conditions are not known at this time. Plans are being made to complete a survey by the end of 2009.

Literature Cited

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City of Boulder (1999.) Boulder mountain parks resource protection and visitor use plan. Boulder, Colorado. Boulder Mountain Parks Division, Parks and Recreation Department. *Adopted by OSBT in 2000*.

City of Boulder (2005.) Visitor master plan. (pp 13,44, plus others) Boulder, Colorado: Open Space and Mountain Parks Department. *Adopted April 2005*.

City of Boulder (2005.) Marshall Mesa/Southern Grasslands trail study area plan. (pp. 9, 12, 15, 20, 44 plus others) Boulder, Colorado: Open Space and Mountain Parks Department. *Approved December 2005*.

City of Boulder (2006.) Eldorado Mountain/Doudy Draw trail study area plan. (pp. 7, 9, 10, 12, 20, 40, 49 plus others) Boulder Colorado: Open Space and Mountain Parks Department. 2006. *Approved December 2006*.

City of Boulder (2007.) Strategic operating plan. (Cultural Resource Management Legacy Program, p. 10.)Boulder, Colorado: Open Space and Mountain Parks Department.

City of Boulder (1995.) Open space long range management policies.(Cultural Resource Management section VI. pp.66) Boulder, Colorado: Open Space/Real Estate Department. *This included the formal adoption by the OSBT of CRM as part of long range management policies.*

Wheeler, B. (1990.) City of Boulder open space cultural resource guidelines. (pp.13) Unpublished report. Boulder, Colorado: Open Space/Real Estate Department. *Approved by OSBT.*

Other Cultural Resource Management (CRM) guidelines/laws that also affect OSMP management:
Boulder City – e.g., all the CRM guidelines in the B.R.C.
Boulder County
Colorado State
Federal – including U.S. and Tribal Sovereignty law

ALSO --- There are likely other OSMP area management plans, such as the North Boulder Valley or South Boulder Creek that have CRM guidelines included.

Glossary

Archaeology: Archaeology is the study of the human past. Its initial objective is the construction of cultural chronology. Its intermediate objective is the reconstruction of past life ways. Its ultimate objective is the discovery of the processes which underlie and condition human behavior.

Artifact: a man-made object which is a form or archaeological data.

Criteria: qualities through which site, buildings, structures or objects are determined to be eligible for National or Colorado State Registers of Historic Places, Boulder County or City of Boulder Historic Landmark designation.

Cultural resource: a building, structure, district, site or object that is significant in our history, architecture, archaeology or culture.

Deterioration: the process of making an historic structure's condition worse by lack of maintenance, normal wear and tear and /or exposure to weather.

Demolition by neglect: the gradual destruction of a building because of lack of maintenance.

Disturbance: the process of affecting an archaeological site's ability to convey its history (worsen its condition), for instance by destroying evidence unintentionally through careless construction or intentionally by looting the site.

Eligibility: ability of a property to meet National Register, State of Colorado or City of Boulder criteria (the standards by which the significance of a historic property is judged).

Historic integrity: the unimpaired ability of a property to convey its historical significance.

Historic property: any prehistoric or historic district, site, building, structure or object.

Historic significance: importance for which a property has been evaluated and found to meet the National Register criteria.

Historical archaeology: the study of cultural remains of literate societies with recorded histories.

Integrity: authenticity of a property's historic identity, evidenced by the survival of physical characteristics that existed during the property's historic or prehistoric period. The following seven aspects help define a property's integrity:

- Location is the place where the historic property was constructed or the place where the historic event occurred;
- Setting is the physical environment of a historic property;

- Materials are the physical elements that were combined or deposited during a particular period of time in a particular pattern or configuration to form a historic property;
- Workmanship is the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory;
- Feeling is a property's expression of the aesthetic or historic sense of a particular period of time;
- Association is the direct link between an important historic event or person and a historic property.

Interpretation: the educational methods by which the history and meaning of historic sites, buildings, objects, districts and structures are explained by use of docents, leaflets, tape recordings, signs, film and other means.

Local significance: importance of a property to the history of its community, such as a town or county.

Local criteria: The place (building, site, area) should show character, interest or value as part of the development, heritage, or cultural characteristics of the community, state or nation; be the site of an historic or prehistoric event that had an effect upon society; or exemplify the cultural, political, economic, or social heritage of the community:

- Date of Construction: Particular importance is placed on the age of the structure. Association with Historical Persons or Events
- Distinction in the Development of the Community of Boulder:
  This is most applicable to an institution (religious, educational, civic, etc.) or business structure, though is some cases residences might qualify. It stresses the importance of preserving those places which demonstrate the growth during different time spans in the history of Boulder.
- Recognition by Authorities: Significant recognition includes Historic Boulder, Inc., the Boulder Historical Society, local historians, State Historical Society, The Improvement of Boulder, Colorado by F.L. Olmsted, or others in published form.
- Other, if applicable.

National Register of Historic Places is the official list of the nation's historic places worthy of preservation. The National Register is administered by the National Park Service, which is part of the U.S. Department of the Interior.

National significance criteria: importance of a property to the history of the United States as a nation. Nationally significant properties embody one or more of the following characteristics:

- associated with events that have made a significant contribution to the broad pattern of our history;
- associated with the lives of persons significant in our past;
- embodies the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic

values, or that represent a significant and distinguishable entity whose components may lack individual distinction;
- has yielded, or is likely to yield, information important in history or prehistory.

Paleontology: The study of life in past geologic time. Paleontologists use the knowledge they gain in their study of fossils to answer important questions such as: (1) what was the world like in the past, (2) what were the forces that made the world change, and (3) how could these forces impact the world in our lifetime and that of future generations.

Potential to yield information: likelihood of a property to provide information about an important aspect of history or prehistory through its physical composition and remains.

Preservation: the act or process of applying measures to sustain the existing form, integrity, and material of a building or structure and the existing form and vegetative cover of a site. It may include initial stabilization work, where necessary, as well as ongoing maintenance of the historic building materials and vegetation.

Property: area of land containing a single historic resource or a group of resources, and constituting a single entry in the National or State Register of Historic Places or Boulder City or County Landmark inventory.

Prehistory: a term often used to describe the period before written history.

Prehistoric archaeology: the study of extant cultural remains of societies which existed prior to recorded history.

Rehabilitation: the act or process of returning a property to a state of utility through repair or alteration which makes possible an efficient contemporary use while preserving those portionsor features of the property which are significant to its historical, architectural and cultural values.

Restoration: the act or process of accurately recovering the form and details of a property and its setting as it appeared at a prticular period of time by means of the removal of later work or by the replacement of missing earlier work.

Site: location of a significant event, a prehistoric or historic occupation or activity, or a building or structure, whether standing, ruined or vanished, where the location itself possesses historic, cultural or archaeological value regarldess of the value of any existing structure.

Stabilization: the act or process of applying measures designed to reestablish a weather-resistant enclosure and structural stability while maintaining the essential form as it exists at present.

State Historic Preservation Office (SHPO): office in State government that administers the preservation programs under the National Historic Preservation Act.

State significance criteria: importance of a property to the history of the State of Colorado. Significant properties embody one or more of the following associations:

- Associated with events that have made a significant contribution to the history of Colorado;
- The property is associated with the lives of persons significant in our past;
- The property has distinctive characteristics of a type, period, method of construction or artisan;
- The property contains the possibility of important discoveries related to prehistory or history.

APPENDIX A:

COLORADO CULTURAL RESOURCE SURVEY OAHP1400

Management Data Form

Rev. 9/98

The *Management Data Form* should be completed for each cultural resource recorded during an archaeological survey. Exceptions to this are isolated finds and re-evaluations, neither of which require a *Management Data Form*. Please attach the appropriate component forms and use continuation pages if necessary.

1. Resource Number: _____ 2. Temporary Resource Number: _____

3. Attachments (check as many as apply)
   - ___ Prehistoric Archaeological Component
   - ___ Historic Archaeological Component
   - ___ Historic Architectural Component Form
   - ___ Sketch/Instrument Map (required)
   - ___ U.S.G.S. Map Photocopy (required)
   - ___ Photograph(s)
   - Other, specify: _____

4. Official determination (OAHP use only)
   - _____ Determined Eligible
   - _____ Determined Not Eligible
   - _____ Nominated
   - _____ Need Data
   - _____ Contributing to NR Dist.
   - _____ Not Contributing to NR Dist.

I. IDENTIFICATION

5. Resource Name: _____
6. Project Name/Number: _____
7. Government Involvement: Local____ State____ Federal____

   Agency: _____
8. Site Categories: Check as many as apply

   Prehistoric: archaeological site____ paleontological site____

   in existing National Register District? yes____ no____ name_____

   Historic: archaeology site____ building(s)____ structure(s)____ object(s)_____

   in existing National Register District? yes____ no____ name_____
9. Owner(s)'s Name and Address: _____

   _____
10. Boundary Description and Justification: _____

    _____

    _____
11. Site/Property Dimensions: _____m x _____m Area: _____m^2 (÷4047) _____acres

    Area was calculated as: Length x Width _____ OR (length X width) X .785 _____
    rectangle/square ellipse

II. LOCATION

12. Legal Location

    PM____ Township_____ Range_____ Section_____ ____1/4 of ____1/4 of ____1/4 of ____1/4

    PM____ Township_____ Range_____ Section_____ ____1/4 of ____1/4 of ____1/4 of ____1/4

    if section is irregular, explain alignment method:_____

    _____

Resource Number: _____
Temporary Resource Number: _____

Management Data Form

13. USGS Quad: _____ 7.5'_ 15' _ Date(s): _____ (attach photocopy)
14. County: _____ 15. Other Maps: _____
16. UTM Reference: Check your Datum! _____NAD 27 _____NAD 83
    A. ___ ___; ___ ___ ___ ___ ___ ___mE ___ ___ ___ ___ ___ ___ ___mN
    B. ___ ___; ___ ___ ___ ___ ___ ___mE ___ ___ ___ ___ ___ ___ ___mN
    C. ___ ___; ___ ___ ___ ___ ___ ___mE ___ ___ ___ ___ ___ ___ ___mN
    D. ___ ___; ___ ___ ___ ___ ___ ___mE ___ ___ ___ ___ ___ ___ ___mN
17. Address: _____ Lot___ Block___ Addition_____
18. Location/Access: _____

_____

_____

III. NATURAL ENVIRONMENT

19. Topographic Feature(s)

___ mountain	___ ledge	___ playa
___ hill	___ terrace/bench	___ talus slope
___ tableland/mesa	___ canyon	___ alluvial fan
___ ridge	___ valley	___ plain
___ saddle/pass	___ basin	___ dune
___ alcove/rockshelter	___ floodplain	___ _____
___ cliff	___ cutbank	___ _____
___ slope	___ arroyo/gully	___ _____

20. Site Topographic Description (mention named landforms): _____

_____

21. Site Elevation: _____feet =(x .3048) _____meters 22. Aspect: _____
23. Degree of Slope on Site: _____ 24. Soil Depth: _____cm
25. Soil Description (character and color): _____

_____

26. Depositional Environment:

    ___ Aeolian ___ Colluvial ___ Residual
    ___ Alluvial ___ Moraine ___ None
    ___ Other, specify; _____

27. Nearest Water: name/nature: _____ distance: _____m _____ft.
28. Nearest Permanent Water: name: _____ distance: _____m _____ft.
29. Vegetation on Site (list predominant species): _____

_____

30. Vegetation Associations/Communities Surrounding Site: _____

Resource Number: _____
Temporary Resource Number: _____

Management Data Form

IV. NATIONAL/STATE REGISTER ELIGIBILITY ASSESSMENT

31. Context or Theme: _____

_____

32. Applicable National Register Criteria:
___ Does not meet any of the below National Register criteria

___ A. Associated with events that have made a significant contribution to the broad pattern of our history; or

___ B. Associated with the lives of persons significant in our past; or

___ C. Embodies the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

___ D. Has yielded, or may be likely to yield, information important in history or prehistory; or

___ Qualifies under exceptions A through G.

Level of Significance: National____ State___ Local___

33. Condition

a. Architectural/Structural	b. Archaeological/Paleontological
_____ Excellent	_____ Undisturbed
_____ Good	_____ Light disturbance
_____ Fair	_____ Moderate disturbance
_____ Deteriorated	_____ Heavy disturbance
_____ Ruins	_____ Total disturbance

34. Describe condition: _____

_____

35. Vandalism: yes_____ no_____ describe: _____

_____

36. National Register Eligibility Field Assessment:

Eligible___ Not Eligible____ Need Data____

Statement of Significance/N.R.H.P. Justification: _____

_____

_____

37. Status in an Existing National Register District:

Contributing_____ Non-Contributing____

38. National Register District Potential yes____ no_____ discuss: _____

_____

Resource Number: _____
Temporary Resource Number: _____

Management Data Form

V. MANAGEMENT AND ADMINISTRATIVE DATA

39. Threats to Resource: Water erosion___ Wind erosion___ Grazing___ Neglect ___
    Vandalism___ Recreation___ Construction___ Other (specify): _____
    comments: _____
40. Existing Protection: None___ Marked___ Fenced___ Patrolled___ Access controlled ___
    other (specify): _____
41. Local landmark designation: _____ 42. Easement: _____
43. Management Recommendations: _____

VI. DOCUMENTATION

44. Previous Actions Accomplished at the site:
    a. Excavations: Test___ Partial_____ Complete_____ Date(s): _____
    b. Stabilization: Date(s): _____
    c. HABS/HAER Documentation: Date(s) & Numbers: _____
    d. Other: _____
45. Known collections/reports/interviews and other references (list): _____
46. Primary Location of Additional Data: _____
47. State or Federal Permit Number: _____ Collection Authorized: yes____ no___
    Artifact Collection: Yes_____ No_____ Artifact Repository: _____
    Collection Method: Diagnostics_____ Grab Sample___ Random Sample_____ Transect
    Other (specify): _____
48. Photograph Numbers: _____ Negatives filed at: _____
49. Report Title: _____
50. Recorder(s): _____ Date(s): _____
51. Recorder Affiliation: _____
    Phone Number: _____

NOTE: Please attach a sketch map, a photocopy of the USGS quad. map indicating resource location, and photographs.

Colorado Historical Society - Office of Archaeology & Historic Preservation,
1300 Broadway, Denver, CO 80203
1303-866-3395

City of Boulder
Open Space and Mountain Parks

West Trail Study Area
Recreational Resource Inventory Report

Final draft
August 2009

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Introduction

The West Trail Study Area (West TSA) contains 10,669 acres of City of Boulder Open Space and Mountain Parks (OSMP) fee-owned land. All the lands in the West TSA are categorized under one of four management area designations that were identified in the Visitor Master Plan (VMP). Three of these management area designations exist in the West TSA: Passive Recreation Area, Natural Area and Habitat Conservation Area (HCA). The primary goal of each management area is to plan for and facilitate visitor activity in areas that can best accommodate the activity, which includes providing a high-quality visitor experience and ensuring compatibility of visitor activity with natural and cultural resources. Thus, the management area designations provide the foundation for what recreational opportunities are allowed and where.

At one end of the spectrum are Passive Recreation Areas that emphasis providing a high-quality visitor experience in areas that are closer to where people live and work, and can accommodate a higher level of visitor activity. At the other end of the spectrum are Habitat Conservation Areas where the emphasis is on protecting high quality habitats while providing a more remote visitor experience. In the West TSA, there are 3,959 acres designated as HCA, 5,240 acres designated as Passive Recreation Area and 1,470 acres designated as Natural Areas.

Results from the 2004-05 Visitation Study estimate that the West TSA receives 40-45% of the total number of person visits annually to OSMP, which equates to roughly 2 million visits annually (Vaske, Shelby, & Donnelly 2009). The West TSA's popularity is also evident by the 1,072 planned Commercial Use Permit trips for lands within the West TSA boundary in 2008. A total of 15,976 people planned to participate on the 1,072 trips. The following list breaks out the total people by activity:

- Hiking 3,127
- Nature Education 6,678
- Climbing 5,743
- Photos 243
- Filming 125

To help accommodate this level of activity, approximately 78 of OSMP's 144 miles (54%) of designated trails, and 51% of the 100 trailheads/access points are located within the West TSA. There are also five facilities that can be rented by the community. These include: the Wood Shelter (Jaycee Shelter), the Stone Shelter, Sunrise Amphitheater, the Half-Way House and the Bluebell Shelter.

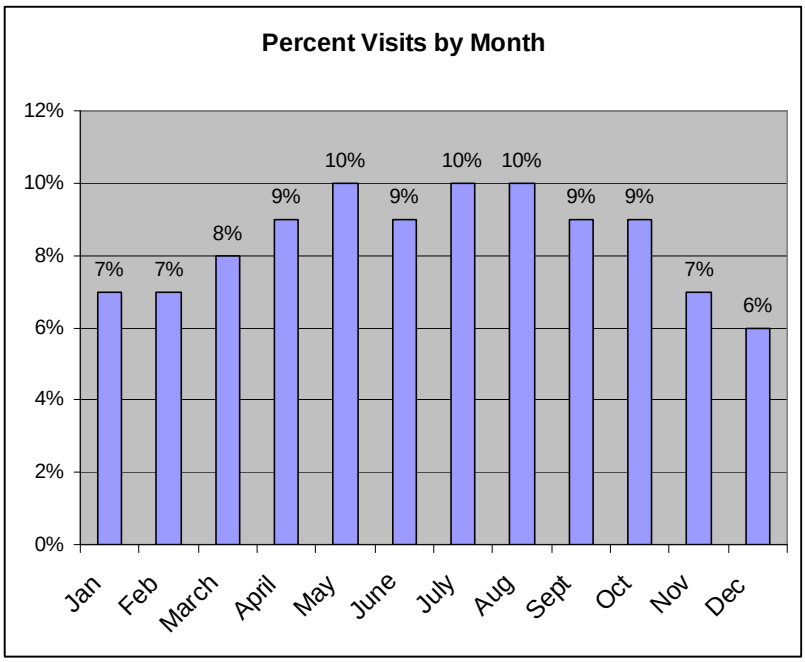
OSMP uses a variety of surveys to help understand and track visitor satisfaction with services provided by OSMP.

- The Citizen Survey is a survey of registered City of Boulder residents administered by phone or mail, and is usually repeated every 5 years (1999, 2004-05).
- The Visitor Survey is also typically administered every 5 years (2004-05), and is an exit survey of people leaving the OSMP system. The main purpose of this survey is to obtain demographic information, trip characteristics and experience evaluations.
- The Participant Survey is handed out at the end of many OSMP education programs and is used to rate participant satisfaction. This information is helpful when developing

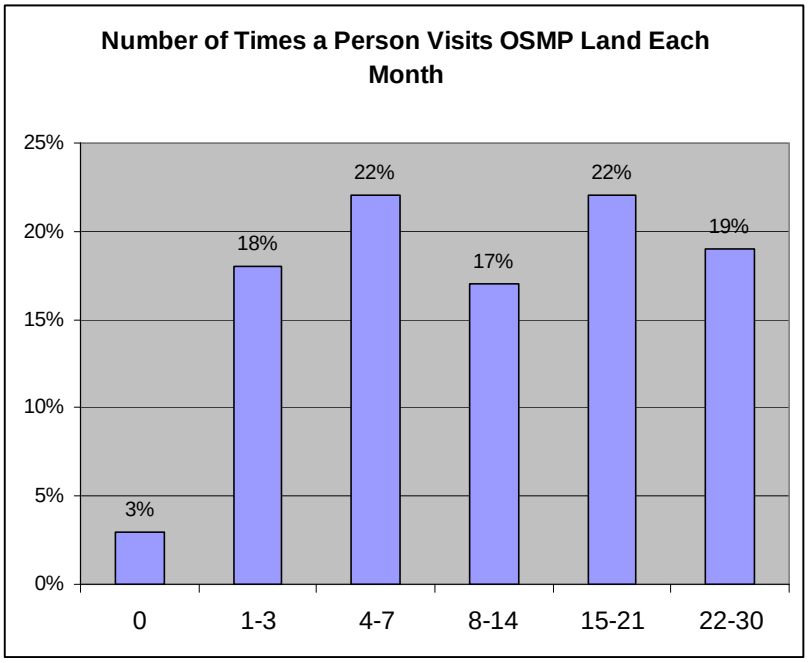
educational programs such as Meadow Music, Fishing for Kids and Roll or Stroll Birdwatching.

- The Volunteer survey is a year-end survey of every volunteer that contributed hours that year. This is an opportunity for volunteers to provide feedback about their experience and help staff continue to provide meaningful opportunities.

The following information is from the 2004-05 Visitor Survey (results are not specific to the West TSA) and is helpful to understand the "average" OSMP visitor.



- There is no "Slow Season." OSMP receives consistent, year round visitation.
- 60% of the visitation occurs Monday – Friday, with each day receiving 12%. 19% occurs Saturday and 21% on Sunday.
- During the day, visitation peaks between 1-5:00 p.m.



- 41% of respondents visit OSMP 15 times a month or more
- The average visit lasts 1 hour
- 58% of respondents arrive at OSMP trailheads/access points by car. Compared to 32% who walk, 9% bike and 1% arrive by bus

The West TSA Recreation Recourses Inventory Report is a synthesis of the existing knowledge and data that relates to this portion of the OSMP system. This report integrates background information, recent monitoring data, past surveys and newly developed tracking systems to report the current condition of the recreation targets, attributes and indicators.

Future West TSA planning will identify and describe:

- Desired Future Conditions
- Management Issues
- Recommended strategies to deliver a quality visitor experience, sustainable visitor infrastructure and the conservation of natural and cultural resources

Recreation Target: Visitor Experience

The VMP identifies four key goals, including enhancing the visitor experience (VMP, p.28). All that a visitor does, thinks, feels and senses while on OSMP contributes to the visitor experience. Enhancing the visitor experience implies creating opportunities for visitors to enjoy their trip on OSMP. A high quality visitor experience is one that meets or exceeds the visitor's expectations (Bultena and Klessig, 1969 & La Page, 1983). OSMP managers can influence the visitor experience both directly through personal contact, and indirectly through influencing the recreation environment. The quality of the visitor experience can also be influenced by factors that land managers have no influence over, such as the weather. Given the extensive combination of all these factors and the visitor's personal preferences and values, the quality of visitor experience is difficult to measure. However, being able to gauge the quality of visitor experience is very important to land managers, and many agencies have created measures specific to the unique qualities of the resource they manage.

In the West TSA, OSMP has identified six attributes that define and can be used as a basis to measure the quality of Visitor Experience.

List of Associated Attributes

- *Recreation Opportunities*
- *Access to Destinations*
- *Lack of Conflict*
- *Connection with the Land*
- *Safety*
- *Remoteness*

Attribute: Recreational Opportunities

Summary Statistics: Trail based activities

Dog Walking

- Dogs are allowed under voice and sight control on 69% of trails in the West TSA (5% on corridor)
- Dogs are required to be on leash on 26% of the trails in the West TSA (6% are seasonal requirements)
- Dogs are not permitted on 5% of the trails in the West TSA

Horseback Riding

- Horses are permitted on 94% of the trails in the West TSA

Bicycling

- Bikes are not currently permitted on any trails in the West TSA

ADA accessible

- 1.1 miles of trail
- 7 trailheads

Refer to the following maps for the activities allowed on trail.

Map 1 Designated Trails by Type of Activity is a map of the trails along with the associated allowed activities.

Map 2 Dog Regulations on Designated Trails.

Map 3 Trails and Trailheads Accessible for People with Disabilities

Passive Recreation Activities

Providing "passive recreation" is one of several OSMP purposes identified in the City of Boulder Charter. Although not precisely defined, the Charter does mention several "passive" recreational activities including: hiking, nature study and photography. Three other recreational activities are listed as appropriate under certain conditions: bicycling, fishing and horseback riding. However, mountain biking on lands previously managed under Boulder Mountain Parks was disallowed by City Council in the mid-1980s due to community concerns related to visitor safety and resource protection. To assist OSMP, a Passive Recreation Activity Assessment process, developed as part of the VMP, determines what activities will be considered appropriate.

The following table is from the VMP and summarizes the current status of recreational activities system-wide and where they are allowed.

Current Status of Recreational Activities on Open Space and Mountain Parks			
Allowed on Open Space and Mountain Parks (OSMP) Lands	**Allowed only on Designated Trails**	**Allowed only in Specifically-Designated Areas or Sites**	**Activities *not* considered passive recreation**
At current levels of use, these activities are generally compatible with OSMP visitor use and resource protection goals. The lower the impact, the greater degree of compatibility. Whenever possible, staying on-trail will minimize impact. In Habitat Conservation Areas, all visitor activities are required to be on-trail, unless approved under an off-trail permit.	To provide high-quality recreation opportunities in locations that can handle the impacts, these activities are allowed only on appropriate trails.	To provide high-quality recreation opportunities in locations that can handle the impacts, these activities are allowed only at appropriate sites.	These activities do not fit the criteria for passive recreation and therefore are not allowed on OSMP lands.
Hiking Trail running/jogging Wheel-chair use Nature study Photography Picnicking Traditional climbing/ bouldering Cross-country skiing Snowshoeing Virtual Geocaching Orienteering	Bicycling Horse-drawn wagons or sleds Dog sleds Strollers/joggers In-line skates Wheeled boards (e.g., skateboards, mountain boards) Horseback riding	Fishing Wading Tubing, kayaking, canoeing Sledding Hang/paraglilding Bolted climbing Dog walking Camping (at 4th-of-July campground only) Swimming (in creeks only) Model glider flying	Motorized vehicles Hunting Organized sports Paintball games Swimming (prohibited in lakes and ponds) Geocaching (when cache is left on OSMP property)

In the West TSA, the type of recreation opportunities provided will be based on their compatibility with natural and cultural resource protection, the management area designations, and other allowed activities in the area or on the trail.

The following table is a list of the recreational opportunities currently permitted/not permitted in the West TSA.

Current Status of Recreational Activities In West TSA			
Allowed on Open Space and Mountain Parks (OSMP) Lands	**Allowed only on Designated Trails**	**Allowed only in Specifically-Designated Areas or Sites**	**Currently not permitted in the West TSA (are considered passive recreation)**
Hiking Trail running/jogging Wheel-chair use Nature study Photography Picnicking Horseback riding Traditional climbing/ bouldering Cross-country skiing Snowshoeing Geocaching Orienteering	Horse-drawn sleds (non-wheeled) Dog sleds Strollers/joggers	Fishing Wading Tubing, kayaking, canoeing Sledding Bolted climbing Dog walking Swimming (in creeks only) Model glider flying	Hang gliding /paraglilding Bicycling* In-line skates* Wheeled boards* (e.g., skateboards, mountain boards) Horse-drawn wagons* *(allowed only on designated roadways i.e. Flagstaff Summit Rd.)

Peer Agency Review

OSMP staff is interested in learning how OSMP's situation and strategies compare to other jurisdictions, and thus conducted a peer agency review. Municipal and county open space agencies in the Front Range were used in the analysis. Similar to OSMP, these agencies are supported by a voter-approved open space sales tax. Two Colorado State Parks were also used in the comparison. These parks are funded by visitor fees.

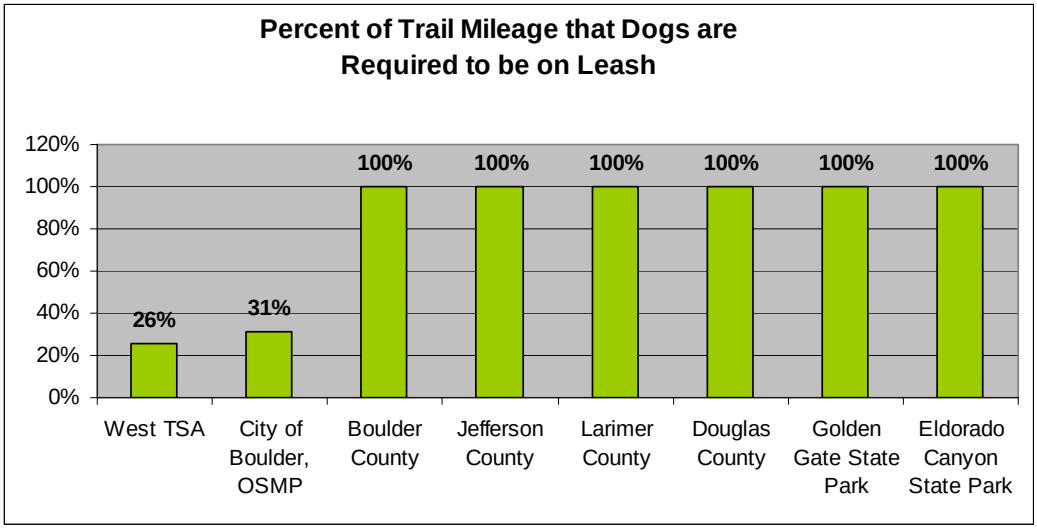
The agencies used for the peer agency review were:

- Jefferson County Open Space
- Boulder County Parks and Open Space
- Douglas County Open Space
- Larimer County Parks and Open Lands Areas
- Eldorado Canyon State Park
- Golden Gate State Park

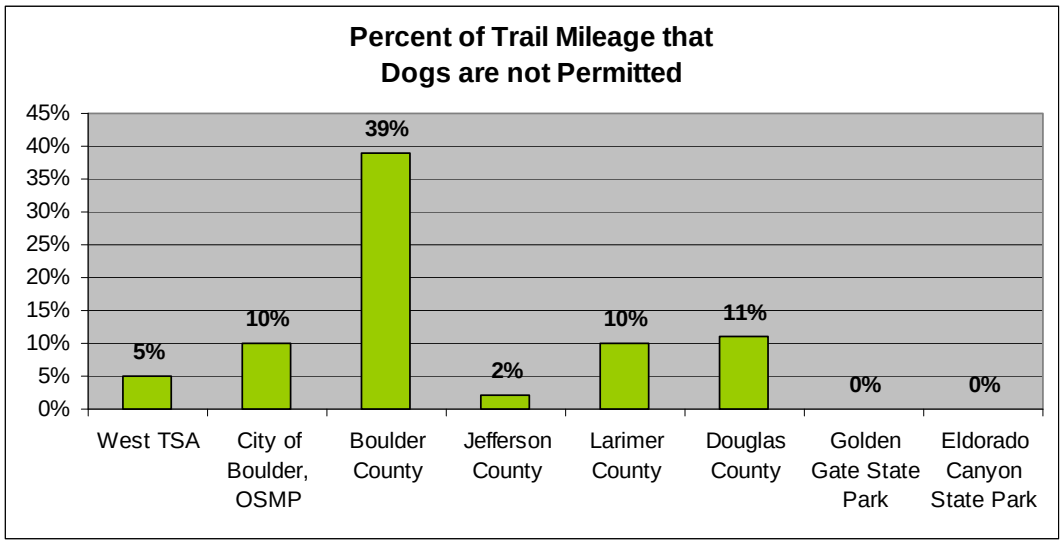
Appendix B contains the agency data used in the comparisons. Each agency's data was obtained from their website, compiled, and sent to the respective agencies for review. Changes were made to reflect agency responses. Greenways and regional trails were not included in the analysis. Appendix B also lists the trails that were omitted from the analysis.

OSMP is interested in a comparison of:

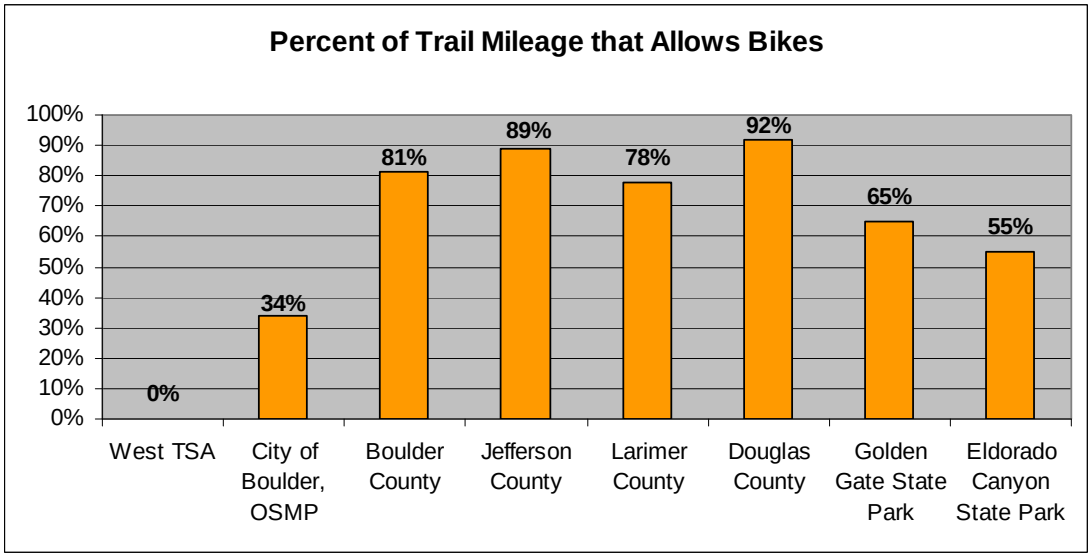
- Dog Management
- Bicycling
- Horseback Riding
- Annual Wildlife Seasonal Closures



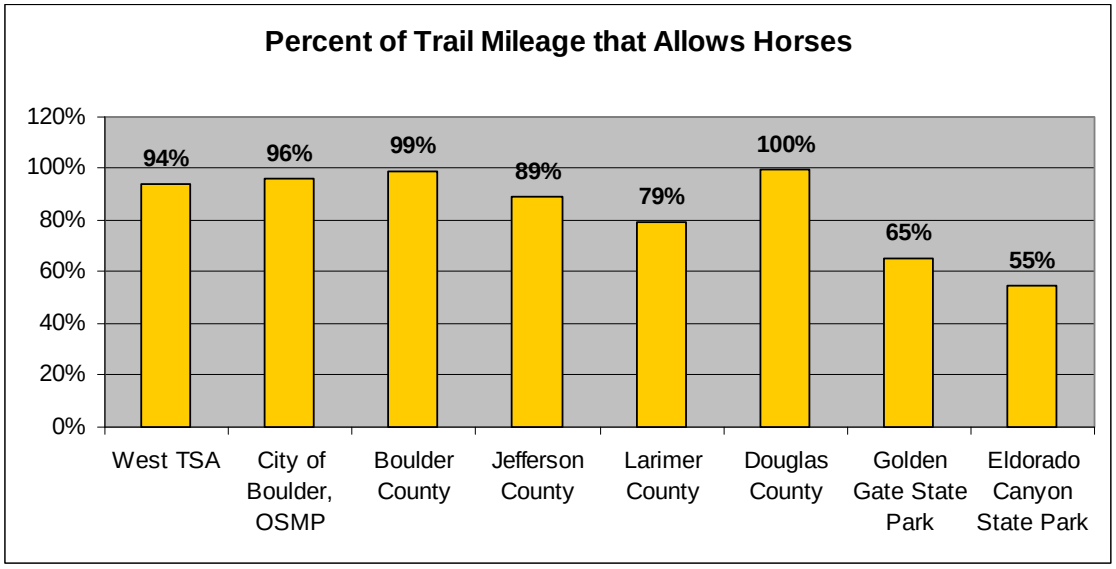
- Among the agencies surveyed, none allow dogs off-leash on trails. However, some agencies do have relatively small dog parks where dogs are allowed off-leash.
- OSMP is the only agency where dogs are allowed off-leash, under voice and sight control, on a significant portion of the trail system.



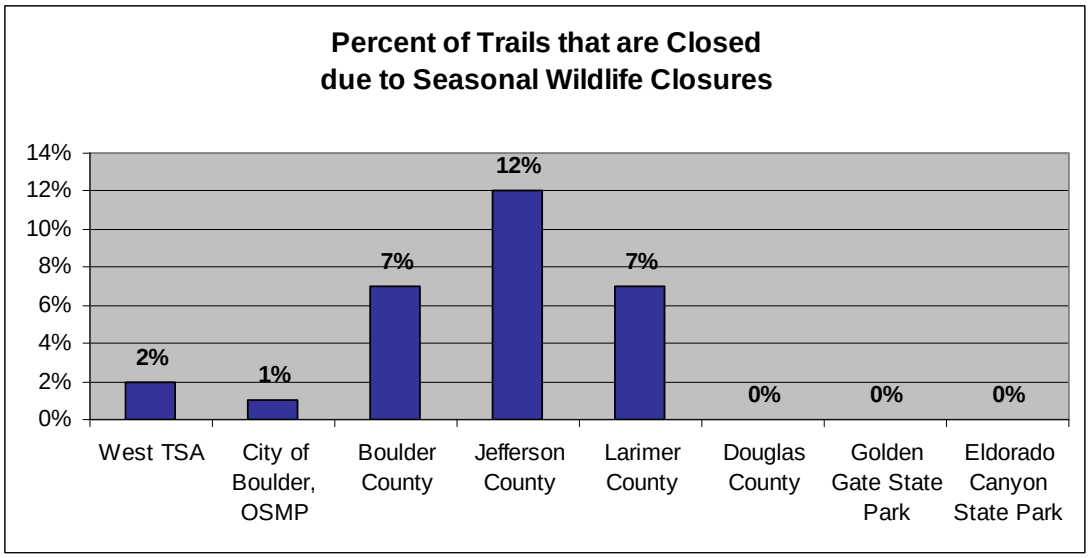
- All of the Open Space agencies (does not include State Parks) prohibit dogs on some portion of the trail system.
- Although a commonly used strategy, not allowing dogs is typically restricted to a small portion of the trail system.
- Boulder County had the highest percentage (39%) of trails where dogs are prohibited.



- Among the agencies surveyed, all allow bicycling on trails.
- All agencies, except OSMP, allow bicycling on over half their trail mileage.
- Jefferson County recently segregated hiking and biking on a portion of one of their trails.
- Boulder County and Jefferson County use an alternating activity management strategy. (i.e. bikes on even dates, hiking only on odd dates).



- Among the agencies surveyed, all allow equestrians on trails.
- In all cases, horses are allowed on a majority of the trail system.



- Four out of the seven agencies close a portion of their trail system each year for wildlife protections.
- Jefferson County also closes a portion of their trail system to accommodate hunting activities (included in their 12%).
- This strategy is typically restricted to a small portion of the trail system.

Snapshot of the Region

The relative availability and spatial distribution of passive recreational opportunities provided by land management agencies in the region may be a consideration when decided what opportunities should be provided in the West TSA planning area. Examining the West TSA planning area in a regional context may provide direction in determining the mix of recreational opportunities.
The following agencies are the land management agencies surrounding the West TSA, and OSMP system, and create the larger context to explore the recreational opportunities of the West TSA.

- Open Space and Mountain Parks entire land system
- City of Boulder, Parks and Recreation Department
- Boulder County Parks and Open Space
- Eldorado Canyon State Park
- United States Forest Service (USFS) Boulder Ranger District

The West TSA encompasses most of the climbing and bouldering opportunities on OSMP lands. It also includes the only natural lands in the City of Boulder where sledding is allowed, Chautauqua. The West TSA contains the tallest peaks in the OSMP system, South Boulder Peak (8,549ft) and Bear Peak (8,461ft).

- The West TSA contains 78 miles of designated trails, 54% of all OSMP trails.
- One of the largest differences between the entire OSMP system and the West TSA is mountain biking opportunities. No trails in the West TSA permit mountain bikes, while they are permitted on 34%, or 49 miles, of trails in the OSMP system.
- While dogs are required to be on leash on 26% of West TSA trails, it is slightly higher for all OSMP trails at 31%. 5%, or 4 miles, of West TSA trails provide no-dog opportunities, and again is slightly higher on all OSMP lands at 10%, or 15 miles.
- 73 miles in the West TSA allow equestrians, while 138 miles of all OSMP trails allow equestrians.

The City of Boulder Parks and Recreation Department provides a variety of recreation opportunities in neighborhood ball and dog parks, recreation centers and the Boulder reservoir. Some recreation opportunities they provide are similar to those provided by OSMP. Parks and Recreation has trails in Natural Lands on three of their properties: the Boulder Reservoir Natural Area, Coot Lake, and Eaton for a combined trail mileage of approximately 6 miles. Both dogs and non- motorized bikes are allowed on all three trails. The Boulder Reservoir and Coot Lake allow dogs under voice-and-sight control, while at Eaton dogs are required to be on leash. There are three City of Boulder Parks where sledding is allowed; however sledding is not allowed on their natural lands.

Three of the larger Boulder County Parks and Open Space parks - Hall Ranch, Rabbit Mountain, and Heil Valley Ranch - are located in north Boulder County around Lyons. Other large parks are located in the western portion of Boulder County such as Walker Ranch, Caribou and Mud Lake, located near Nederland. Walker Ranch and Betasso are popular parks with relatively close proximity to the West TSA. Boulder County Parks and Open Space does not provide any voice-and-sight opportunities, and dogs are not permitted on almost 40 % (33 miles) of their trail

system. There are approximately 23 miles of mountain biking trails in Boulder County, some of which implement an alternating activity management strategy.

Eldorado Canyon State Park, located south of the West TSA, offers over 1000 climbing routes. Picnicking is also another popular activity. The park provides approximately 6 miles of trails to mountain bikers and equestrians, and 12 miles are open to dogs, but requires that they be on leash.

The Forest Service, Boulder Ranger District "elevations start at 7,000 feet in the lower foothills of the Rocky Mountains and soar to over 13,000 feet on the Continental Divide". It is home to the east side of the Indian Peaks Wilderness, James Peak Wilderness, Brainard Lake Recreation Area, the Peak-to-Peak Highway and hundreds of miles of hiking, biking and four-wheel-drive roads. Located primarily in Boulder County and the northern portions of Gilpin County, the Boulder Ranger District covers 250,000 acres. About 160,000 acres of that area are National Forest and 87,000 acres are private lands interspersed within the national forest boundary. The Boulder Ranger District offers 261 miles of trails and Forest Development Roads (those that allow non-motorized bikes were included). They offer no dog-free areas and 65 % of the trails permit dogs to be off-leash. Dogs must be leashed in Wilderness Areas, which corresponds to 35% of trail mileage. They offer 140 miles of mountain biking opportunities, the majority of which are on 4WD roads. There are approximately 21 miles of single-track trail open to mountain bikes.

Deciding the Mix of Recreational Opportunities

The mix of recreational opportunities allowed in the West TSA is a very critical and important decision to be made during the West TSA planning process. In the Target, Attribute, Indicator report, recreational opportunities were identified as a key attribute of visitor experience. However, there are no associated indicators. This is because a standards based, scientifically driven, framework cannot alone answer what is ultimately a policy decision that must account for concerns related to visitor conflict, trail sustainability and natural and cultural resource protection. Deciding what recreational opportunities will be allowed will be made through a collaborative community group process. An open and inclusive community conversation will be the means to working through these difficult decisions.

Attribute: Access to Destinations

The ability to travel to, enter, and navigate within the OSMP land system to destinations are all components of access. Designated trails and off-trail travel, where allowed, provide access within the OSMP system.

In HCAs, off-trail permits provide visitors an opportunity to access destinations not served by a designated trail. While in Natural Areas and Passive Recreation Areas, a permit is not required for off-trail travel. In many cases the visitor's desire to access areas not served by a designated trail is evident by the appearance of undesignated trails.

Although providing designated access to destinations is important to the visitor experience, it might not always be appropriate due to natural and cultural resource concerns.

Five indicators have been identified to measure and monitor Access to Destinations.

Indicators for Access to Destinations

- *Key Destinations Served by a Designated Trail*
- *Undesignated Trails*
- *Access Points*
- *Wayfinding Signs at Designated Trail Intersections*
- *Signs at the Intersection of Designated and Undesignated Trails*

Indicator: Key Destinations Served by a Designated Trail or Trailhead

Indicator Results:

- Habitat Conservation Areas: all 11 key destinations served, or 100%
- Natural Areas: 16 of 29 key destinations served, or 55%
- Passive Recreation Areas: 51 of 62 key destinations served, or 82%
- NCAR & NIST: 3 of 5 key destinations served, or 60%

- Overall 81/106 served or 76%

Key destinations are distinct landscape features, sites or infrastructure that have their own appeal and/or provide a point or place to linger for those traveling along a trail. Although access to key destinations is important to the quality of the visitor experience, it is only a part of the equation. Access needs to be considered along with other factors such as trail sustainability, safety and people's opportunity to get away from the crowd.

Two categories of key destinations were identified by OSMP staff. The first category includes facilities, vistas, natural features, structures or popular gathering spots. This category makes up 66 of the 106 key destinations. The second category includes popular climbing and bouldering sites, and make up 40 of the 106 key destinations. "Popular" is defined as a formation or boulder that was estimated to receive greater than 300 visits per year. The initial list was created by OSMP staff and will need to be further refined during the community collaborative process.

Visitation to Climbing and Bouldering Areas:

Experienced climbers associated with the Flatirons Climbing Council assisted OSMP with the mapping of climbing/bouldering areas and also helped estimate visitation rates. The climbing activity ratings are:

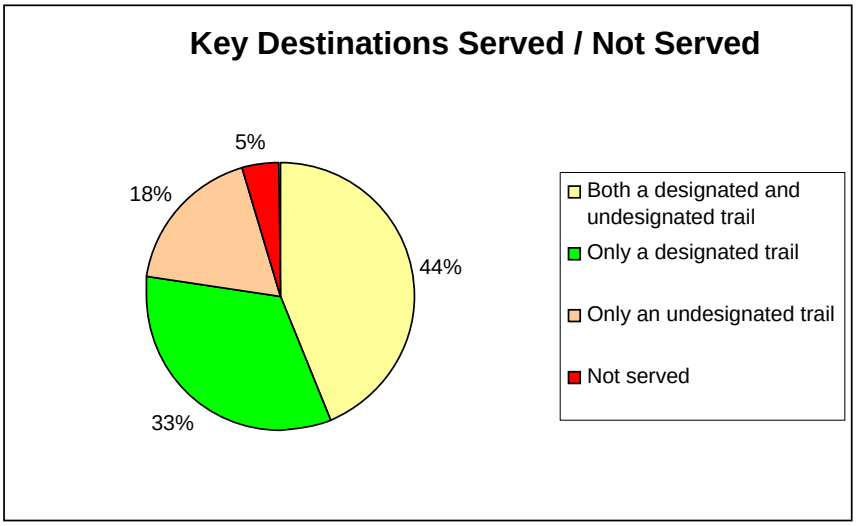
Infrequent = 1 to 100 visits/year
Moderate = 100 to 500 visits/year
Popular = over 500 visits/year

See HMap 5H for Climbing Activity with Estimated Visitation Rates.

Locations of key destinations are shown on Map 4. All key destinations that are within 100ft of a designated trail or trailhead are considered served. Each point on the map represents a key destination. For the purpose of accurately analyzing spatial data, rock formations and trailheads were best described as geographic areas – rather than points. For these exceptions, a polygon was created around the point that encompassed the entire feature. This method of analysis can cause some confusing visual mapping results. In certain locations within the West TSA there are going to be "served" destinations that appear further from a designated trail than a non-served destination.

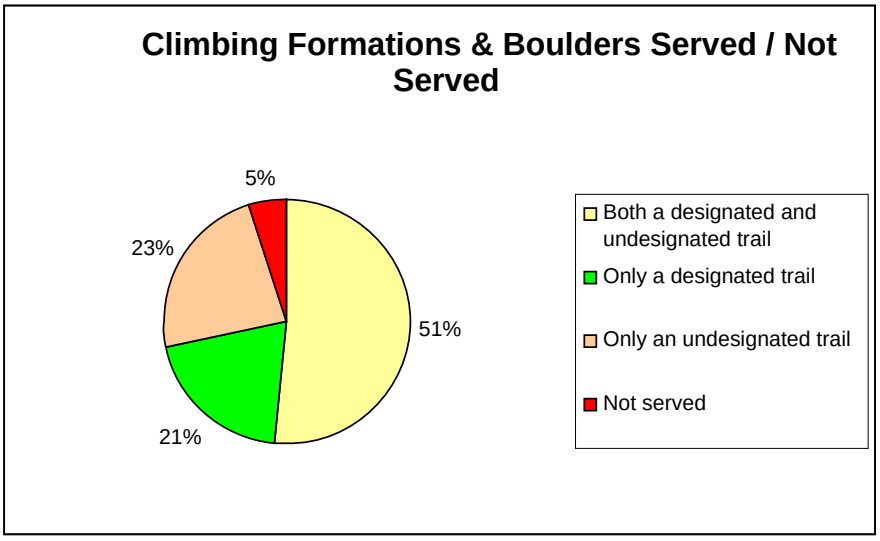
See Appendix C for a list of the key destinations, what they are, and how they are served (i.e. by both a designated trail and undesignated trail, only a designated, only an undesignated trail, and those not served).

The following figure illustrates how all key destinations are served in the West TSA.



- Undesignated trails lead to over half of the key destinations.
- Of the 23 % either not served or served only by an undesignated trail around half are in a Natural Area and the other half are in a Passive Recreation Area.

The following figure illustrates how climbing formations and boulders are served in the West TSA.



- Around half of the climbing formations and boulders in the West TSA are served by multiple trails.
- Around ¾ of the climbing formations and boulders have an undesignated trail leading to them.
- Around ¾ of the climbing formations and boulders are served by a designated trail.

Indicator: Undesignated Trails

Indicator Results:

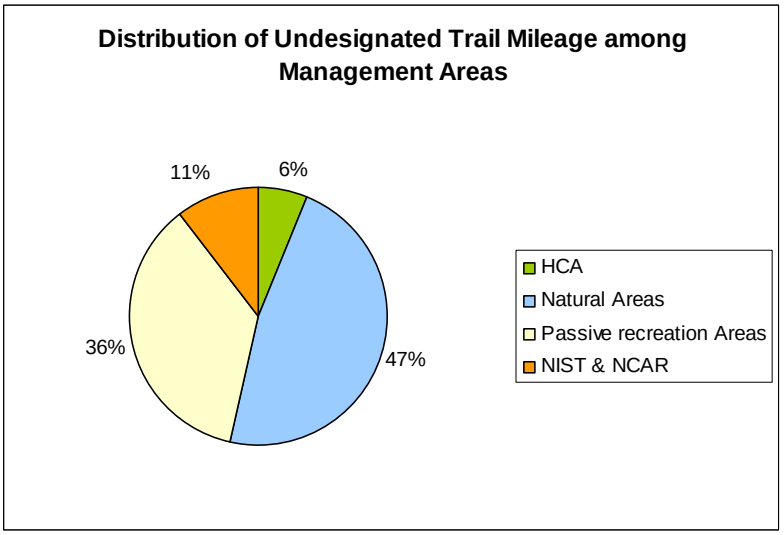
Miles of Undesignated Trails in each Management Area	
Management Area	Miles of Undesignated Trails
Habitat Conservation Area	3.5
Natural Area	27.7
Passive Recreation Area	20.9
NIST & NCAR	6.2
Total	58.3

See HMap 6H for Undesignated Trails in the West TSA.

The proliferation of undesignated trails in the West TSA is a good indication that the designated trail system does not provide access to some places visitors want to go. Undesignated trails can contribute positively to the visitor experience by providing access to destinations. However, there are also ecological impacts associated with undesignated trails, such as reduced habitat effectiveness and habitat connectivity, vegetation loss and weed spread.

This indicator is closely tied to the previous indicator, key destinations served by a designated trail or trailhead. Providing designated access, where feasible, to key destinations currently not served by a designated trail could reduce the total miles of undesignated trails. However, to reduce the mileage of undesignated trails, a variety of restoration efforts combined with public awareness tools would need to be used.

In addition, OSMP believes that some undesignated trails exist to provide links between trails. See Map 7 for Key Connections Not Being Served by a Designated Trail. The identified connections are an initial list developed by staff.



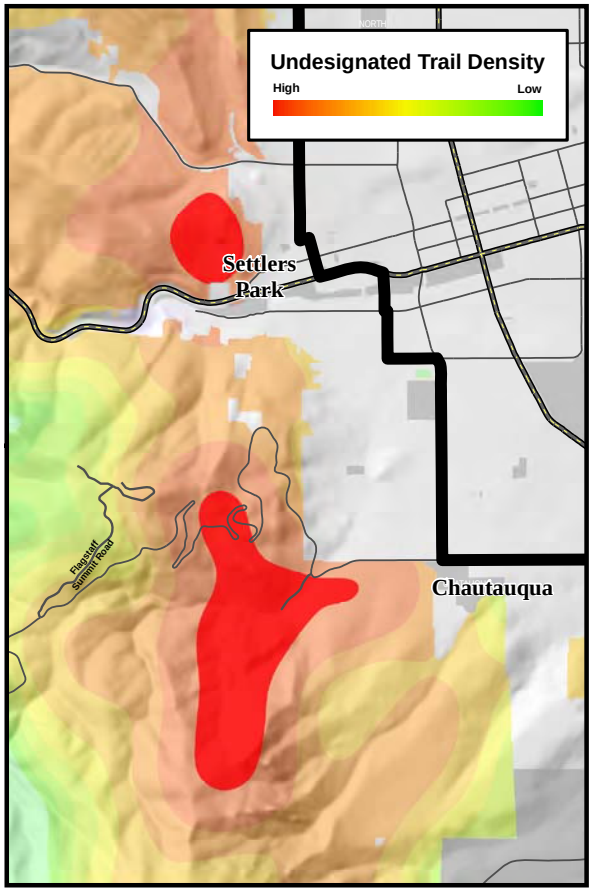
- 83% of the undesignated trails in the West TSA are located in the Natural Areas and Passive Recreation Areas.

Background

Since undesignated trails are not designed, constructed or maintained by experienced professionals they often have greater impacts to natural resources when compared to trails that are consciously designed, constructed and maintained. The lack of design in undesignated trails is evident where: multiple social trails serve a single destination, routes traverse vulnerable vegetation or sensitive wildlife habitats, and rare plants, animals or cultural resources are adversely affected by trampling or vandalism (Marion and Carr, 2007). Due to the lack of design and engineering, undesignated trails are more likely to be on flat terrain or strait up a hill. Flat trails drain poorly, this in turn leads to muddy conditions, which causes the trail to widen as people avoid muddy conditions, and erode because runoff is not properly directed off the trail. Steep trails that go strait up a hill, or follow the fall line, allow water to travel at greater speeds washing away soil material leading to erosion. Both flat and steep trails do not typically have any impediments to walking off the trail and are more susceptible to vegetation trampling and widening (Wimpy and Marion, in press).

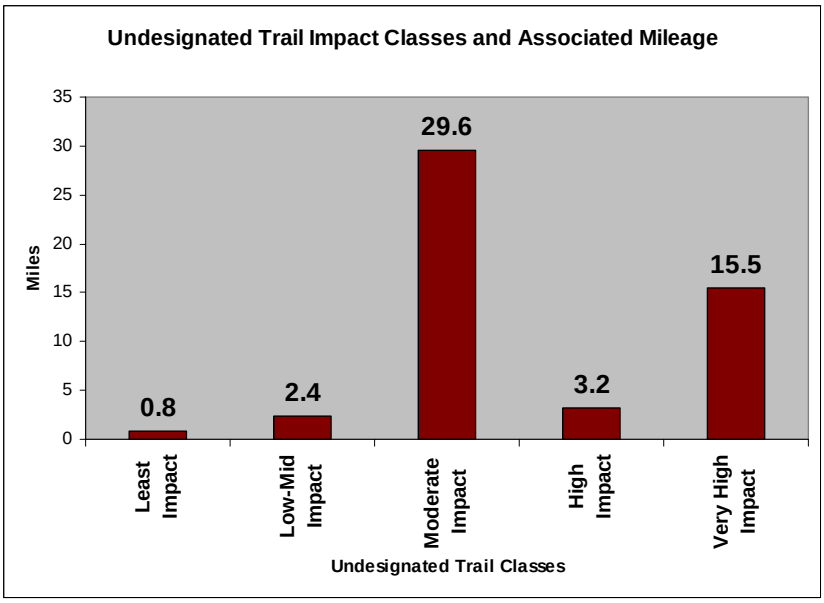
In 2006 a system-wide mapping of undesignated trails was undertaken by OSMP (City of Boulder, 2009), using methods highlighted in Appendix D. Data from this system wide mapping was used to create West TSA specific maps and summaries, illustrating undesignated trail locations.

The following figure is of the areas with the highest undesignated trail density in the West TSA. See Map 8 for Density of Undesignated Trails in the West TSA.



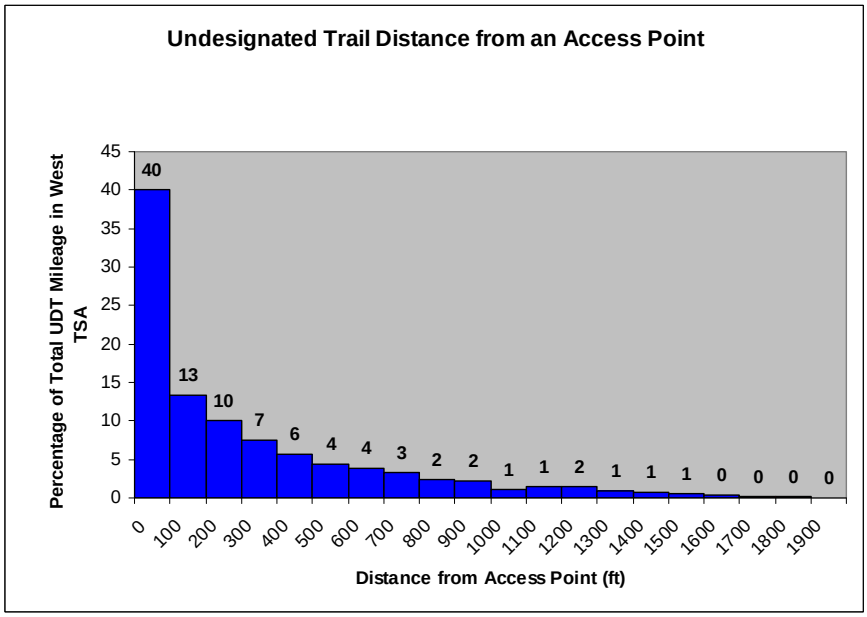
In the West TSA, undesignated trail density was found to be the highest in the vicinity of Chautauqua Meadow, Flagstaff, the 1st and 2nd Flatirons, and Settlers Park.

Undesignated trails were classified into "impact classes" (see methods in Appendix D) that measure the trail's physical impact on natural resources, but not the overall impact to natural resources. Trail width, trail cross sectional area (width / 2 x maximum incision) and tread cover percent were measured and ranked. These rankings were combined to create one composite value, which was then classified into an "impact class". The impact classes were Least Impact, Low-Mid, Moderate, High, and Very High Impact. See Map 9 for the Impact Class of Undesignated Trails. The following figure displays the mileage of undesignated trails for each impact class.



- 57% of undesignated trails in the West TSA are classed as having a moderate impact.
- 30% are classed as having a very high impact.

The following figure illustrates the percentage of undesignated trail miles found at varying distances from a road or designated trail.



- Analysis of West TSA undesignated trail data suggests that the density of undesignated trails is related to the proximity of existing trails or roads, and the likelihood of encountering an undesignated trail diminishes with increasing distance from designated trails.

Indicator: Access Points

Indicator Results:

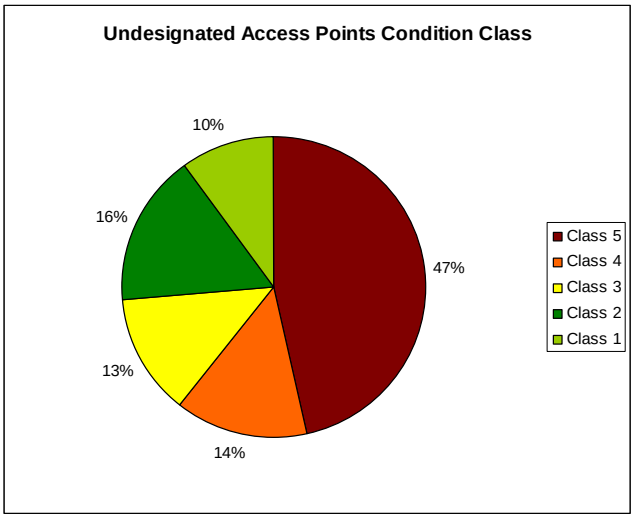
- 79% of designated access points along the urban interface are within ½ mile of another designated access point.

Most people can walk a quarter mile in about 5 minutes, which OSMP considers adequate convenience. Of the 29 designated access points along the urban boundary, 23 are within ½ mile of another access point (meaning the farthest a person would need to walk would be ¼ mile). As shown on Map 10, there are three gaps where this ½ mile goal is not met. All three gaps exist in areas where houses on private property create a physical barrier to access. Two of the three gaps are also on steep hillsides where trail construction and maintenance is difficult and expensive. Also, 8 of the 29 designated access points along the urban boundary are within a ¼ mile of a bus stop and are shown on Map 11.

Designated access points are classified based on estimated visitation levels. The level of facilities provided, such as signs and trash cans, is based on the access point's class, more people = more services, fewer people = fewer services, in general.

In additional to the 29 designated access points along the urban boundary, there are 22 additional designated access points and 129 undesignated accesses within the West TSA. See Map 12 for Designated and Undesignated Access Points.

Two steps were used to map undesignated access points and then rate the size of the trail extending from each point. First, the 2006 undesignated trail information was used to generate points of likely access. Utilizing the undesignated trail information, staff identified points along the OSMP boundary that had multiple undesignated trails originating from them. Second, a staff member walked the OSMP boundary to verify the undesignated access points identified in step one and to locate any additional access points not corresponding to undesignated trails. Based on the condition of the first 30ft of trail on OSMP, each undesignated access point was placed into one of Marion's five condition classes (Marion & Carr, 2001). Of the undesignated access points, almost half fall in Class 5.



Marion's Condition Classes

- Class 1: Trail distinguishable; slight loss of vegetation cover and/or minimal disturbance of organic litter.
- Class 2: Trail obvious; vegetation cover lost and/or organic litter pulverized in primary use area.
- Class 3: Vegetation cover lost and/or organic litter pulverized within the center of the tread, some bare soil exposed.
- Class 4: Nearly complete or total loss of vegetation cover and organic litter within the tread, bare soil widespread.
- Class 5: Soil erosion obvious, as indicated by exposed roots and rocks and/or gullying.

Indicator: Wayfinding Signs at Designated Trail Intersections

Indicator Results:

- Designated Trail Intersections with wayfinding signs: 68.4%
- Designated Trail Intersections without wayfinding signs: 31.6%

Wayfinding signs provide useful information at decision points along a trail and usually consist of a trail name with directional arrows or a map. Wayfinding signs mark the designated trail, reassuring the visitor they are on the designated trail and inform visitor where trail connections lead. They also help visitors navigate the designated trail system and decrease confusion. Being able to easily navigate the trail system without confusion, contributes greatly to the quality of visitor experience.

See Map 13 for Wayfinding Signs at Designated Trail Intersections.

Sample Wayfinding Sign

Indicator: Signs at the Intersection of Designated and Undesignated Trails

Indicator Results:

- Intersections with a sign: 9.5%
- Intersections not signed: 90.2%

Signs provide useful information at decision points along a trail. OSMP has developed a suite of signs that are used to sign undesignated trails that are being restored or areas where travel is discouraged. These signs help visitors stay on the designated trail system, decrease confusion and help visitors distinguish between designated and undesignated trails.

Over the years, OSMP staff has encountered innumerable visitors who are lost, confused and frustrated. For those visitors who want to remain on a designated trail, to reach a certain destination, doing so is often difficult given the extensive network of undesignated trails in the West TSA. Often a map is not of much use, because it is difficult to distinguish between designated trails shown on the map and undesignated trails on the ground.

Example Trail Restoration Signs

During the implementation of the Eldorado Mountain/Doudy Draw Trail Study Area, OSMP developed a system to address undesignated trails. Each undesignated trail was categorized as one of the following: Retain (needed for OSMP management activities, but do not show on maps), Restore (close and restore) or Designate (the trail remains open, unsuitable conditions or alignments may be addressed and receives regular maintenance).

A process similar to this will be used in the West TSA. Once each undesignated trail has been categorized, it will then be signed appropriately so visitors who want to stay on a designated trail can do so.

Attribute: Lack of Conflict

Conflict results when behaviors of one or more visitors interfere with other visitors' ability to achieve desired experiences. Conflict degrades the quality of the visitor experience (Jacob and Schreyer, 1980). Conflict can include annoying and unpleasant encounters with others, such as loud yelling or noises, bikes startling other visitors or dogs jumping on other visitors. Conflict does not include experiences with natural objects or phenomena, such as slipping and falling or bad weather. Lack of conflict is a commonly accepted way to measure visitor satisfaction, particularly in front country environments like OSMP lands (Graefe and Thapa, 2004).

OSMP has used three surveys to assess conflict issues. The Citizen Survey (also called the attitudinal survey) gauged opinions of registered City of Boulder residents. The Visitor Survey measured views of people visiting OSMP. The Dog Conflict study gauged which dog related behaviors visitors rated the most conflicting. The results of previous conflict questions showed respondents believed the most conflicting behaviors were those of dog walkers and cyclists. Therefore, potential future survey questions will be specific to dog walking and bike riding behaviors.

To better understand the level of conflict, some of the potential future survey questions will measure conflict experiences the day the survey was completed, while other questions will measure conflict experiences over the past year. Asking visitors about the past 12 months lets the respondent tell us about something we would otherwise have missed. Asking about the past 12 months also provides OSMP with a generalized idea of how widespread conflict is.

Six indicators have been identified to measure and monitor Conflict. It is important to note that although the West TSA process is recommending including the following indicators as questions on future surveys, it is possible that they will not be selected for inclusion. In designing future surveys, given the practical constraints on the number of questions that can be included in a survey the questions will need to be prioritized. All surveys are administered system-wide. Therefore these potential survey questions will measure conflict system-wide and will not be specific to the West TSA.

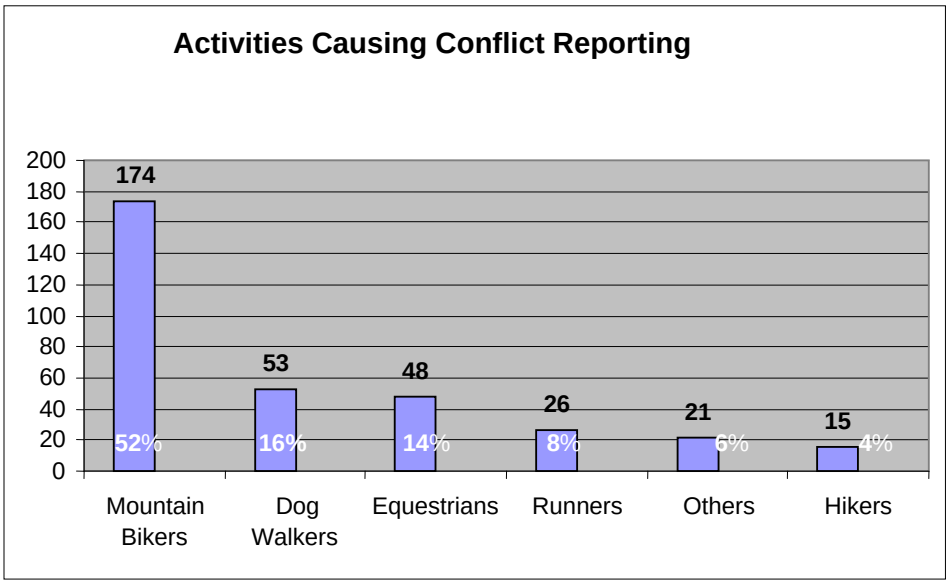
Indicators for Conflict

- *Perception of conflict today*
- *Perception of conflict with dogs today (this will likely be focused on a few specific behaviors with the most public concern as determined by past surveys)*
- *Perception of conflict with mountain bikes today (this will likely be focused on a few specific behaviors with the most public concern as determined by past surveys)*
- *Perception of conflict with dogs within the past 12 months*
- *Perception of conflict with mountain bikes within the past 12 months*
- *Visitor Displacement*

Background

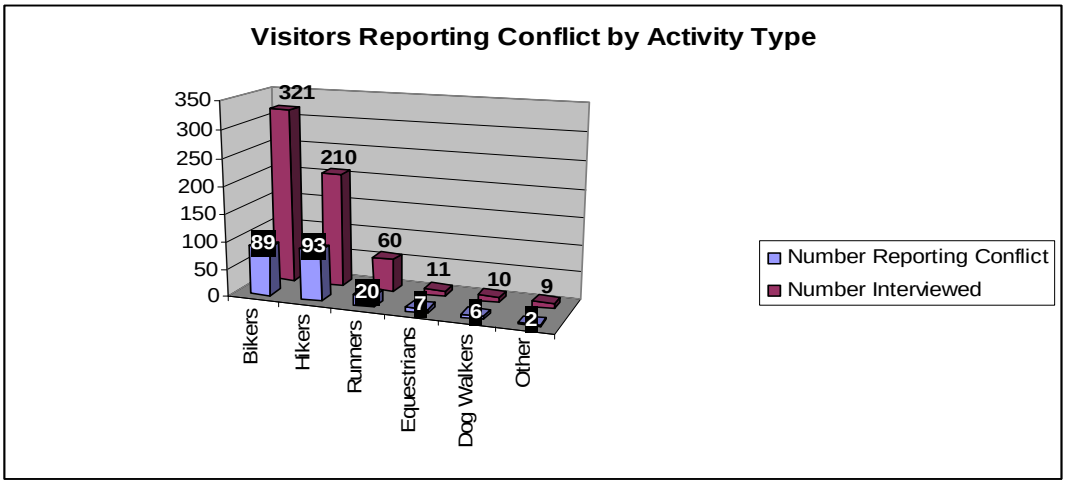
Boulder County Parks and Open Space Recreation Conflict Study

Boulder County Parks and Open Space conducted a recreation conflict study in 2003 to obtain baseline data on perceived visitor conflicts (Bauer, 2004). Another objective of the survey was to provide background data for other land management agencies, such as OSMP. During the summer of 2003, trained staff conducted 624 interviews at six Boulder County Parks and Open Space properties. Of the six County properties included in this conflict study, four properties allow dogs on leash, two do not allow dogs, and none allow dogs off leash. Whereas, dogs are allowed off-leash or with voice-and-sight control, on 69% of the West TSA lands.



The number of comments regarding mountain bikers' behaviors (174) was greater than the sum of the remaining comments (163).

The following figure illustrates the number and type of respondents who reported conflict.



- Of the 93 hikers who reported conflict, 65 reported conflicts with bikers and 25 reported conflict with dog walkers; much higher than the other visitor types.
- Mountain bikers distributed conflict comments more evenly across: bikers (35), equestrians (30), and dog walkers (21). Interestingly, mountain bikers reported conflicts with other mountain bikers (i.e. self reporting) more frequently than did any other activity type.
- Runners also reported conflict comments more evenly across: bikers (9), equestrians (7), and dog walkers (6).

Indicator: Perception of Conflict Today

Indicator Results:

- Percent of respondents experiencing conflict or unpleasant circumstances on today's visit:= 4%
- 4% roughly equals 190,000 conflictual experiences

The 2004-05 Visitor Survey asked the question: "Did you encounter any conflicts or unpleasant experiences today? Yes or No." A follow-up question asked "If yes, could you describe them?" and a space was provided for a write-in answer. 4% of the respondents reported having conflict that day. Dog related issues where identified as a major contributing factor to conflict. Inconsiderate behavior was also identified as a more general factor resulting in conflict.

A visitation study was conducted concurrent to the Visitor Survey and resulted in an estimate of 4.7 million annual visits to OSMP. Given the reported 4% conflict, simple math shows that this equated to roughly 190,000 conflictual experiences. Compared to the Boulder County survey that reported only 2% of respondents experienced conflict on the day they were interviewed - approximately 34% of respondents reported having experienced conflict at some point in the past.

Indicators: Perception of Conflict with Dogs Today
Perception of conflict with Dogs in the Past 12 Months

Indicator Results:

The following are two potential new survey questions:

- "Did you experience recreational conflict with dogs today?"
- "Did you experience recreational conflict with dogs within the past 12 months?"

The Visitor Survey and two Citizen Surveys have illustrated that dogs and dog walking activities are a concern for visitors. The 2004-05 Visitor Survey found that of the people who experienced conflict and provided an answer as to why, 60% said the conflict was dog related. Citizen Survey results found that dogs are thought to have the second greatest level of conflict with other activities, following biking. The 2004 Citizen Survey showed that 23% of people responded that dog issues can conflict with other activities; in the 1999 Citizen Survey the number was 26%.

In 2007, staff worked with interested members of the public to create a list of dog-guardian and dog behaviors thought to be offensive to some OSMP visitors. This list was used in a dog conflict study (Vaske and Donnelly, 2007). All behaviors tested were found to be a slight to extreme problem. The behaviors thought to be most problematic were owners not picking up after their dogs (57% reported extreme problem), dogs causing wildlife to flee (35%), dogs jumping on visitors (35%), dogs pawing visitors (24%), and dogs flushing birds (24%).

The dog conflict study also asked people if they observed the listed behavior that day. The following table illustrates the findings of that study.

Reported Behavior	Percent of respondents who observed the behavior that day
Dogs off-trail	32% (5% reported as extreme problem)
Dogs approach uninvited	19% (16% reported as extreme problem)
Dogs sniffing a visitor	18% (9% reported as extreme problem)
Dogs "playing chase" with another dog	18% (10% reported as extreme problem)
Owners not picking up after their dogs	10%
Dogs causing wildlife to flee	3%
Dogs jumping on visitors	3%
Dogs pawing other visitors	2%
Dogs flushing birds	2%

Based on this information, perception of conflict with dogs today and within the past 12 months, will be measured as the number of times a respondent observes the following behavior on the day of the survey:

- People not picking up after their dog
- Dogs causing wildlife to flee or killing wildlife
- Dogs jumping on or pawing people
- Dogs off-trail

Indicators: Perception of Conflict with Bikes Today
Perception of Conflict with Bikes in the Past 12 Months

Indicator Results:

The following are two potential new survey questions:

- "Did you experience recreational conflict with bikes today?"
- "Did you experience recreational conflict with bikes within the past 12 months?"

Previous Citizen Surveys have illustrated that bikers and biking activities are a concern for visitors. Citizen Survey results found that bikers are believed to have the greatest level of conflict with other activities. The 2004-05 Citizen Survey found that 37% of respondents reported that biking activities can conflict with other activities; in1999 it was 27%.

Based on this information, perception of conflict with bikes today and within the past 12 months, will be measured as the number of times a respondent observes the following behaviors on the day of the survey:

- Bikes not yielding
- Bikers speeding
- Bikers not communicating on approach
- Bikers not being courteous

Indicator: Visitor Displacement

Indicator Results:

- The 1999 Citizen Survey found that 10% of respondents stopped visiting a particular open space area and 9% visited less often (system-wide)

Visitor displacement occurs when someone quits visiting a place or visits less often as a result of some adverse circumstance such as experiencing conflict or the area exceeds the person's tolerance for crowding. The 1999 Citizen Survey found that 10% of respondents stopped visiting a particular open space area and 9% visited less often. A follow-up question, asking respondents why they visited less often or stopped visiting entirely, showed that 36% stopped or visited less often because of crowding, 28% because of conflict, and 21% outside factors not related to open space.

The visitor displacement indicator will be measured as the number of respondents who report that they have quit visiting, or visit less often, a particular area on OSMP.

Attribute: Connection with the Land

OSMP offers hundreds of natural and cultural history interpretive hikes every year, staffs Farmer's Markets and festivals to bring information about OSMP resources and management issues to the public. Volunteer opportunities provide avenues for further involvement on the land with tasks ranging from trail guides and bike patrol to bat and raptor monitors, as well as interpretive hikes, trail building and ecosystem restoration.

A person's connection to the land is an emotional bond between a person and the place they love. As people explore areas in ways meaningful to each of them, these connections are established and reinforced. OSMP works to foster connections to OSMP lands through formal education programs and informal outreach programs. The intent is to enhance visitors' enjoyment of the land by providing opportunities to learn about the remarkable places they find here. Hands-on volunteer activities help preserve and restore areas, deepen visitors' understanding of the complex ecosystems and history of the land and can engender stewardship of the land. Collectively education and outreach opportunities help people strengthen their personal connection to the land.

Four indicators have been identified to measure and monitor Connection with the Land.

Indicators for Connection with the Land

- *Awareness of OSMP Education Opportunities*
- *Participation in OSMP Education Events*
- *Participant Satisfaction with OSMP Education Programs*
- *Volunteer Satisfaction with OSMP Programs*

Interpretive hike participants, including staff & volunteer leaders

Indicator: Awareness of OSMP Education Opportunities

Indicator Results:

- From the Citizen Survey administered in 2004-05:
  73% respondents were aware of the fact that OSMP offered guided hikes, programs at local schools, information at trailheads and events like Farmers' Market.

OSMP offers formal and informal education programs to the community year round. The public has many opportunities to ask questions of staff and volunteers at places like the Ranger Cottage, the Flagstaff Summit Nature Center, the holiday tree cutting event, Farmer's Market and local festivals. In 2008, about 64,000 informal contacts occurred. Specific to the West TSA in 2008, 7,808 people participated in formal education programs.

In an effort to poll a wide array of citizens, OSMP conducted a Citizen Survey (see Appendix F) of registered voters in the City of Boulder. One question asked if people are aware of the variety of OSMP education opportunities. The percentage of respondents who answer "yes" will serve as the indicator, or measure, for the public's awareness of OSMP's nature education offerings.

Trailhead outreach

Indicator: Participation in OSMP Education Events

Indicator Results:

- From the Citizen Survey administered in 2004-05:
  47% of the citizens polled had participated in an educational event with Open Space and Mountain Parks.

The Citizen Survey (see Appendix F) asks, "If you or a family member has ever received nature education from City of Boulder Open Space and Mountain Parks staff members, where did it happen?" These responses will collectively serve as the indicator for the level of the general public's participation in OSMP's nature education programs.

Where did you participate in an education event with OSMP?

Farmers' Market	11%
Chautauqua	10%
Schools/youth activities and places . . .	8%
On guided hikes	8%
Flagstaff Mountain	4%
Miscellaneous	4%
Information media/newspapers/mail…	2%
Total……..	47%
Didn't participate in education program	38%
No response	4%

Responses of less than 2 percent, which totaled 11 percent, are not included.

Volunteer at Farmer's Market

Indicator: Participant Satisfaction with OSMP Education Programs

Indicator Results:

- Participant Surveys, handed out at the end of a program, show an average rating of 9.2 (on a 1 worst - 10 best scale) for overall satisfaction with the program quality.

In 2008, OSMP staff and volunteers offered 424 programs across all OSMP properties to the community, with 12,490 people attending. These programs took the form of both free public educational hikes known as Natural Selections Programs and programs requested by various community groups and schools. Of the 424 programs offered in 2008, 194 were requested by the community and 230 were offered as Natural Selection hikes. These programs covered a range of topics including general wildlife, ecology, geology, astronomy, history, various arts, accessible trail activity, bird watching, OSMP 101, Habitat Conservation Areas, pine beetles, forest ecology, wetlands, grasslands, full-moon hikes, and bike hikes. These programs take visitors all over the OSMP system.

In 2008, a total of 306 programs were provided for 7,808 participants within the West TSA boundary. This accounts for about 73% of the total system-wide interpretive events offered by OSMP for the year of 2008. The intent of the Participant Survey is to measure overall satisfaction with each program; however the survey has been administered sporadically. With the identification of this indicator, OSMP staff and volunteers will work towards distributing the survey more regularly and encourage all participants to complete it. This will help education programs continue to evolve in a way that meets the community's expectations/desires.

Indicator: Volunteer Satisfaction with OSMP Programs

Indicator Results:

- The year end Volunteer Survey asks: "How would you rate your overall satisfaction with your volunteer experience on a scale of 1 - 5."

Score	Number of Respondents
5 (Very Satisfied)	40
4	14
3	1
2	1
1 (Very Unsatisfied)	0

OSMP offers about 15 volunteer programs that occur in the West TSA area. Opportunities range from trail building and ecosystem restoration work, to bat, raptor, and frog monitoring, leading interpretive hikes for children, native plant gardening, Nature Center hosting, trash pick-up, neighborhood bear education teams and trail guides to name a few. More than 25,000 hours of volunteer time was logged in OSMP in 2008. About 9,150 hours, roughly 36%, occurred in the West TSA to some degree. For example, volunteers monitor bat activity across the OSMP system, some of which occurs in the West TSA.

At the end of each year, all volunteers are given a survey (see Appendix G) which is used by staff to help guide decisions about program development. This indicator will be used to provide an overarching view of how these programs serve the volunteers. In 2008, 71% of volunteers reported that their experience was "Very Satisfying".

Bat Monitor Volunteer

Attribute: Safety

While risk is inherent in wildland settings and in many of the activities pursued on OSMP lands, OSMP does seek to improve the visitor experience by reducing the likelihood that visitors will encounter hazardous situations. In addition, OSMP provides information on how visitors can avoid some dangerous situations, and promptly responds to safety issues that come to the attention of the department.

Rangers respond to many types of incidents in the West TSA such as law enforcement situations, injured or lost persons, and wildfires. There are 12 full-time rangers on the OSMP organizational chart. However, at this time not all the positions are filled. Some of the incidents handled by OSMP rangers in the West TSA during 2008 are included below (number of incidents):

- Dog Related— 268
- Illegal Camping— 78
- Injuries— 30
- Lost Individuals— 5
- Wildfires/Smoke Reports— 5
- Car Break-Ins— 3

See Appendix I for a complete list of incidents that occurred in the West TSA in 2008.

Safety issues and corresponding actions can include the temporary closing of an area due to bear or mountain lion activity, the repair of trail infrastructure such as protruding rebar, and rangers enforcing the prohibition of campfires. As the departments' highest priority, OSMP is prepared to respond promptly to any emergency including wildfires. Additional emergency services are provided by the Boulder Police and Fire Departments, Boulder County Sheriff's Department, Fire Protection Districts, and many volunteer organizations such as Rocky Mountain Search and Rescue.

Safety issues related to road crossings such as Flagstaff Trail along Flagstaff Road and South Boulder Creek Trail at Hwy 93 are addressed as part of the Visitor Infrastructure Target.

Four indicators have been identified to measure and monitor Safety.

Indicators for Safety

- *Response time to safety calls*
- *Patrol frequencies*
- *Perception of safety*
- *Perception of rule enforcement*

Indicator: Response Time to Safety Calls

Indicator Results:

- Rangers responded to 100 % of the safety calls within 24 hours from March 15 to May 31 of 2009: Examples of safety issues responded to:
  - Injured hiker on the 1st/2nd Flatiron trail
  - Lost hikers on the Eldorado trail

The response time to safety calls is measured as the percent of public safety service calls responded to within 24 hours of department notification. Rangers began documenting response time to safety calls in March of 2009.

To measure ranger response time to public safety service calls, safety related incidents are recorded in a database. The database tracks the type of safety incident reported, location information, reporting party information, and the corresponding times that the call was received and the time the ranger responded to the call. A database has been used by OSMP rangers to record incidents for many years. This database provides information on the types and locations of law enforcement and emergency responses by rangers (but not response time until 3/09).

OSMP's highest priority is to be prepared to respond promptly to any emergency or safety related incident. The department's rangers are trained, equipped and available to render assistance in emergencies. Rangers are on duty daily and on-call for responding to after-hour incidents. As state certified peace officers, trained in first aid and wildland fire fighting, rangers are capable of emergency responses to incidents involving wildland fires, criminal activity and life threatening injuries. While not all incidents may require an emergency response, OSMP is committed to responding to all reported safety issues in a timely way.

Examples of Public Safety Service Calls:

- Report of lost person who has not returned from a hike
- A bicyclist injured after falling off their bike
- A dog behaving aggressively
- Report of a bear and cubs near a trail
- Smoke observed on OSMP lands

Indicator: Patrol Frequencies

Indicator Results:

- Percent of trailheads, trails, and properties patrolled by rangers at the desired frequencies.

First quarter results for 2009	
% of Desired Frequency	% of Patrol Points
100%	48%
70-99%	24%
0-69%	28%

See HMap 14H for Ranger Patrol Frequency

One of the primary responsibilities of rangers is to provide a consistent level of patrol across OSMP lands. During this base patrol, rangers check the condition of infrastructure, manage visitor activity and monitor resource condition. To guide and document this base patrol effort, patrol locations were identified and grouped by intended patrol frequency. Five groupings have been established which include trailheads, trail and property priority areas 1, 2, 3 and problem areas. The "problem area" category is a way to address special resource protection issues such as new trails in HCAs or areas that are generating ongoing visitor complaints. The patrol groupings are based upon visitation levels and where conflicts are most likely to occur.

The high proportion of patrol locations in the West TSA reflects the relatively high level of visitor activity.

The ability of ranger services to meet the desired patrol frequencies can vary based on factors such as harsh weather, muddy trails, and competing needs for ranger time (such as responding to wildfires, injuries, search and rescue missions, leading educational programs, and assisting with trail and sign maintenance).

The West TSA contains the following proportion of the system-wide total for each of the patrol groups:	
Category	**Patrol Frequency Target**
Trailheads = 39%	3 times per week
Priority 1 = 50%	2 times per week
Priority 2 = 59%	1 time per week
Priority 3 = 38%	1 time every 2 weeks
Problem Areas (% can vary depending on conditions)	3 times per week (can change monthly)

Indicator: Perception of Safety

Indicator Results:

- The 2004-05 Citizen Survey asked: "How safe do you feel during your visits to Open Space and Mountain Parks areas?" 95% of respondents felt "Safe."
  - 74% felt "Very Safe"
  - 21% felt "Somewhat Safe"
  - 3% felt "Somewhat Unsafe" or " Very Unsafe"
  - 2% did not respond

- Reasons for "Very Safe" responses include:
  - Never a problem / never think about it
  - Lots of people / I stay in groups or go with companions
  - Rangers are patrolling / easy to get help if needed

*****This indicator and results are system wide. It is not West TSA specific.

Measuring how visitors perceive personal safety during their visits is the most direct way of determining the visitors' experience of "Safety" on OSMP. Many of the factors that affect a person's perception of safety are not, and can not, be managed by OSMP. Some of these factors include personal comfort levels with outdoor activities and the OSMP landscape. Additionally, individuals have varying tolerances for risk, with some individuals desiring a higher degree of risk in their experience. The factors that can be managed, such as ranger staffing and responding quickly to concerns, are integral to providing a safe and quality visitor experience.

Reasons for "safe/ unsafe" responses:

Reasons for feeling safe:

- Never a problem/never think about it/never attached = 47%
- Lots of people there/I stay in groups/go with companions = 8%
- I'm very careful/can take care of myself/trust my instincts = 5%

Reasons for not feeling safe:

- Presence of mountain lions/fear of being killed by a bear = 7%
- I worry when I'm out alone/you never know who's out there 5%
- Security gaps/not enough rangers/ car break-ins = 2%

Indicator: Perception of Rule Enforcement

Indicator Results:

- The average letter grade given by Visitor Survey respondents to the question "enforcement of rules" is 3.11 (on a point scale of 0-4, F=0, D=1, C=2, B=3, A=4)

*****This indicator and results are system wide. It is not West TSA specific.

The presence of rangers patrolling OSMP properties and the enforcement of regulations are direct management actions that can impact, and hopefully reduce, the likelihood of criminal activity or activities that pose a safety risk. This indicator compliments the ranger patrol frequency indicator as it measures the perceived satisfaction visitors have with enforcement efforts. This indicator will be measured as the visitor perception and satisfaction with "enforcement of rules." If visitors feel there is satisfactory enforcement, then safety concerns are also likely being addressed.

Attribute: Remoteness

People seek a remote experience where they can be alone with few visual reminders of every-day life. The OSMP land system provides an uncommonly good opportunity near an urban area for visitors to get away from the city, everyday stresses and other people. OSMP believes an hour long walk into the foothills can still provide a visitor with a near-wilderness experience with little evidence of human impact.

Many land management agencies manage Wilderness Areas to provide a visitor with a sense of remoteness and solitude by issuing a limited number of permits, thus allowing them to manage for a set carrying capacity. Although the number of off-trail permits issued in HCAs is monitored, it is not OSMP's intent to limit the number of visitors.

While a sense of remoteness can occur throughout the OSMP system, HCAs offer the best opportunity. One characteristic identified in the VMP of a HCA is that they tend to be located in more remote areas and are harder to access. This helps manage crowding, which plays an important role for providing a sense of remoteness. Also, HCAs typically represent the largest blocks of habitat with few, if any, trails or roads.

The presence of human evidence, such as signs and trails, can impact a visitor's sense of remoteness. Remoteness, similar to visitor experience, is influenced by the visitor's personal preferences. Therefore, OSMP selected three indicators that focus on what can be directly managed.

Indicators for Remoteness

- *Undesignated trails in Habitat Conservation Areas*
- *Sign structures in Habitat Conservation Areas*
- *Sign structures in Natural Areas*

Indicator: Undesignated Trails in Habitat Conservation Areas

Indicator Results:

- There are 16.6 miles of trails in the Western Mountain Park HCA
  - 22% are Undesignated Trails (3.5 miles)
  - 80% are Designated Trails (13.1 miles)

See HMap 6H for the Undesignated Trails in the West TSA.

The proliferation of undesignated trails in the West TSA is a good sign that the designated trail system does not provide access to some places visitors want to go. In comparison, there are the following miles of undesignated trails in the other management areas:

- There are 52.6 miles of trails in the Natural Areas within the West TSA
  - 53% are Undesignated Trails (27.7 miles)
  - 47% are Designated Trails (24.9 miles)
- There are 54.1 miles of trails in the Passive Recreation Areas within the West TSA
  - 39% are Undesignated Trails (20.9 miles)
  - 61% are Designated Trails (33.2 miles)
- There are 11.9 miles of trails on NCAR and NIST
  - 52% are Undesignated Trails (6.2 miles)
  - 48% are Designated Trails (5.7 miles)

Undesignated trails can contribute positively to the visitor experience by providing access to destinations. However, undesignated trails can also negatively impact the visitor experience by detracting from a visitor's sense of remoteness or visually representing ecological impacts.

The VMP specifically calls for the elimination of all undesignated trails in HCAs, unless they are made part of the designated trail system (pg.48). OSMP has developed a system to address undesignated trails. This system includes the categorizing of all undesignated trails as one of the following: Retain (keep for official OSMP use), Restore (close and restore) or Designate (the trail remains open and receives regular maintenance).

Indicator: Sign Structures per Trail Mile in Natural Areas and Western Mountain Parks HCA

Indicator Results:

- Western Mountain Parks HCA: 3.4 structures/ trail mile
- Natural Areas: 3.5 structures/ trail mile
- Although not an indicator, the number of signs structures/ trail mile in:
  - Passive Recreation Area: 6.4 sign structures/ trail mile
  - NCAR & NIST: 2.8 sign structures/ trail mile

Structures along a trail can add to or detract from the trail experience and sense of remoteness. Signs are one of the most visible built forms associated with trails. Each sign structure should be designed to fulfill the intended purpose and add to the character of the trail. Simple sign structures tend to be most harmonious in natural settings where visitors are seeking escape from the built environment and are most interested in viewing natural landscapes. In these instances, the success of a structure lies in how well it serves its purpose without detracting from the visual context and sense of remoteness.

Each sign structure can hold multiple signs that are intended to inform, provide directions, or elicit a certain behavior. Visitors are more willing to see sign structures/signs in a heavily used Passive Recreation Area than in a remote setting such as HCAs. OSMP partnered with Leave No Trace Inc., and the focus groups informed OSMP that the tolerance for signs was higher at the start of a hike and directly proximate to where an issue is. Many of our trails begin in a Passive Recreation Area, where sign structures would be tolerated, and not in HCAs.

Duplicate Sign Structures

Recreation Target: Visitor Infrastructure

OSMP maintains a system of trails, trailheads and other facilities to support and enhance the visitor experience. Although all development impacts the natural system either directly (i.e. a trail) or indirectly (e.g. changes to surrounding hydrological patterns, habitat fragmentation), sustainable infrastructure can reduce those impacts. Well designed, constructed and maintained infrastructure is stable over time, can reduce the likelihood that visitors will encounter hazardous situations, can increase visitor enjoyment, provides access, and reduces the aesthetic impact of litter. A recreation facility or trail is considered physically sustainable when it is able to accommodate all physical forces acting upon it, both natural and human caused, while encouraging visitors to stay on the trail (Minnesota Department of Natural Resources, 2006).

It is important to note that sustainable infrastructure requires regular maintenance to remain sustainable. In the absence of regular maintenance and upgrades, the condition of infrastructure can reach a degree of disrepair that is extremely costly to repair, or actually requires complete replacement.

Infrastructure can also help increase safety. For example, infrastructure such a road striping, flashing cross-walk signs and bridges can all increase safety when a trail crosses a road. The VMP identified two unsafe road crossing in the West TSA. These are located along Flagstaff road and at Centennial (old Sanitas) trailhead. The road crossing at Centennial trailhead has been upgraded, leaving the crossings along Flagstaff to be addressed.

For the West TSA, two attributes associated with the Visitor Infrastructure have been identified.

Attributes for Visitor Infrastructure

- *Condition of Concentrated Use Areas*
- *Condition of Trails*

Attribute: Condition of Concentrated Use Areas

OSMP manages and maintains concentrated use areas such as trailheads, overlooks, amphitheaters, picnic areas, access points, road crossings and large group areas.

In 2008, OSMP created a Classes and Standards document (Appendix K) to classify all concentrated uses areas based on visitation levels. Information from the 2004-05 Visitor Survey/Visitation Estimate and staff knowledge was used to estimate the visitation levels. In addition, each class has associated amenities that must be present and an associated maintenance frequency that must be met to comply with the standard.

The following table displays the number of concentrated use areas in each category and provides a brief description. The estimated use for each area breaks down as follows: 0-10,000 visits/per year were classified as very-low, 10-25,000 as low, 25-50,000 as medium, 50-90,000 as high and 90-110,000 as very high.

Concentrated Use Areas in the West TSA			
Type of Concentrated Use Area	**Description**	**Estimated Use**	**Count**
Trailheads			**14**
TH 1	Simple/Minor Developed Trailhead	Very Low Use	2
TH 2	Developed/Improved Trailhead	Medium Use	8
TH 3	Fully Developed Trailhead	High to Very High Use	4
Access Points			**33**
AP 1	Access to trails	Very Low Use	25
AP 2		Medium to High Use	5
AP 3		Very High	3
Recreational Facilities			**4**
RF 1	Provides no designated trail access. Includes picnic areas, viewpoints and bench sites.	Low to Medium Use	1
RF 2		High to Very High Use	3
		Total	**51**

Two indicators have been identified for the West TSA to help measure compliance with the identified required amenities and maintenance schedule.

Indicators for Condition of Concentrated Use Areas

- *Service Level Compliance*
- *Infrastructure Maintenance*

Indicator: Service Level Compliance

Indicator Results:

Concentrated Use Areas in the West TSA				
Type	**Class**	**Total Number**	**Total that Comply with Standard**	**Total % that Comply**
Trailhead (TH)	TH 1	2	0	0%
	TH 2	8	0	0%
	TH 3	4	0	0%
Access Points (AP)	AP 1	25	15	60%
	AP 2	5	4	80%
	AP3	3	3	100%
Recreation Facility (RF)	RF 1	1	0	0%
	RF2	3	1	33%

The Classes and Standards for Trailheads, Access Points and Recreation Sites (Appendix K) identifies the classification for each concentrated use area. Each classification has associated standard facilities, that must be present, and a list of optional facilities, that might be present given each site's unique characteristics. For example, the only standard facility at an A1 is a wayfinding/regulatory sign post. Whereas the standard facilities at a T2 include: fence, parking area (road base surface), trailhead signs, trash cans, dog stations, ADA picnic tables/area and bike racks.

OSMP has inventoried all existing concentrated use areas, identified those sites out of compliance and identified a list of necessary upgrades (Appendix K). As illustrated in the above table, many sites do not comply. However, all newly constructed concentrated use areas should comply with the identified classification.

Indicator: Infrastructure Maintenance

Indicator Results:

There are currently no results to report. Although OSMP believes that we are meeting the maintenance standards at all concentrated use areas, OSMP has not historically tracked this. As a result of the West TSA planning process, a system has been implemented to track concentrated use maintenance schedules. Preliminary result will be available in 6 months.

The Classes and Standards for Trailheads, Access Points and Recreation Sites document (Appendix K) details the maintenance standards that OSMP staff will apply to each classification. Concentrated use areas are examined on a regular basis, the frequency of maintenance depends on the area's classification. For example, a very low – low access point (A1) is checked monthly for maintenance issues, whereas a high to very high trailhead (T3) is inspected twice weekly. Each time a concentrated use area is inspected OSMP staff look for erosion problems, pickup loose trash, repair any damage, trim and mow surrounding vegetation, service outhouses, and inspect the parking areas. Generally, problems or damage identified in an inspection is recorded and fixed as quickly as practical. However, some maintenance issues have a very specific timeline called out. Examples are listed below (see Appendix K for a complete list).

- Large items of trash, such as appliances or furniture, will be removed within 48hrs of identification/notification.
- Graffiti will be removed within 72 hours of being discovered.
- Outhouse exteriors will be stained/painted at least one every three years.
- Outhouse interiors will be power washed each month or on a more frequent basis if needed.

Attribute: Condition of Trails

OSMP manages 78 miles of designated trails in the West TSA, see Appendix L for a complete list of trail names and associated miles.

The construction and maintenance of trails provides opportunities for visitor travel, access to key destinations and specific passive recreational activities. When designing a trail many factors are taken into consideration, including the types of activities that will be allowed on the trail, the physical constraints of the terrain, resource protection priorities, estimated levels of activity, anticipated maintenance needs, potential viewsheds and the cost of construction. Well designed trails encourage visitors to stay on them because they provide the easiest and safest routes to destinations (Byers et al., 2000).

Trail infrastructure (e.g., steps, bridges, water bars and culverts) is often used to help increase the sustainability of the trail and decrease impacts to the surrounding natural and cultural resources. However, an abundance of trail infrastructure can detract from the visitor experience; therefore, trails and their associated infrastructure should be designed to add to the character of the trail while serving a function related to sustainability.

Each OSMP trail has an associated Trail Management Objective (TMO) that identifies a range of construction and maintenance guidelines. Guidelines are based on trail class and designed use. The trail class refers to a trail's level of development and the designed use describes the allowed activity on the trail, which dictates how it is built and maintained. All OSMP trails fall into one of six designed uses: Official Vehicle, ADA accessible, Equestrian, Biking, Hiking or Climbing Access.

TMOs identify construction guidelines for the cross-slope, tread width, clearing width and height, turn radius, maximum sustained grade, outslope and surface materials for a trail (see Appendix M). TMOs also identify desired maintenance frequencies to address issues such as trail widening, poor drainage, erosion, and trail braiding. While the TMO guidelines serve as baseline goals for OSMP trails, there are instances where deviations from the specification may be warranted. OSMP has established these guidelines and TMO's in order to define a physically sustainable trail.

Existing levels of visitation are high enough to result in significant wear and tear on the trail system. Thus, there is a need to monitor existing trail conditions using TMO guidelines to determine which trails need maintenance. Trails in a degraded condition can decrease the quality of the visitor experience and adversely affect natural resources. OSMP seeks to have well designed and maintained trails to mitigate impacts to resources and provide a quality visitor experience.

Indicators for Condition of Trails

- *Trail Management Objective Compliance*
- *Trail Maintenance*

Indicator: Trail Management Objective Compliance

Indicator Results:

Trail Management Objective (TMO) Compliance in the West TSA		
Condition Class *	**Total Mileage of Trail**	**Percent of Trail Segments**
0-20%	27.3	35%
20-40%	21.8	28%
40-60%	7	9%
60-80%	7.8	10%
>80%	7.8	10%
Not Inventoried	6.2	8%

* Condition Classes were broken down by the percent of trail that was not in compliance. This means the trail does not conform to the specifications in its TMO and had maintenance issues, such as poor drainage, erosion, and/or trail braiding.

See Map 15 for Trail Segment Conditions. The >80% and 60-80% trail segments on the map indicate areas where work needs to be done, but these do not always represent the highest priority trail projects. Higher priorities may exist when trail segments that have a significant natural resource or safety concern, or do not affect a large section of trail and can be fixed quickly.

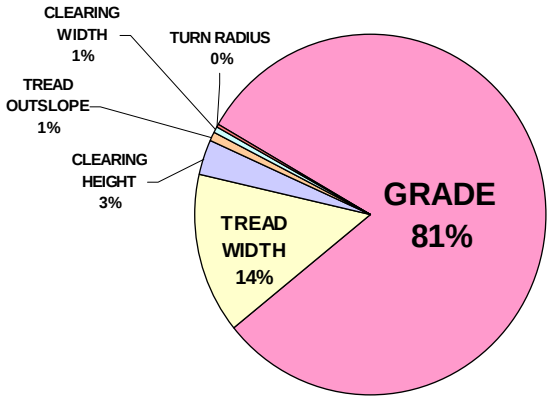
The following are trail compliance characteristics and maintenance issues for the West TSA trails system.

Trail Compliance Characteristics
• Trail grade • Trail width • Outslope • Clearing width, height • Surface materials • Turn radius

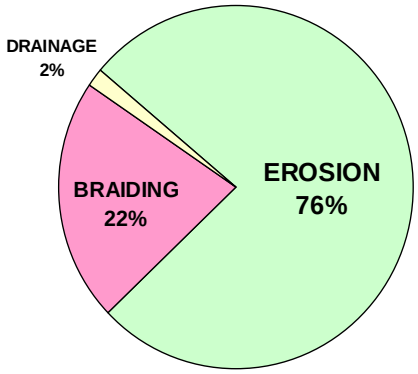
Maintenance Issues
• Drainage • Erosion • Braiding

The figures below show the maintenance issues and TMO Non-Compliance issues in the West TSA as identified in the 2008 Trail Condition Monitoring Report.

Non Compliance Issues



Maintenance Issues



- Trail grade (trails that are too steep) was responsible for over 80% of the non-compliant segments.
- Tread width (trails that are too wide) accounted for 14% of the non-compliant segments.
- Erosion was the primary maintenance issue identified (maintenance issues were identified along approximately 12 miles of trails in the West TSA).
    - Most eroded portions occur in the following areas: Kohler Mesa, mountain backdrop, Flagstaff Road area, Red Rocks and Mount Sanitas. Most eroded sections co-occur with areas that are too steep.

Background

Although popular among visitors, much of the trail system in the West TSA is not physically sustainable and is in poor condition. There are several possible factors for the existing condition of the trails in the West TSA.

First, much of the designated trail system was never designed for long-term sustainability. Many, if not most trails came about because of historic, repeated travel along game trails and temporary roads used for forestry and quarrying. Also, trails in the West TSA are not in sustainable locations. They are either located on the fall line or in a drainage or along a ridgeline, instead of a more sustainable locations along the hillside.

In addition to the lack of design, the West TSA is characterized by steep grades and highly erodable substrates. Under these conditions, trails built without appropriate design and engineering are especially vulnerable to degradation.

A third factor responsible for the trail condition is the high level of activity. Wear and tear to trails is directly related to the amount of visitor traffic. The West TSA sees considerable year round activity.

Lastly, the trails in the West TSA have not been regularly maintained. Extended periods of low, or no routine maintenance have resulted in accelerated degradation of trails in the West TSA, especially in steep, highly erodable areas where activity levels are high.

Indicator: Trail Maintenance

Indicator Results:

Currently there are no results to report. Qualitatively, OSMP staff believes that most of the trails in the West TSA received light maintenance in 2008. However, all trail work conducted in 2009 will be entered in a "work log" database. This will allow OSMP to track this indicator. Results will be available at the end of the season (generally the end of October)

Each year OSMP staff endeavor to asses every designated trail in the system. They perform Light Maintenance, which means water diversion structures (water bars, dips) are cleaned out and repaired, the trail corridor is cleared, safety issues are addressed, and other trail repairs that takes 2 people a half or less are completed. Work that needs to be done that will take a larger labor effort gets put on a list of work projects, is prioritized in with other pending trail projects.

Despite the large need for maintenance, the OSMP trails group has a budgeted amount of resources: staff hours, seasonal hours, Jr. Ranger hours, and money for equipment, contractors, and construction materials. A certain amount of those resources are committed to Light Maintenance and an allocation of time/materials for unforeseen trail work (such as a bridge getting washed out or trees blowing down and blocking a trail).

Junior Rangers

In 2008, Junior Rangers provided Light Maintenance on the OSMP system to correct drainage and erosion problems, maintain tread conditions and the trail corridor. Junior Rangers also address safety hazards and degraded structures.

Junior Rangers completed Light Maintenance on approximately 50% of the trail system (by mileage).

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Appendix A: Glossary

Bench Cut/Bench: A relatively flat, stable surface (tread) on a hillside occurring naturally or by excavation. When excavated often referred to as full, half, or partial bench.

Berm: The ridge of material formed on the outer edge of the trail that projects higher than the center of the trail tread. When improperly designed or unintentionally caused by tread compaction and soil displacement during trail use, a berm can trap water on the trail and lead to erosion

Boardwalk: An elevated, fixed-planked structure, usually built on pilings in areas of wet soil or water to provide dry crossings.

Borrow: Fill material required for on-site trail construction and obtained from other nearby locations.

Braiding: Parallel, redundant trail tread(s) adjacent to an established trail caused by users avoiding the established trail and wearing in a new path(s).

Citizen Survey: Survey of City of Boulder residents by phone or mail and typically repeated every 5 years. (1999, 2004)

Clearing: Removal of windfall trees, uproots, leaning trees, loose limbs, wood chunks, etc. from both the vertical and horizontal trail corridor.

Clearing Height (Vertical Clearance): The vertical dimension, which must be cleared of all tree branches and other obstructions that would otherwise obstruct movement along the trail.

Clearing Limit: The area over and beside a trail that is cleared of trees, limbs, and other obstructions.

Concentrated Use Area: A discrete place containing a concentration of facilities and services used to provide and support recreation opportunities. Examples include: trailheads, overlooks, amphitheater, picnic areas, access points, road crossings, large group areas.

Control Point, Negative: Are places you want users to avoid.

Control Point, Positive: Are places you want trail users to visit.

Corridor, Trail: The full dimensions of the trail, including the area (2 to 3 feet) on either side of the tread and the space overhead (10 to 12 feet) from which brush and obstacles need to be cleared. The area of passage of the trail, including all cleared and managed parts above, below, and adjacent to the tread.

Culvert, Cross Drainage: Pipe- or box-like construction of native rock, wood, metal, plastic, or concrete under a trail to catch surface water from side ditches and direct it away from a trail. Generally, a catch basin is created above the trail; the culvert is then buried underneath the trail between the catch basin and the downhill side. Sometimes a rock lining is laid on the downhill side to slow the flow of water.

Cupped (Cupping): A board or plank whose edges are higher or lower than the center. Cupping is often found in decks, where the board edges are higher than the middle. Water, trapped in the cupped area, accelerates rot. Cupping also refers to a process of erosion that turns the trail into a gully or the opposite of crowning. Lowering of the center portion of the tread due to user caused erosion or stock traffic, loosening soil in the center of the tread which is then removed by water or kicked off and built up into a berm.

Deberming: Removing the high ridge of material that has formed along the outer (downhill) edge of a trail, allowing water to once again flow off and not down the trail.

Designated Trails: Trails which are signed, shown on public trail maps, and maintained.

Designed Use: Refers to the allowed use on the trail which dictates how it is designed, built and maintained. All City of Boulder Open Space and Mountain Parks trails fall into one of six designed uses: Official Vehicle, ADA accessible, Equestrian, Biking, Hiking or Climbing Access.

Drainage Structure: A water diversion structure constructed across the trail tread to remove water flowing down the trail tread or to prevent it from entering the tread.

Erosion: Natural processes (water, wind, ice, or other physical processes) by which soil particles are detached from the ground surface and moved downslope, principally by the actions of running water (gully, rill, or sheet erosion). The combination of water falling on the trail, running down the trail, and freezing and thawing, and the wear and tear from traffic create significant erosion problems on trails.

Fall Line: Steepest line across a given contour or the direction water flows down a slope (path of least resistance) under most circumstances. Constructing a trail on the fall line encourages water to run down the trail and leads to erosion.

Grade: The vertical distance of ascent or descent of the trail expressed as a percentage of the horizontal distance, commonly measured as a ratio of rise to length or as a percent. For example, a trail that rises 8 vertical feet in 100 horizontal feet has an 8% grade. Grade is different than angle; angle is measured with a straight vertical as 90º and a straight horizontal as 0º. A grade of 100% would have an angle of 45º.

Grade, Average Trail (Overall Trail Grade): The average steepness of a trail over its entire length.

Grade, Reverse (Grade Reversal, Grade Change, Adverse Pitch): A reverse in the trail grade, usually a short dip followed by a rise&emdash;that forces water off the trail. Grade reversals are subtle and typically designed into the alignment of the trail. When designed into the alignment they can prevent the future need for more artificial water diversion structures such as waterbars.

Grade, Sustained: The steepest acceptable grade permitted over the majority of the trail length.

Grade, Trail: The average grade over the length of a trail or long section of trail.

Hazard: A reported trail, infrastructure or facility related hazard, or a natural hazard that does not pose an immediate public safety risk but does require an investigation and a response. (examples: rebar protruding from a wooden water bar, fallen trees near a trail, icy sidewalk)

Outslope (Outsloping, Offslope): A method of tread grading that leaves the outside edge of a hillside trail lower than the inside to shed water. The outslope should be barely noticeable, usually no more than about one inch of outslope for every 18 inches of tread width.

Public Safety Service Call: A report from a citizen of an emergency, injury, law enforcement incident, unsafe condition, or natural hazard that is passed on to OSMP rangers for their investigation and response. Rangers will determine if a particular issue constitutes an emergency or if an immediate response is needed to provide for public safety. If so, the report is categorized as a public safety service call. (examples: wildland fire, lost person, injured hiker, aggressive wildlife, criminal activity)

Rake Down: Trail construction where all spoils are distributed below or to the side of the trail vs. "full clean" where all spoils must be removed.

Saddle: Ridge between two peaks.

Sideslope: The natural slope of the ground measured at right angles to the centerline of the trail, or the adjacent slope, which is created after excavating a sloping ground surface for a trailway, often termed a cut-and-fill-slope, left and right of the trail tread.

Site Classification: All trailheads, access points and recreation sites on OSMP lands are classified based on visitor use levels. Each class identifies a set of required facilities, optional facilities and a maintenance schedule. For more information please refer to the *Classes and Standards for Trailheads, Access Points and Recreation Sites* document dated 12/08.

Substrate: Underlying layer of loose/soft material below topsoil and overlying bedrock. The composition of a streambed, including either mineral or organic materials.

Switchback: A sustainable sharp turn on a hillside (usually on a slope of more than 15%) to reverse the direction of travel and to gain elevation. The landing is the turning portion of the switchback. The approaches are the trail sections upgrade and downgrade from the landing.

Trail Class: Refers to a trail's level of development. All City of Boulder Open Space and Mountain Parks trails fall into one of the following classes: Class 1 (Primitive/Undeveloped), Class 2 (Minor Development), Class 3 (Developed/Improved), Class 4 (Highly Developed) or Class 5 (Fully Developed).

Trail Design: Designing and layout of trails requires special training, knowledge, experience, and skill. When designing trails, many different factors are taken into account including hydrology, topography, soils, flora, fauna, management objectives, user expectations and characteristics, and trail design standards. The designer will utilize data collected from area site analysis, environmental assessments, public meetings, and area trail and management plans.

Trail Infrastructure: Any managed or constructed features or components of those features on or associated with a trail. Examples include: walls, steps, bridges, water bars, culverts (this is not an exhaustive list).

Trail Management Objective Index: Based on a trail's designed use and trail class, a range of construction and maintenance guidelines are identified for the cross-slope, tread width, clearing width and heights, turn radius, maximum sustained grade and appropriate surface materials. Combined, these guidelines make-up the Trail Management Objective Index for each trail.

Trailbed: The finished surface on which base course or surfacing may be constructed. For trails without surfacing, the trailbed is the tread.

Tread (Treadway): The surface portion of a trail upon which users travel excluding backslope, ditch, and shoulder. Common tread surfaces are native material, gravel, soil cement, asphalt, concrete, or shredded recycled tires.

Undesignated Trails: Trails created or worn into the landscape by visitors repeatedly walking off of designated trails. Sometimes, undesignated trails begin as wildlife or cattle trails that attract the interest of hikers or other visitors. They are not shown on public trail maps and are not maintained.

Visitor Survey: Exit survey of people leaving OSMP system and typically repeated every five years. The main purpose of the survey is to obtain demographic information, trip characteristics, and experience evaluations. (2004)

Volunteer Survey: A yearly survey of all active OSMP volunteers.

Waterbar: A drainage structure (for turning water) composed of an outsloped segment of tread leading to a barrier (log, stone, or timber) placed at a 45° angle to the trail. Water

flowing down the trail will be diverted by the outslope or, as a last resort, by the barrier. This type of drainage structure is not longer recommended for construction or use on trails. Grade dips are preferred.

Appendix B: Peer Agency/ Regional Data

Jefferson County

Park Name	Trail mileage	dogs on leash	Dogs not permitted	Bikes permitted	Horses permitted	Closed Seasonally
Alderfer / Three Sisters	15.2	15.2	0	15.2	15.2	0
Apex	8.3	8.3	0	8.3	8.3	0
Centennial Cone	14.3	14.3	0	14.3	14.3	14.3
Crown Hill	6.5	0	.7	5.8	5.8	0
Deer Creek Canyon	10.6	10.6	0	7.5	7.5	0
Elk Meadow	9.6	9.6	0	9.6	9.6	0
Flying J	3	3	0	3	3	0
Lair o' the Bear	4.6	4.6	0	3.8	3.8	0
Lookout Mtn Nature Center	1.4	0	1.6	0	0	0
Matthews / Winters **	7.1	7.1	0	7.1	7.1	0
Meyer Ranch	4.3	4.3	0	4.3	4.3	0
Mount Galbraith	4.7	4.7	0	0	0	0
Mount Falcon	11.1	11.1	0	9.4	9.4	0
Pine Valley Ranch	5.2	5.2	0	3.3	3.3	0
Reynolds	5.9	5.9	0	5.9	5.9	0
South Valley	6.9	6.9	0	5.7	5.7	2.5
Van Bibber	4.0	4.0	0	4.0	4.0	0
Windy Saddle	2.1	2.1	0	2.1	2.1	0
White Ranch	19.7	19.7	0	19.7	19.7	0
Total	**144.5**	**136.6**	**2.3**	**129**	**129**	**16.8**

Properties not included: Hildebrand Ranch (under construction), Hiwan Homestead (museum- no trails), Welchester (only .2 miles of trail- small pocket park), Clear Creek Trail (trail only- no park land), Coal Creek Canyon (currently developing a management plan), Fairmount Trail (trail only- no park land), Mount Glennon (no facilities or parking- access is limited), Mount Lindo (no facilities or parking- access is limited), North Table Mountain Park (currently undeveloped- in the conceptual management planning stage), Pioneer Trail (trail only- limited park land), and South Table Mountain Park (management plan in progress, have completed around 3-4 miles of multiuse trails)

**Recently designated portions of Matthew/Winters Park as "Bike Only" and "Hike Only".
Alternating use management strategy: yes
Percent of Trail Mileage where dogs are required to be on leash (on trails where dogs are allowed) - 100%
Percent of Trail Mileage where dogs are not permitted - 2%
Percent of Trail Mileage where bikes are allowed - 89%
Percent of Trail Mileage where horses are allowed - 89%
Percent of Trails that are closed seasonally – 12%

Boulder County

Park Name	Trail mileage	dogs on leash	Dogs not permitted	Bikes permitted	Horses permitted	Closed Seasonally
Hall Ranch	13.6	0	13.6	6.9	13.6	0
Rabbit Mountain	6.1	6.1	0	6.1	6.1	0
Heil Valley Ranch	14.6	0	14.6	13.3	14.6	0
Lohr Agricultural Heritage Center	.5	0	.5	0	0	0
Pella Crossing	3.6	3.6	0	3.6	3.6	0
Fairgrounds	2.8	2.8	0	2.8	2.8	0
Lagerman Reservoir	1.6	1.6	0	1.6	1.6	1.6
Niwot Loop Trail	5.8	5.8	0	5.8	5.8	0
Twin Lakes	3.3	3.3	0	3.3	3.3	0
Bald Mountain	1.5	1.5	0	1.5	1.5	0
Walden Ponds	2.5	2.5	0	2.5	2.5	0
Betasso Preserve	5	5	0	4.6	5	0
Legion Park	.9	.9	0	.9	.9	0
Caribou Ranch	4.5	0	4.5	0	4.5	4.5
Mud Lake	2.6	2.6	0	2.6	2.6	0
Walker Ranch	9.6	9.6	0	9.6	9.6	0
Carolyn Holmberg Preserve	3.1	3.1	0	3.1	3.1	0
Four Mile Open Space	2.6	2.6	0	0	2.6	0
Total	**84.2**	**51**	**33.2**	**68.2**	**83.7**	**6.1**

Properties not included: Beech, James F. Bailey Assay Office Museum (museum – no trails), Flagg Park, Boulder Canyon (trail only – no park land), Coal Creek Trail (regional trail- no park land), Coalton Road (trail only- no park land), Dodd Lake (0.1 miles), Gunbarrel Est. (trail only- no park land), Harney-Lastoka (trail only- no park land), Heatherwood (trail only- no park land), Homestead (trail only- no park land), Imel/NW Parkway (trail only- no park land), Mayhoffer-Singletree (trail only- no park land),

Alternating use management strategy: yes
Percent of Trail Mileage where dogs are required to be on leash (on trails where dogs are allowed)- 100%
Percent of Trail Mileage where dogs are not permitted - 39%
Percent of Trail Mileage where bikes are allowed - 81%
Percent of Trail Mileage where horses are allowed - 99%
Percent of Trails that are closed seasonally - 7%

Golden Gate Canyon State Park

Park Name	Trail mileage	dogs on leash	Dogs not permitted	Bikes permitted	Horses permitted	Closed Seasonally
Black Bear	2.8	2.8	0	0	0	0
Blue Grouse	.7	.7	0	.7	.7	0
Buffalo Trail	1.2	1.2	0	1.2	1.2	0
Burro Trail	4.5	4.5	0	0	0	0
Coyote Trail	2	2	0	0	0	0
Elk Trail	1.7	1.7	0	1.7	1.7	0
Horseshoe Trail	1.8	1.8	0	1.8	1.8	0
Mountain Lion Trail	6.7	6.7	0	6.7	6.7	0
Mule Deer Trail	5.2	5.2	0	5.2	5.2	0
Raccoon Trail	2.5	2.5	0	2.5	2.5	0
Snowshoe Trail	3	3	0	3	3	0
Beaver Trail	2.5	2.5	0	0	0	0
Visitor Center Show Pond Trail	.25	.25	0	0	0	0
Visitor Center Nature Trail	.10	.10	0	0	0	0
Reverend's Ridge Nature Trail	.25	.25	0	0	0	0
TOTAL	**35.1**	**35.1**	**0**	**22.8**	**22.8**	0

Alternating use management strategy**:** no
Percent of Trail Mileage where dogs are required to be on leash (on trails where dogs are allowed) - 100%
Percent of Trail Mileage where dogs are not permitted - 0%
Percent of Trail Mileage where bikes are allowed - 65%
Percent of Trail Mileage where horses are allowed - 65%
Percent of Trails that are closed seasonally - 0%

Eldorado Canyon State Park

Park Name	Trail mileage	dogs on leash	Dogs not permitted	Bikes permitted	Horses permitted	Closed Seasonally
Eldorado Canyon Trail	3.5	3.5	0	0	3.5	0
Rattlesnake Gulch Trail	3.6	3.6	0	3.6	0	0
Fowler Trail	.9	.9	0	0	0	0
Streamside Trail	.5	.5	0	0	0	0
Crescent Meadows	2.5	2.5	0	2.5	2.5	0
Total	**11**	**11**	**0**	**6.1**	**6**	**0**

Alternating use management strategy: no
Percent of Trail Mileage where dogs are required to be on leash (on trails where dogs are allowed) - 100%
Percent of Trail Mileage where dogs are not permitted - 0%
Percent of Trail Mileage where bikes are allowed - 55%
Percent of Trail Mileage where horses are allowed - 55%
Percent of Trails that are closed seasonally (wildlife closures) - 0%

Douglas County

Park Name	Trail mileage	dogs on leash	Dogs not permitted	Bikes permitted	Horses permitted	Closed Seasonally
Greenland Open Space Trail	8.5	8.5	0	8.5	8.5	0
Columbine Open Space Trail	1.5	0	1.5	1.5	1.5	0
Glendale Open Space Trail	1.6	1.6	0	1.6	1.6	0
Hidden Mesa Trail	5.5	5.5	0	5.5	5.5	0
High Line Canal Trail	8	8	0	8	8	0
Sharptail Ridge Trail System	4	0	4	0	4	0
Spruce Meadows	8.5	8.5	0	8.5	8.5	0
Spruce Mountain Trail	4.5	4.5	0	4.5	4.5	0
Swallowtail Trail	3.5	3.5	0	3.5	3.5	0
Ringtail Trail	3.5	3.5	0	3.5	3.5	0
Total	**49.1**	**43.6**	**5.5**	**45.1**	**49.1**	**0**

Properties / Trails not included**:** Cherry Creek Regional Trail, East – West Regional Trail, Bluffs Regional Park Trail, Town of Parker, Town of Castle Rock, City of Lone Tree

Alternating use management strategy: no
Percent of Trail Mileage where dogs are required to be on leash (on trails where dogs are allowed) - 100%
Percent of Trail Mileage where dogs are not permitted - 11%
Percent of Trail Mileage where bikes are allowed - 92%
Percent of Trail Mileage where horses are allowed - 100%
Percent of Trails that are closed seasonally - 0%

Larimer County Open Space

Park/Trail Name	Trail mileage	dogs on leash	Dogs not permitted	Bikes permitted	Horses permitted	Closed Seasonally
Carter Lake	4	4	0	4	4	0
Coyote Ridge	2.1	0	2.1	2.1	2.1	0
Devil's Backbone	12.5	12.5		12.5	12.5	0
Rimrock	1.7	0	1.7	1.7	1.7	0
Eagle's Nest	4.8	4.8	0	0	4.8	1.8
Hermit Park	3.75	3.75	0	1	1	0
Horsetooth Mountain	26.4	26.4	0	22.7	22.7	0
Ramsay-Shockey	4	4	0	4		0
Fossil Creek Reservoir	2.4	0	2.4	0	0	2.4
Total	**61.65**	**55.45**	**6.2**	**48**	**48.8**	**4.2**

Properties not included: Carter Lake, Flatiron Reservoir, Horsetooth Reservoir, Pinewood Reservoir

Percent of Trail Mileage where dogs are required to be on leash (on trails where dogs are allowed) - 100%
Percent of Trail Mileage where dogs are not permitted - 10%
Percent of Trail Mileage where bikes are allowed - 78%
Percent of Trail Mileage where horses are allowed - 79%
Percent of Trails that are closed seasonally - 7%

United States Forest Service USFS-Boulder Ranger District

Trails and Forest Development Roads, FDR's

Trail or Forest Development Road (FDR)	Trail mileage (distances are one way)	Bikes permitted	Horses Permitted	Dogs required on leash	Dogs off leash
Arapaho Glacier Trail Indian Peaks Wilderness	7.8	0	7.8	7.8	0
Arapaho Pass Trail Indian Peaks Wilderness	3.3	0	3.3	3.3	0
Beaver Bog Road FDR, 4WD road	1	1	1	0	1
Beaver Creek Trail Indian Peaks Wilderness	6.9	0	6.9 * enter from Coney Flats only	6.9	0
Blue Lake Indian Peaks Wilderness	2.5	0	0	2.5	0
Bright Extension Trail	1.8	0	1.8	0	1.8
Buchanan Pass Indian Peaks Wilderness	9.1	0	9.1	~4.1(approximately)	~5
Bunce School Road FDR, 4WD road	5.2	5.2	5.2	0	5.2
Carabou Flats FDR, 4WD road	11	11	11	0	11
Ceran Saint Vrain Trail	6	6	6	0	6
Coney Creek Road FDR, 4WD road	4	4	4	0	4
Coney Lake Trail (after Coney Creek Road) Indian Peaks Wilderness	2.5	0	2.5	2.5	0
Coulson Gulch loop Trail	9	0	9	0	9
Crater Lakes James Peak Wilderness	4.6	0	4.6	4.6	0
Devil's Thumb Trail (from Lost Lake) Indian Peaks Wilderness	5.1	0	5.1	5.1	0

United States Forest Service USFS-Boulder Ranger District Cont.

Trail or Forest Development Road (FDR)	Trail mileage (distances are one way)	Bikes permitted	Horses Permitted	Dogs required on leash	Dogs off leash
Diamond Lake Indian Peaks Wilderness	2	0	0	2	0
Dry Saint Vrain Trail	1.5	0	1.5	0	1.5
Forest Lakes James Peak Wilderness	4	0	4	4	0
Fourth of July Road, County Road 111	5	5	0	0	5
Gross Reservoir Area, FDR, 4WD road	5	5	5	0	5
Heart Lake/ South Boulder Creek Trail James Peak Wilderness	4.6	0	4.6	4.6	0
Isabelle Glacier Trail Indian Peaks Wilderness	4.2	0	0	4.2	0
James Peak Lake & Ute Trail	5	0	5	5	0
Jean Lunning Trail Indian Peaks Wilderness	3.2	0	0	3.2	0
Johnny Park Area FDR, 4WD road	14	14	14	0	14
King(Betty & Bob) Lake Trail (from Lost Lake) Indian Peaks Wilderness	4.6	0	0	4.6	0
Lost Lake Trail	1.4	0	1.4	0	1.4
Mammoth Basin FDR, 4WD road	25	25	25	0	25
Middle Saint Vrain Road FDR, 4WD road	4.5	4.5	4.5	0	4.5
Mitchell Lake Trail Indian Peaks Wilderness	2.5	0	0	2.5	0
Moffat Road FDR, 4WD road	13	13	13	0	13

United States Forest Service USFS-Boulder Ranger District Cont.

Trail or Forest Development Road (FDR)	Trail mileage (distances are one way)	Bikes permitted	Horses Permitted	Dogs required on leash	Dogs off leash
Mount Audubon Trail Indian Peaks Wilderness	3.8	0	0	3.8	0
Pawnee Pass Trail Indian Peaks Wilderness	4.6	0	0	4.6	0
Rainbow Lakes Trail Indian Peaks Wilderness	1.2	0	1.2	1.2	0
Rainbow Lakes Road, FDR, rough 2WD road	4.5	4.5	4.5	0	4.5
Rock Creek Road 4WD road	4	4	4	0	4
Saint Vrain Glaciers Trail Indian Peaks Wilderness	8.4	0	8.4	~ 4	~ 4.4
Saint Vrain Mountain Trail Indian Peaks Wilderness	4.5	0	4.5	4.5	0
Sourdough Trail	14.7	14.7	14.7	0	14.7
South Boulder Creek Trail James Peak Wilderness	4.6	0	4.6	4.6	0
South Saint Vrain Trail	5.9	0	~ 5 *no horses within BLRA	0	5.9
Switzerland Trail old railroad bed	18.6	18.6	18.6	0	18.6
Taylor Mountain FDR, 4WD road and single track	5	5	5	0	5
Woodland Lake Trail (from Devil's Thumb Trail juncture) Indian Peak Wilderness	2.4	0	2.4	2.4	0
Total	**261.5**	**140.5**	**223.2**	**92**	**169.5**

* did not include the Continental Divide Trail

United States Forest Service USFS-Boulder Ranger District Cont.

Percent of Trail Mileage where dogs are required to be on leash- 35%
Percent of Trail Mileage where dogs are not permitted- 0% (dogs are allowed either on or off leash on all forest service trails)
Percent of Trail Mileage where bikes are allowed- 54% (however of that 54%, 15% (or 20.7 miles) are multiuse trails, the remaining 85% are roads)
Percent of Trail Mileage where horses are allowed- 85 %

Percent of Trail Mileage where dogs are required to be on leash (on trails where dogs are allowed)

Jefferson County	100%
Boulder County	100%
Douglas County	100%
Larimer County	100%
City of Boulder OSMP	31.2%
West TSA	25.9%
Golden Gate Canyon State Park	100%
Eldorado Canyon State Park	100%
USFS Boulder Ranger District	35%

Percent of Trail Mileage where dogs are not permitted

Jefferson County	2%
Boulder County	39%
Douglas County	11%
Larimer County	10%
City of Boulder OSMP	10%
West TSA	5%
Golden Gate Canyon State Park	0%
Eldorado Canyon State Park	0%
USFS Boulder Ranger District	0%

Percent of Trail Mileage that bikes are allowed on

Jefferson County	89%
Boulder County	81%
Douglas County	92%
Larimer County	78%
City of Boulder OSMP	34%
West TSA	0%
Golden Gate Canyon State Park	65%
Eldorado Canyon State Park	55%
USFS Boulder Ranger District	54%

Percent of Trail Mileage that horses are allowed on

Jefferson County	89%
Boulder County	99%
Douglas County	100%
Larimer County	79%
City of Boulder OSMP	96%
West TSA	94%
Golden Gate State Park	65%
Eldorado Canyon State Park	55%
USFS Boulder Ranger District	85%

Percent of Trails that are closed seasonally (due to wildlife)

Jefferson County	12%
Boulder County	7%
Douglas County	0%
Larimer County	7%
City of Boulder OSMP	1%
West TSA	2%
Golden Gate State Park	0%
Eldorado Canyon State Park	0%

Counties that use an alternating use management strategy

Jefferson County
Boulder County

Jefferson County recently designated portions of trails as “bike only” and “hike only”.

Appendix C: Key Destinations

Habitat Conservation Areas		
Destination	**Destination Type**	**Trail Service**
Lost Gulch Accessible	Viewpoint	Designated and Undesignated Trails
Cathedral	Concentrated Use Area	Designated and Undesignated Trails
Tenderfoot Overlook	Viewpoint	Designated and Undesignated Trails
Green Mountain Summit	Peak Summit	Designated and Undesignated Trails
Green Mountain False Summit	Viewpoint	Designated and Undesignated Trails
Sacred Overlook	Viewpoint	Designated and Undesignated Trails
Bear Peak Summit	Peak Summit	Designated and Undesignated Trails
Mays Point	Viewpoint	Designated Trails
Lost Gulch	Concentrated Use Area	Designated Trails
South Boulder Peak	Peak Summit	Designated Trails
Green Mountain Lodge	Historic Feature	Designated Trails

Natural Areas		
Destination	**Destination Type**	**Trail Service**
First Flatiron	Climbing Formation	Designated and Undesignated Trails
Third Flatiron	Climbing Formation	Designated and Undesignated Trails
Der Zerkle	Climbing Formation	Designated and Undesignated Trails
Bear Canyon Pool	Natural Feature	Designated and Undesignated Trails
Second Flatiron	Climbing Formation	Designated and Undesignated Trails
Mesa Trail Viewpoint @ skunk Canyon	Viewpoint	Designated Trails
Dinosaur Rock	Climbing Formation	Designated Trails
Royal Arch	Natural Feature	Designated Trails
Mallory Cave	Natural Feature	Designated Trails
G-friend Boulder	Boulder	Designated Trails
Stardust Boulder	Boulder	Designated Trails
A-7 Boulder	Boulder	Designated Trails
BBC Boulder	Boulder	Designated Trails
Sentinal Ridge	Viewpoint	Designated Trails
Nebel Horn Saddle	Viewpoint	Designated Trails
Stockton Cabin	Historic Feature	Designated Trails
The Matron	Climbing Formation	Undesignated Trails
The Maiden	Climbing Formation	Undesignated Trails
Twin Fins	Boulder	Undesignated Trails
Funk Soul Boulder	Boulder	Undesignated Trails
Animal Chin Boulder	Boulder	Undesignated Trails
The Ice Cube-Fairview Boulder	Boulder	Undesignated Trails
Stone Shelter	Historic Feature	Undesignated Trails
Harmon Cave	Natural Feature	Undesignated Trails

Natural Areas		
Destination	**Destination Type**	**Trail Service**
Shanahan Stock Pond	Manmade Feature	Undesignated Trails
Saddle Rock	Viewpoint	Not Served
Ghetto Bouldering	Boulder	Not Served
Compound Boulder	Boulder	Not Served
The Slab	Climbing Formation	Not Served

Passive Recreation Areas		
Destination	**Destination Type**	**Trail Service**
Crown Rock	Climbing Formation	Designated and Undesignated Trails
Flagstaff Stone Shelter	Concentrated Use Area	Designated and Undesignated Trails
Contact Corner	Concentrated Use Area	Designated and Undesignated Trails
Capstan	Boulder	Designated and Undesignated Trails
Cloud Shadow	Boulder	Designated and Undesignated Trails
Pumpkin Rock	Boulder	Designated and Undesignated Trails
Panorama Point	Concentrated Use Area	Designated and Undesignated Trails
Lower Gregory Canyon	Natural Feature	Designated and Undesignated Trails
North Shelf Blocks	Boulder	Designated and Undesignated Trails
Red Rocks Quarry	Manmade Feature	Designated and Undesignated Trails
Red Rocks Summit	Viewpoint	Designated and Undesignated Trails
Flagstaff Amphitheater	Concentrated Use Area	Designated and Undesignated Trails
Woods Quarry	Manmade Feature	Designated and Undesignated Trails
Scoop Wall	Boulder	Designated and Undesignated Trails
Amphitheatre	Climbing Formation	Designated and Undesignated Trails
Beer Barrel/Tree Slab/	Boulder	Designated and Undesignated Trails
Alamo	Climbing Formation	Designated and Undesignated Trails
Cookie Jar	Boulder	Designated and Undesignated Trails
Classy Wall	Boulder	Designated and Undesignated Trails
Ridge Gap Wall	Boulder	Designated and Undesignated Trails
Mt Sanitas Summit	Viewpoint	Designated and Undesignated Trails
Dakota Ridge Hogback A	Viewpoint	Designated and Undesignated Trails
Dakota Ridge Hogback B (bench)	Viewpoint	Designated and Undesignated Trails
Sanitas Ridge View Point	Viewpoint	Designated and Undesignated Trails
The Dome	Climbing Formation	Designated and Undesignated Trails
Corner Rock	Boulder	Designated and Undesignated Trails
Davey Crockets Cave	Natural Feature	Designated and Undesignated Trails
Monkey Traverse	Boulder	Designated and Undesignated Trails
Elephant Buttresses	Climbing Formation	Designated and Undesignated Trails
Photo OPP rocks, boulders and sweet pea	Natural Feature	Designated and Undesignated Trails
McGilvery Cabin	Historic Feature	Designated and Undesignated Trails
Dunn House	Historic Feature	Designated and Undesignated Trails

Passive Recreation Areas

Destination	Destination Type	Trail Service
Four Pines Bench	Viewpoint	Designated and Undesignated Trails
Halfway House	Concentrated Use Area	Designated Trails
Flagstaff Summit Nature Center	Concentrated Use Area	Designated Trails
Flagstaff Wood Shelter	Concentrated Use Area	Designated Trails
Sanitas Shelter	Concentrated Use Area	Designated Trails
Ranger Cottage	Concentrated Use Area	Designated Trails
Realization Point	Concentrated Use Area	Designated Trails
Sledding Hill	Natural Feature	Designated Trails
Sanitas Proper	Boulder	Designated Trails
Settlers Park	Concentrated Use Area	Designated Trails
Rangeview Photo Opp.	Viewpoint	Designated Trails
Ute Overlook	Viewpoint	Designated Trails
Mt Sanitas False Summit	Viewpoint	Designated Trails
Artists Point	Viewpoint	Designated Trails
South Shelf Blocks	Boulder	Designated Trails
Sputnik Boulder	Boulder	Designated Trails
Roosa (Boy Scout) Cabin	Historic Feature	Designated Trails
McClintock Rock	Natural Feature	Designated Trails
Bluebell Shelter	Concentrated Use Area	Designated Trails
Old Reservoir	Manmade Feature	Undesignated Trails
Upper Area	Boulder	Undesignated Trails
Candel Area	Boulder	Undesignated Trails
Sanitas Rock Quarry D	Manmade Feature	Undesignated Trails
Sanitas Rock Quarry C	Manmade Feature	Undesignated Trails
Sanitas Rock Quarry B	Manmade Feature	Undesignated Trails
3-of-a-Kind Wall	Boulder	Undesignated Trails
Sanitas Stone Shelter	Historic Feature	Undesignated Trails
Campbell Cliffs	Viewpoint	Undesignated Trails
Holiday Star	Manmade Feature	Not Served
Sanitas Rock Quarry A	Manmade Feature	Not Served

NCAR and NIST

Destination	Destination Type	Trail Service
NCAR mesa	Viewpoint	Designated and Undesignated Trails
NCAR East Overlook	Viewpoint	Designated Trails
NCSR Ridge	Viewpoint	Designated Trails
Anthill	Viewpoint	Undesignated Trails

Appendix D
Undesignated Trails Report Methodology

The following is excerpted from the Draft Inventory and Analysis of Undesignated Trails report.

Undesignated trails were mapped by collecting waypoints with a Global Positioning System (GPS) receiver. Waypoints were collected at the start of the trail, at a randomly selected distance along the 1st 200 ft trail segment, and every 200 ft thereafter. At each GPS waypoint, undesignated trail condition indicators were measured or characterized along a transect perpendicular to the trail. Measured variables were entered electronically using the data dictionary programmed into the GPS.

Table 1 – Indicators of undesignated trail conditions measured and recorded for each sample point

Indicator	Description
Tread width (in.)	Tread width measured with metal tape between trail edges. Edges defined by pronounced changes in ground vegetation height, cover, composition (including improved surface), or organic litter.
Trail alignment (*proxy for ½ rule*)	a. Within 45º of direct ascent b. Within 45º of side-hill
Trail gradient	Slope measured with hand held clinometer. Recorded in 5% increments
Tread Cover	Percentage of trail width covered by various tread surfaces listed below. Measured by observation and recorded in increments of 10%
• Exposed soil	Exposed soil of all types, including mud but excluding rock and organic litter
• Rock	Naturally occurring rock surfaces (bedrock, stones, boulders & gravel)
• Organic litter	Organic litter or duff sufficient to obscure the tread surface
• Vegetative cover	Vegetative cover rooted within the tread boundaries, including exposed tree or shrub roots
Maximum incision	Maximum depth between tread surface and a line connecting trail tread edges. Measured with a meter stick (to provide horizontal surface) and metal tape to measure depth.
OSMP maintenance	Signs, improved surfaces, water bars, etc.
Comments	Presence of noxious weeds, other notable occurrences

Undesignated Trail Impact Classification

A multi-metric analysis was conducted to classify undesignated trails into "impact classes". In a multi-metric analysis several trail measurements are assigned ranked values

representing their relative impacts and the rankings combined to create one composite value. For this analyses, three metrics, trail width, trail cross-sectional area (trail width/2 x maximum incision), and tread cover percent were combined to create a composite trail impact value. Each trail metric was first divided into three impact categories and assigned ranks of 3, 9, or 15 representing increasing degrees of impact.

For trail width and cross-sectional area metrics, the three impact categories were defined quantitatively to include the range of measurements below, within, and above one standard deviation of the mean (Table 2).

Table 2 shows the trail width and trail cross-sectional area classes and the related rank associated with each class.

Table 2: Width and Cross-Section Ranks

Trail Width (in)	**Rank**	**Trail Cross-Sectional (in^2)**	**Rank**
5-11	3	1-11	3
12-22	9	12-34	9
≥ 23	15	≥ 34	15

For the tread cover percent metric, field measurements of organic litter, exposed soil, and vegetation cover on undesignated trail segments were compared to cover values for an ideal "no trail" reference condition desired by OSMP. Reference values (means; standard deviations) for "un-trailed" conditions on OSMP lands were derived separately for mountainous forest (70 forest understory plots, Chris Wanner) and grasslands (85 transects). For each cover type (organic litter, exposed soil, and vegetation) and undesignated trail segment measured, a corresponding rank value of 1, 3, or 5 was assigned, representing increasing degrees of deviation from the ideal reference conditions (Table 3) and increasing levels of impact. Summing these ranks across the three tread cover types gave a metric that was comparable in weight to the other two metrics.

Table 3 summarizes cover classes and associated ranks for the mountains/forests and grassland plains locations. Rank values of 1 represent conditions on undesignated trails most similar to reference conditions.

Table 3 – Cover Classes Ranks

(a) Forested Lands

Soil Cover (%)	**Rank**	**Vegetation Cover (%)**	**Rank**	**Organic Cover (%)**	**Rank**
< 10	1	> 20%	1	> 80%	1
NA	3	10–20%	3	60–80%	3
≥ 10	5	0%	5	< 60%	5

(b) Grasslands					
Soil Cover (%)	**Rank**	**Vegetation Cover (%)**	**Rank**	**Organic Cover (%)**	**Rank**
≤ 25	1	≥ 30	1	25–50	1
25–35	3	15–30	3	5–25 or 60–100	3
> 35	5	< 15	5	0	5

Table 4 contains composite rank ranges and the associated impact classes, derived by summing all three trail metrics and then dividing by three.

Table 4 – Impact classes and associated rank values for undesignated trail segments.

Impact Class	Composite Ranks (ranges)
Least	1.0 – 1.7
Low-Mid Impact	1.9 – 2.1
Moderate Impact	2.3 – 3.7
High Impact	3.9 – 4.1
Very High Impact	4.3 – 5.0

Open Space and Mountain Parks Survey #_____

1. What time did you start on a trail today? _____ Start time _____ Current time

2. How did you get to the trailhead? □ Car □ Walk/Run □ Bike □ Bus

3. How many people are in your group? _____

4. Which <u>one</u> of the following was the most important reason for visiting Open Space & Mountain Parks?
   - □ I came here to enjoy the <u>place</u> itself.
   - □ I came here because it is a good place to do the <u>activities</u> that I enjoy.
   - □ I came here because I wanted to spend more time with <u>family or friends</u>.

5. What activities did <u>you</u> do during this visit? (PLEASE CHECK ALL THAT APPLY)

□ Climbing/Bouldering	□ Walking dog(s)	□ Viewing scenery
□ Photography	□ Picnicking	□ Viewing wildlife
□ Social gathering	□ Contemplation/Meditation	□ Horseback riding
□ Hiking	□ Biking	□ Nature study
□ Running	□ Pleasure driving	□ Other _____

6. Please **CIRCLE** the one activity from **ABOVE** that you consider your **PRIMARY ACTIVITY** today.

7. If walking dogs today, how many are with you? □ 1 □ 2 □ 3 □ 4 □ 5+ □ N/A

8. What made your trip enjoyable today? (PLEASE CHECK ALL THAT APPLY)

□ Scenery	□ Close to home	□ Get away from daily pressures
□ Wildlife	□ Family or friends	□ Exercise/Health
□ Plants/Wildflowers	□ Being with my dog(s)	□ Other _____

9. Where do you live?

□ Boulder (within city limits)	□ Longmont	□ Other area in Colorado
□ Louisville	□ Unincorporated Boulder County	□ Out of state
□ Lafayette	□ Other city in Boulder County	□ Out of country
□ Superior	□ Metro Denver	

PLEASE FLIP OVER TO SECOND PAGE →

10. Please grade Open Space & Mountain Parks on the following categories based on your recent experience. **A= Excellent** **F=Failing**

PLEASE CHECK ONE FOR EACH CATEGORY.	A	B	C	D	F	N/A
Trail conditions and maintenance	☐	☐	☐	☐	☐	☐
Trash cans and bag dispensers	☐	☐	☐	☐	☐	☐
Usefulness of signs and brochures	☐	☐	☐	☐	☐	☐
Experience with bikers	☐	☐	☐	☐	☐	☐
Fixing eroded or trampled areas	☐	☐	☐	☐	☐	☐
Restroom cleanliness	☐	☐	☐	☐	☐	☐
Experience with dogs and dog walkers	☐	☐	☐	☐	☐	☐
Trailhead and nature education	☐	☐	☐	☐	☐	☐
Enforcement of rules	☐	☐	☐	☐	☐	☐
Overall satisfaction with Open Space & Mountain Parks	☐	☐	☐	☐	☐	

11. Did you encounter any conflicts or unpleasant experiences today? ☐ Yes ☐ No

12. If yes, could you describe them?

_____

_____

_____

13. Please estimate how many times a month, on average; you have visited Open Space & Mountain Parks during the last year? _____ Times per month

14. How many years have you been coming to Open Space & Mountain Parks?
_____ Number of years

QUESTION # 15 AND QUESTION # 16 ARE OPTIONAL

15. How old were you on your last birthday? _____ Years old

16. What is your gender? ☐ Female ☐ Male

PLEASE REFER TO THE MAP

17. Did you enter from this access/trailhead?
☐ Yes ☐ If No, where did you enter from? Please write access number _____
OR, I entered off the scope of this map ☐ (CHECK BOX)

18. Do you have any additional comments to improve the management of OSMP?

_____

_____

THANK YOU FOR YOUR TIME!

Location _____, AM, MID-DAY, PM, Interview initials _____

Index No. _____
(Leave blank)

Open Space & Mountain Parks Questionnaire

(Note: all bold and italicized items are instructions to interviewers.)

"Hello. My name is _____. I'm a public opinion interviewer with The Public Information Corporation. We're conducting a public opinion survey of voting age residents for the City of Boulder Open Space and Mountain Parks program. We're not talking about the Boulder County government's Parks and Open Space, or national parks or national forests. The survey results will be used to help improve recreational experiences and the natural environment in open space and the mountain parks.

1. First of all, what do you feel is the most important purpose for having open space and mountain parks? ***(Open end. Probe.)***

_____

2. When you visit the City's open space and mountain parks areas, would you describe the quality of your experiences being excellent, good, only fair or poor?

Excellent 1
Good 2
Only fair 3
Poor 4
No Response 5

3. As a whole, would you rate the facilities and services of the City's open space and mountain parks areas, such as trails and signs, and services such as education and law enforcement, as being excellent, good, only fair or poor?

Excellent 1
Good 2
Only fair 3
Poor 4
No response 5

4. If there is one thing about open space and mountain parks facilities and services that you feel is most in need of improvement, what would it be? ***(Open end. Probe.)***

_____

5. In order to both protect the natural environment and provide high quality recreational experiences a careful management balance is required. Do you think Open Space and Mountain Parks management is about right, OR is there too much emphasis on preserving the natural environment and not enough on recreation, OR is there too much emphasis on providing recreation and not enough on preserving the natural environment?

About right 1
Too much/natural env. 2
Too much/recreation 3
Other_____ 4
No response 5

6. I am going to read you a list of Open Space and Mountain Parks management responsibilities. When managing the lands which one of the following do you believe should receive the highest priority? ***(Read each of choices from the list at right. Repeat as necessary. Accept but <u>do not read</u> "all the same."***

Preserving scenic views 1
Protecting habitat for wildlife . . . 2
Providing passive recreation, such as hiking, biking and dog walking 3
Preserving agricultural lands . . 4
OR
Providing community buffers . 5
All the same 6
No response 7

7. What activities do you personally do on the City's open space and in mountain parks? ***(Open end. Probe. Accept, but do not solicit, as many as three responses.)***

_____

_____

The folks at Open Space and Mountain Parks try to keep recreation activities, on one hand, in balance with preservation of wildlife habitat and ecosystems, on the other. They also work to reduce conflict among visitors. They currently are considering a number of strategies to help do this. I am going to tell you about some of these strategies, and for <u>each</u> of them I would like you to tell me, based on what you know or have heard, if you feel that it is very appropriate, somewhat appropriate, somewhat inappropriate or very inappropriate. What about:

(Read questions 8-19 and repeat the response categories as necessary. Record but do not read "no response." Rotate questions starting with the check mark.)

	Very Apprp	**Some-what Apprp**	**Some-what Inappr**	**Very Inappr**	**No Resp**
8. Requiring dogs to be kept on leash for for the first 100 yards at trailheads?	1	2	3	4	5
9. Requiring dogs to be certified in order to be off leash under voice and sight control.	1	2	3	4	5
10. Having City ecologists determine what open space and mountain parks areas will be designated as having high wildlife habitat value.	1	2	3	4	5
11. Having City ecologists determine how areas with high wildlife habitat value will be managed.	1	2	3	4	5
12. Prohibiting dogs in areas designated as having high wildlife habitat value.	1	2	3	4	5
13. Requiring dogs to be <u>leashed</u> in areas with high wildlife habitat value.	1	2	3	4	5

14. Requiring all visitors to stay on designated trails in areas with high wildlife habitat value.	1	2	3	4	5
15. Requiring all visitors to stay on designated trails in areas with high wildlife habitat value unless they have a permit to be off trail.	1	2	3	4	5
16. Charging a fee for open space and mountain parks use by people who live outside of Boulder County.	1	2	3	4	5
17. Charging a fee for open space and mountain parks use by people who live outside of the City of Boulder.	1	2	3	4	5
18. Providing more trails west of Broadway for bikes.	1	2	3	4	5
19. Requiring a permit and fee for commercial uses such as horse liveries or teaching rock climbing or hang gliding.	1	2	3	4	5

Next, I will describe some kinds of management provided by Open Space and Mountain Parks. Please tell me how adequate you feel they are -- very adequate, somewhat adequate, somewhat inadequate or very inadequate. What about:

(Read questions 20-23 and repeat the response categories as necessary. Record but do not read "no response."

	Very Adeq.	**Some-what Adeq.**	**Some-what Inadeq.**	**Very Inadeq.**	**No Resp.**
20. Enforcement of bike regulations.	1	2	3	4	5
21. Enforcement of regulations for people whose dogs are <u>not</u> under voice and sight control when off leash.	1	2	3	4	5
22. Enforcement of regulations about removal of dog excrement.	1	2	3	4	5
23. Signs warning of hazards.	1	2	3	4	5

24. Open Space and Mountain Parks provides nature education with guided nature hikes, programs at local schools, information at trailheads and events like Farmer's Market. Were you aware of these educational opportunities?

Yes 1
No 2
No response . . 3

(If "no" to q. 24, SKIP to q. 26).

25. If you or a family member have ever received nature education from City of Boulder Open Space and Mountain Parks staff members, where did it happen? ***(Open end. Probe.)***

_____

26. How safe do you feel during your visits to Open Space and Mountain Park areas? Would you say very safe, somewhat safe, somewhat unsafe or very unsafe?

Very safe	1
Somewhat safe	2
Somewhat unsafe	3
Very unsafe	4
No response	5

(If "no response" to q.26, SKIP to q.28).

27. What mostly caused you to say that you feel _____ in Open Space and Mountain Parks? ***(Repeat response to q.26. Open end. Probe.)***

_____

28. Sometimes particular recreational activities in open space and mountain parks areas conflict and result in unpleasant encounters. From what you know or have heard, what specific recreational activities would you say are in conflict with other specific activities? ***(Open end. Probe.)***

_____

(If unresponsive to q.28, <u>skip</u> to text just above q.30

29. What do you think Open Space and Mountain Parks should <u>do</u> to help remedy the conflict you just mentioned?

_____

Activities of other users of open space and mountain parks areas could make your own experience more pleasant or less pleasant. I will read a list of such activities. Please tell me if they make your experience much more pleasant, somewhat more pleasant, somewhat less pleasant or much less pleasant. How about . . . . ***(Read questions 30 through 35. Rotate. Accept, but do not read "no impact.")***

	Much more pleasant	Some-what more pleasant	Some-what less pleasant	Much less pleasant	No impact	No resp.
30. Mountain bikers	1	2	3	4	5	6
31. Horseback riders.	1	2	3	4	5	6
32. Dogs on leash	1	2	3	4	5	6
33. Dogs off leash	1	2	3	4	5	6
34. Runners	1	2	3	4	5	6
35. Hikers	1	2	3	4	5	6

36. How often do you use City of Boulder Open Space or Mountain Parks? ***(Read the list only if respondent needs prompting. Enter anything "once a year" or more as "no response/never.")***

Every day 1
2 to 3 times per week 2
Once a week 3
2 to 3 times a month 4
Once a month 5
2 to 3 times a year . . . 6
No response/never . . 7

37. Do you ever walk or run a dog in City of Boulder Open Space or Mountain Parks areas?

Yes 1
No 2
No response 3

(If response to q.37 was "no" or "no response," SKIP to q.39).

38. How often or when do you use a leash? Would you say: always, frequently, occasionally, never, OR just when other people are near?

Always 1
Frequently 2
Occasionally 3
Never 4
When others near 5
No response 6

39. How long have you lived in Boulder?	1 to 2 years	1
	3 to 4 years	2
	5 to 6 years	3
	7 to 10 years	4
	11 to 20 years	5
	21 years or more	6
	No response	7
40. How old are you?	18 to 24	1
	25 to 34	2
	35 to 44	3
	45 to 54	4
	55 to 64	5
	65 and older	6
	No response	7

(Double check to make certain that you asked all of the questions. Thank the respondent, hang up and then complete q.41 and q.42 from your calling sheet. These are important, too, because they are used in making certain that we have a representative sampling.)

(Question 42 is only used to ensure the sample is reflective of the population)

41. Gender:	Male	1
	Female	2
42. Party affiliation	Republican	1
	Democrat	2
	Unaffiliated	3
	Other _____	4

Precinct number _____ Calling sheet number _____

"I certify that the responses on this questionnaire are complete and accurate, as presented by the respondent."

INTERVIEWER'S INITIALS _____ INTERVIEWER'S NUMBER_____ Date:_____

# # #

Appendix G:

City of Boulder Open Space and Mountain Parks Volunteer Survey - Fall 2008

Dear Open Space and Mountain Parks Volunteer,

Please take a moment to fill out this evaluation. We appreciate knowing about your experiences, suggestions and insights!

Please respond as soon as possible. You can respond directly to this email, or if you wish to remain anonymous, print out the e-mail and return by snail mail. We also appreciate hearing from you in person.

Thanks for your service in 2008, and here's to another great year in 2009!

Yours,

Lisa Dierauf and Susan Ross
Coordinators of Volunteer Services
720-564-2014 and 720-564-2013
66 South Cherryvale Road, Boulder, CO 80303

1. How long have you been a volunteer for OSMP?

2. In which programs have you participated?
   Dates or years for each if possible.

3. Did you feel you were appropriately trained for your volunteer work?

4. How would you rate your overall satisfaction with your volunteer experience?

   Very satisfied 5 4 3 2 1 Very unsatisfied

5. What three (or more) things worked well for you in 2008?

6. What three (or more) things can be improved?

7. Were you able to fulfill your commitment?
___ Yes ___ No

If no, please let us know why. Is there anything we can do to help you meet your commitment?

8. Are you interested in joining another OSMP volunteer program?
(Go to www.OSMP.org for more information on assignment opportunities.)

9. Other comments and suggestions:

If printing, use the other side of this page if necessary.

Name:(optional)

Date:

Appendix: H

City of Boulder Open Space and Mountain Parks

Public Program Evaluation

Please take a minute to evaluate the program you attended. Your comments help us improve our programs**.**

Program _____ Date _____ Naturalist(s) _____

Please rate the overall quality of this program on a scale of 1 (worst) to 10 (best). _____

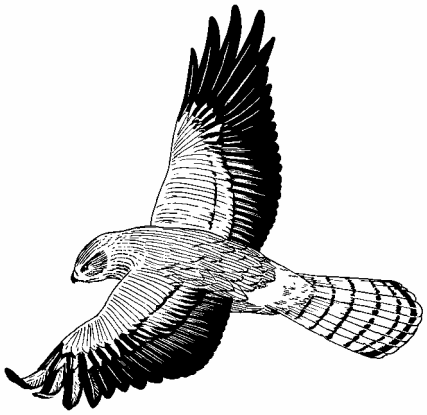
Was the program the right amount of time? Y/N Too long?___ Too Short? ____
Did the program start at a good time and day? Y/N
What would have been a better time or day?_____

Was the level of exertion required for this hike good? Y/N. Too strenuous?___ Not strenuous enough?___

Were the activities and content presented at an appropriate level for the group? Y/N.
Too technical?___ Not technical enough?___
Comments:

Please rate the naturalist(s) on the following qualities:

Enthusiasm	Excellent	Good	Fair	Poor
Rapport with group	Excellent	Good	Fair	Poor
Knowledge of subject	Excellent	Good	Fair	Poor
Voice level and clarity	Excellent	Good	Fair	Poor
Receptivity to questions	Excellent	Good	Fair	Poor



What did you learn about the OSMP Program from this hike?_____
_____
_____

What did you like about the program? _____

How could the program be improved?_____

Would you attend another OSMP naturalist program?_____

How did you hear about this program?_____

What other programs would you like to see us offer? _____

Is there anything else you would like us to know?

Do you want Natural Selections sent to you by e-mail?
go to naturehikes.org and you'll see the link to subscribe to the list

Appendix I: West TSA Safety Incidents (2008)

2008 West TSA Incidents	
Type of Incident	**Number**
Dogs	268
Camping Without Consent	78
Injured Hiker	21
Trespass-Wildlife Closure	15
Other	14
Drug Possession	11
Injured Climber	5
Littering/Dumping	5
Damaging Public Property	4
Lost Party	4
Alcohol	3
Animal Welfare Check	3
1st Degree Criminal Trespass (Vehicle Break-In)	3
Injured Dog	3
Wildfire	3
Permits	3
Injured Cyclist	3
Smoke Report	2
Vehicle Accident	2
Assault	2
Building Illegal Campfire	2
Wanted Person	2
Suicidal Person	2
Person Stuck on Rock	2
Juvenile Party (Alcohol)	2
Vehicle Off-Road	1
Injured Horseback Rider	1
Bear Incident	1
Bikes Prohibited	1
Domestic Abuse	1
Property Damage	1
Fireworks	1
Death	1
Rattlesnake Bite	1
Harassment	1
Overdue Hikers	1
Resource Damage	1
Firearms	1
Trespass-Public Property	1

Appendix J: West TSA Summons'

2008 West TSA Summons'	
Type of Violation	**Number**
Voice and sight control evidence tag required	118
Dog running at large, not on leash	82
Camping on property without consent	64
Dog running at large, no guardian	25
Dog running at large, not in voice and sight control	15
Entering wildlife closure	12
Dogs prohibited	7
Possessing glass bottles	6
Building fires prohibited	5
Damaging public property	4
Travel off designated trail prohibited in HCA	3
Aggressive animal prohibited	3
Dog running at large, not on leash in trailhead area	2
Entering Boulder Falls closure	2
Littering	2
Permit required for commercial use	2
Possession of alcohol by minors	2
Obstructing a police officer	2
Failure to protect wildlife	1
Driving/parking vehicle in violation of signs	1
Possession/consumption of alcohol in public	1
Possession/discharge of fireworks	1
Tent, net, structure prohibited	1
Assault in the third degree	1
Entering closed property	1

City of Boulder Open Space and Mountain Parks - Visitor Access Classifications - October 21, 2008

Appendix K

Classes*	Visitor Use Patterns	Examples	Standard Facilities**	Optional	Replace - Nonconforming Structures	Maintenance Standards***
Class A1 Access to trails	Very Low to Low	Four Pines at 17th St. Shanahan Ridge - Hardscrabble Sawhill Access East	1. Wayfinding/regulatory sign post ****	1. Trailhead signs ****	1. Dog station	1. Checked monthly 2. Pickup loose trash 3. Fix and repair any damage
Class A2 Access to trails	Medium to High	Wonderland Lake Trail at Poplar South Boulder Creek Trail south of South Boulder Road Eagle Trail at coffee shop Dakota Ridge - 4th and Maxwell	1. Wayfinding/regulatory sign post ****	1. Trailhead signs **** 2. Fence	1. Dog station 2. Outhouse 3. Trash can(s)	1. Checked monthly 2. Pickup loose trash 3. Fix and repair any damage
Class A3 Access to trails	Very High	Wonderland Lake Trail at Utica Sanitas Valley Trail, south end	1. Trailhead signs **** 2. Dog station 3. New bear proof trash can	1. Fence	1. Outhouse	1. Checked monthly 2. Pickup loose trash 3. Fix and repair any damage
Class T1 Simple/Minor developed Trailhead	Very Low to Low	White Rocks Greenbelt Plateau Halfway House White Rocks	1. Fence 2. Parking area (road base surface) 3. Trailhead signs **** 4. New bear proof trash can 5. Dog stations 6. Bike racks	1. Access to facilities 3. Horse trailer parking 4. Asphalt parking if required by law 5. Parking bollards	1. Bench 2. Grills 3. Horse trailer parking 4. Picnic tables 5. Outhouse	1. Checked twice weekly 2. ID erosion problems and fix as needed 3. Pickup loose trash 4. Fix and repair any damage 5. Trim and mow when vegetation height is greater than 8"
Class T2 Developed/Improved Trailhead	Medium	South Teller Wonderland Lake Realization Point Crown Rock Boulder Valley Ranch	1. Fence 2. Parking area (road base surface) 3. Trailhead signs **** 4. Trash can(s) 5. Dog stations 6. ADA Picnic tables/area 7. Bike racks	1. Outhouse if not near developed area 3. Bench 4. Parking bollards 5. Asphalt parking if required by law 6. Horse trailer parking	1. Grills	1. Checked twice weekly 2. ID erosion problems and fix as needed 3. Pickup loose trash 4. Fix and repair any damage 5. Trim and mow when vegetation height is greater than 8" 6. Service restrooms 7. Power wash restrooms monthly or as needed
Class T3 Fully Developed Trailhead	High to Very High	Chautauqua Marshall Mesa Dry Creek Four Mile Creek	1. Fence 2. Parking area (road base surface) 3. Trailhead signs **** 4. New bear proof trash can 5. Dog stations 6. Picnic tables/area 7. Bike racks 8. Outhouse	1. Access to facilities 2. Bench 3. Parking bollards 4. Asphalt parking if required by law 5. Horse trailer parking	1. Grills 2. Campground	1. Checked twice weekly 2. ID erosion problems and fix as needed 3. Pickup loose trash 4. Fix and repair any damage 5. Trim and mow when vegetation height is greater than 8" 6. Service restrooms 7. Power wash restrooms monthly or as needed
Class R1 Access to recreational facilities (No access to OSMP designated trail system)	NA	Bench at Eisenhower Bench at Forest and 4th Juniper pulloff in Lefthand	1. Wayfinding/regulatory sign post ****	1. Trailhead signs **** 2. Access to facilities 3. Fence 4. Bench	1. Dog station	1. Checked monthly 2. ID erosion problems and fix as needed 3. Pickup loose trash 4. Fix and repair any damage 5. Trim and mow when vegetation height is greater than 8"
Class R2 Access to recreational facilities (No access to OSMP designated trail system)	NA	Cottonwood pull off (Lefthand Canyon) Baseline Picnic Area Pulloffs on Flagstaff Rd	1. Wayfinding/regulatory sign post **** 2. Picnic tables	1. Trailhead signs **** 2. Access to facilities 3. Fence 4. Bench 5. Picnic tables 6. Trash can	1. Dog station 2. Grills	1. Checked monthly 2. ID erosion problems and fix as needed 3. Pickup loose trash 4. Fix and repair any damage 5. Trim and mow when vegetation height is greater than 8"

*Recreational facilities include picnic areas, viewpoints, bench sites. Trailheads provide access to a trail and have at least one parking spot managed by OSMP.

**Please see "Definition of Facilities' attached.

***Please see 'OSMP Trailhead Maintenance Standards' attached.

**** Please see "Trailhead signs and structures" document to view various signs used at each class of trailhea

Appendix L: Trails in the West TSA

1st Flatiron Bridge	0.02
1st/2nd Flatiron	0.69
3rd Flatiron	0.18
Amphitheater	0.40
Amphitheater Access	0.02
Amphitheater Express	0.23
Anemone	0.44
Artist Point	0.08
Baseline	0.58
Bear Canyon	1.85
Bear Canyon - NCAR	1.17
Bear Peak	0.36
Bear Peak West Ridge	1.80
Big Bluestem West	0.12
Bluebell Mesa	0.44
Bluebell Road	0.93
Bluebell Spur	0.26
Bluebell-Baird	0.65
Bluestem Connector	0.47
Boy Scout	0.67
Chapman Drive	1.72
Chautauqua	0.61
Cragmoor Connector	0.24
Crown Rock	0.40
Crown Rock Climbing Areas	0.54
Dakota Ridge	1.39
Der Zerkel	0.05
Devils Thumb Access	0.08
Dinosaur Rock	0.02
E.M. Greenman	1.54
East Ridge	0.64
Eldorado Canyon	2.40
Eldorado Canyon Spur	0.15
Elephant Buttress	0.13
Enchanted - McClintock Spur	0.07
Enchanted Mesa Trail	1.15
Enchanted-Kohler Spur	0.14
Fern Canyon	1.43
Flagstaff	2.07
Flatirons Descent	0.20
Flatirons Loop	0.54
Four Pines	1.22
Goat Trail	0.60
Green Bear	0.80
Green Mountain West Ridge	1.36
Green Mtn Lodge Road	0.26
Gregory Canyon	1.18

Halfway House	0.21
Hardscrabble Connector	0.10
Homestead	0.98
Homestead Spur	0.09
Kohler Mesa	0.60
Kohler Spur	0.19
Lehigh Connector - North	0.16
Lehigh Connector - South	0.35
Long Canyon	1.08
Lost Gulch	0.10
Lower Big Bluestem	1.79
Mallory Cave	0.78
May's Point	0.11
McClintock Lower	0.37
McClintock Upper	0.45
Mesa	6.24
Mesa Connector	0.18
Mount Sanitas	1.23
N.C.A.R. - Bear Connector	0.53
N.C.A.R. - Skunk Canyon	0.59
N.C.A.R. - Table Mesa	0.53
N.C.A.R. - Table Mesa/Bear	0.51
N.C.A.R. Trail	0.96
N.C.A.R. Water Tank Road	0.29
NIST Service Road	0.88
Northern Quarry Trail	0.04
Panorama	0.27
Plains Overlook	0.34
Range View	0.62
Ranger	1.16
Red Devil	0.20
Red Rocks	0.58
Red Rocks Spur	1.66
Royal Arch	0.88
S. Mesa Spur	0.13
Sacred Cliffs	1.01
Saddle Rock	1.19
Sanitas Bouldering	0.05
Sanitas Connector	0.04
Sanitas Spur	0.13
Sanitas Valley	1.27
Sensory Trail	0.09
Serpentine	0.10
Shadow Canyon North	0.63
Shadow Canyon South	0.86
Shadow Canyon South Spur	0.29
Shadow Canyon Trail	1.22
Shanahan - Mesa	0.45
Shanahan - North Fork	1.25
Shanahan - South Fork	1.83

Shanahan Connector	0.41
Ski Jump	0.24
Skunk Canyon	1.30
Skunk Canyon Path	0.31
Skunk Canyon Spur	0.22
South Boulder Creek West	1.93
South Boulder Peak	0.29
South Mesa Connector	0.05
Southern Quarry Trail	0.10
Spy	0.09
Tenderfoot	0.99
The Dome	0.16
Touch Monkey	0.01
Towhee	1.21
Upper Big Bluestem	0.83
Ute	0.76
Viewpoint	1.11
Woods Quarry	0.40

Appendix M

Trail Design & Management Guidelines Matrix

		X-Slope Range	Tread Width	Max. Sustained Grade	Max. Sustained Outslope	Clearing		Turn Radius	Surface Materials					
						Width	*Height*		*Natural*	*Gravel*	*Crusher*	*Roadbase*	*Concrete*	*Asphalt*
Accessible		0-50%	>=3'	8.33%	<2%	8'	8'	4'	ok	No	ok	ok	ok	ok
Class 5 *Fully Developed*	Hiking	0-30%	3-5'	8%	<=5%	6'	8'	2'	ok	ok	ok	ok	ok	ok
	Biking	0-30%	3-8'	8%	<=5%	10'	10'	6'	No	ok	ok	ok	ok	ok
	Equestrian	0-30%	3-8'	8%	<=5%	10'	10'	8'	No	ok	ok	ok	No	No
	Official Vehicle	N/A	*8-10'*	8%	<= 8%	28-40'	12'	10-12'	No	ok	ok	ok	ok	ok
Class 4 *Highly Developed*	Hiking	0-50%	2.5-5'	10%	<=5%	6'	8'	2'	ok	ok	ok	ok	No	No
	Biking	0-50%	3-8'	8%	<=5%	6-10'	10'	6'	ok	ok	ok	ok	No	No
	Equestrian	0-50%	3-8'	8%	<=5%	6-10'	10'	8'	ok	ok	ok	ok	No	No
	Official Vehicle	N/A	*8-10'*	6%	<= 6%	28'	12'	10-12'	No	ok	ok	ok	ok	ok
Class 3 *Developed/ Improved*	Hiking	0-75%	1.5-3'	15%	<= 8%	4-6'	8'	2'	ok	ok	ok	ok	No	No
	Biking	0-75%	1.5-5'	12%	<=5%	4-6'	10'	6'	ok	ok	ok	ok	No	No
	Equestrian	0-75%	1.5-6'	12%	<=5%	6'	10'	8'	ok	ok	ok	ok	No	No
	Official Vehicle	N/A	*8-10'*	6%	<=5%	12'	10'	10-12'	ok	ok	ok	ok	No	No
Class 2 *Minor Development*	Hiking	0-75%	1.5-2.5'	15%	<=10%	4'	8'	2'	ok	No	No	No	No	No
	Biking	0-75%	1.5-3'	12%	<= 8%	4-6'	10'	6'	ok	No	No	No	No	No
	Equestrian	0-75%	1.5-2.5'	12%	<= 8%	6'	10'	8'	ok	No	No	No	No	No
	Official Vehicle	N/A	*8-10'*	5%	<=5%	10'	10'	10-12'	ok	N/A	No	No	No	No
Class 1 *Primitive/ Undeveloped*	Hiking	0-90%	1.5-2'	15%	<=10%	N/A	N/A	2'	ok	No	No	No	No	No
	Biking	0-90%	1.5-2'	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	No	N/A	N/A
	Equestrian	0-90%	1.5-2'	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	No	N/A	N/A
	Official Vehicle	N/A	*8-10'*	4%	<= 3%	N/A	N/A	10-12'	ok	N/A	No	No	No	No
Climbing Access	Climbing	N/A	0-2'	N/A	<=15%	N/A	N/A	N/A	ok	No	No	No	No	No

Trail Design Parameters provide guidance for the assessment, survey and design, construction, repair and maintenance of trails, based on the Trail Class and Designed Use of the trail.

Exceptions and variances to these parameters can occur when site-specific circumstances demand such exceptions. These exceptions should be noted in the TMO for the trail.

* Accessible is currently a separate Trail Class. If assessing/designing trails for accessibility, refer to current Agency trail accessibility guidance.

Finalized 12/04/07

West TSA Basemap

- West TSA Boundary
- OSMP Conservation Easement
- Other Government Lands
- Trailheads

Trails Managed By OSMP

- Hiking Trail
- Multi-Use Trail
- Paved Path
- Climbing Access
- Service Road

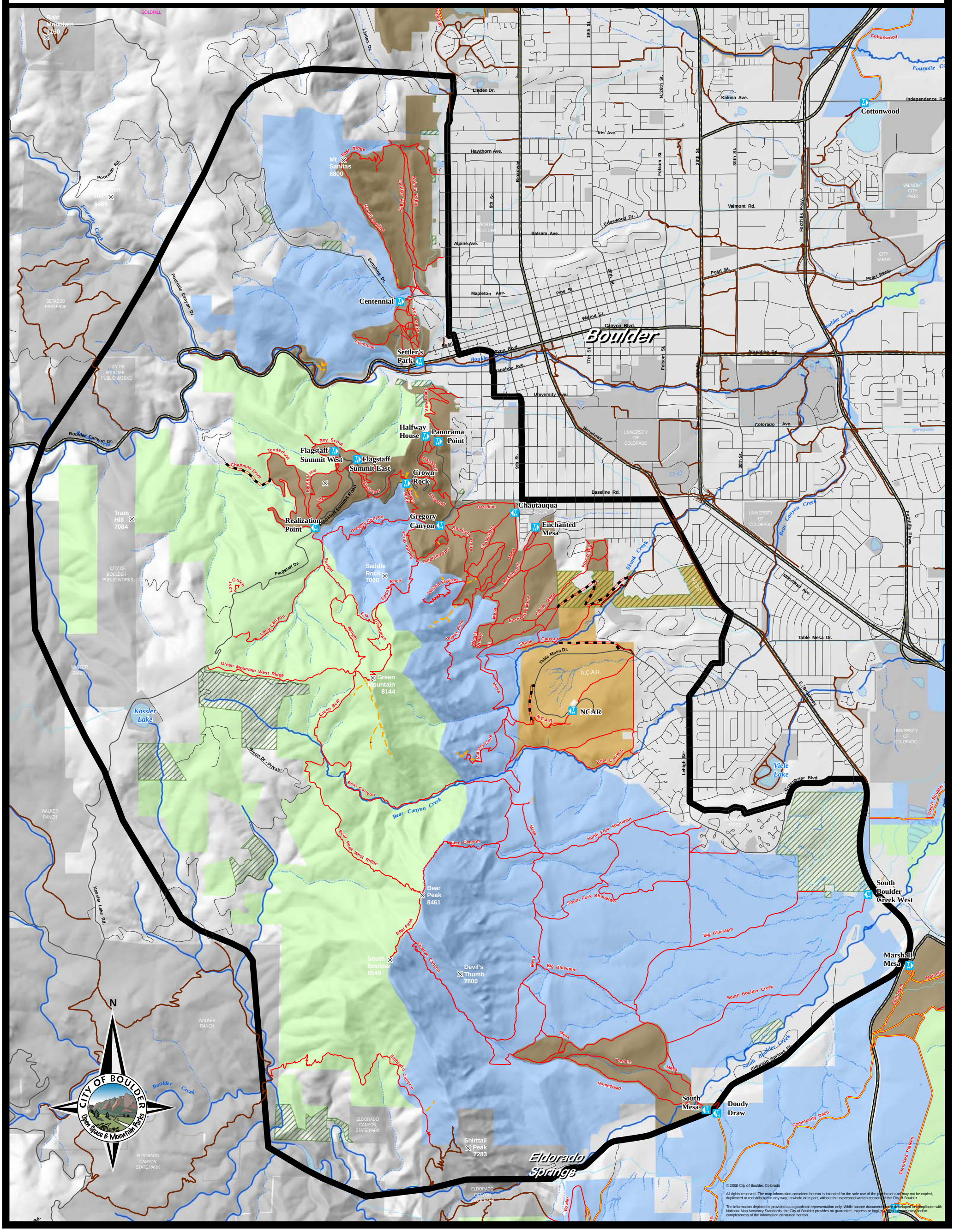
Trails Not Managed By OSMP

Management Zone Designations

- Habitat Conservation Area
- Natural Area
- Passive Recreation Area
- To Be Determined

0.5 0 0.5
Miles

revised: 6/04/2009



Map 1 West TSA - Natural Resource Targets

West TSA Boundary

Forest/Grassland Edge

OSMP Conservation Easement

0 0.5 1
Miles

revised 7/20/2009

Grassland Conservation Targets

- Xeric Tallgrass Mosaic (1122 ac.)
- Mixedgrass Prairie Mosaic (427 ac)
- Plains Foothilss Transitional Riparian (212 ac.)
- Wetlands (108 ac.)
- Mesic Big Bluestem (68 ac.)

Forest Conservation Targets

- Mixed Conifer Forests & Woodlands (3832 ac.)
- Foothills Ponderosa Woodlands & Savannahs (2964 ac.)
- Forest and Montane Forest Openings (960 ac.)
- Cliffs and Talus (544 ac.)
- Foothills and Montane Riparian (241 ac.)

Bald Mountain 7160
Poorman Hill 6485
Mt. Sanitas 6800
Tram Hill 7084
Saddle Rock 7000
Green Mountain 8144
Bear Peak 8461
South Boulder 8549
Devil's Thumb 7800
Shirttail Peak 7283

Violet Ave.
Linden Dr.
Hawthorn Ave.
Alpine Ave.
Mapleton Ave.
Sunshine Dr.
Fourmile Canyon Dr.
Fourmile Creek
Poorman Rd.
Boulder Canyon Dr.
Pearl St.
Boulder Creek
Arapahoe Ave.
University Ave.
Broadway
9th St.
17th St.
Folsom St.
28th St.
30th St.
Colorado Ave.
Baseline Rd.
Flagstaff Summit Rd.
Flagstaff Dr.
Bear Canyon Creek
Skunk Creek
Foothills Pkwy
Moorhead Ave.
Table Mesa Dr.
Table Mesa Pl.
S. Broadway
Lehigh St.
Viele Lake
Kossler Lake
Kossler Lake Rd.
Bison Dr. - Private
Diagonal Hwy.
Independence
Fourmile
Eldorado Springs
South Boulder Creek
Eldorado Springs Dr.

N

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Map 2 West TSA - Coverage of Weeds

West TSA Boundary

Other Government Land

OSMP Conservation Easement

Trail Managed By OSMP

Trail Not Managed By OSMP

0 0.5 1
Miles

revised: 4/21/2009

Percentage of Target with a Prevalence of Management Priority Weed Species

Target	Target Acres RAM Inventoried	Acres of Weed Species (w/ ≥6 % Cover) in Target	% of Target with a Prevalence
Cliffs & Talus	90.1	1.3	1.4
Forest Openings	559.3	70.2	12.6
Riparian	152.0	16.6	10.9
Ponderosa Pine Woodlands and Savannahs	1890.7	117.8	6.2
Mixed Conifer	647.1	2.5	0.4

High — Weed Species Density — Low

Areas Still to be Weed Mapped

Map 3 West TSA - Rare Plants and Communities

West TSA Boundary

Other Government Land

OSMP Conservation Easement

OSMP Land

Trail Managed By OSMP

Trail Not Managed By OSMP

0 0.5 1
Miles

revised: 4/30/2009

Rare Plant Points and Communities
(generalized for resource protection)

Map 4 West TSA - Northern Goshawk Potential Habitat

West TSA Boundary

Other Government Land

OSMP Land

OSMP Conservation Easement

0 0.5 1
Miles

revised: 7/20/2009

Highly Suitable Northern Goshawk Habitat	
Acres of Highly Suitable Habitat in WTSA (crosshatched area)	% of WTSA with Highly Suitable Habitat
482	5%

Northern Goshawk Highly Suitable Habitat

Northern Goshawk Highly Suitable Habitat - Below Minimum Patch Size (10 ha.)

Northern Goshawk Suitable Habitat

High Low

Mt Sanitas 6800
Bohrman Hill 6485
Tram Hill 7084
Saddle Rock 7000
Green Mountain 8144
Bear Peak 8461
South Boulder 8549
Devil's Thumb 7800
Shirttail Peak 7283

Linden Dr.
Hawthorn Ave.
Alpine Ave.
Mapleton Ave.
Jay Rd.
University Ave.
Colorado Ave.
Baseline Rd.
Table Mesa Dr.
Broadway
Boulder Canyon Dr.
Flagstaff Summit Road
Poorman Rd.
Fourmile Creek
Bear Canyon Creek
Skunk Creek
Viele Lake
Kossler Lake
Kossler Lake Rd.
Eldorado Springs Dr.
Eldorado Springs

BETASSO PRESERVE
CITY OF BOULDER - PUBLIC WORKS
WALKER RANCH
CHAUTAUQUA
UNIVERSITY OF COLORADO
N.C.A.R.
ELDORADO CANYON STATE PARK

N

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Map 5 West TSA - Northern Goshawk Potential Habitat with Trail Effect

West TSA Boundary
Other Government Land
OSMP Land
OSMP Conservation Easement
Trail Managed By OSMP
Undesignated Trails
Trail Not Managed By OSMP

0 0.5 1
Miles

revised: 7/20/2009

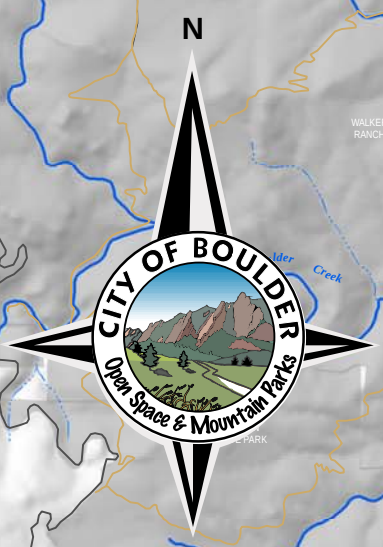
Highly Suitable Northern Goshawk Habitat with Trail Effect	
Acres of Highly Suitable Habitat in WTSA (crosshatched area)	% of WTSA with Highly Suitable Habitat
313	3%

Northern Goshawk Highly Suitable Habitat with Trail Effect

Northern Goshawk Highly Suitable Habitat with Trail Effect - Below Minimum Patch Size (10 ha.)

Northern Goshawk Suitable Habitat
High — Low

N



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Map 6 West TSA - Abert's Squirrel Potential Habitat

West TSA Boundary

Other Government Land

OSMP Land

OSMP Conservation Easement

0 0.5 1
Miles

revised: 7/20/2009

Highly Suitable Abert's Squirrel Habitat	
Acres of Highly Suitable Habitat in WTSA (crosshatched area)	% of WTSA with Highly Suitable Habitat
944	9%

Abert's Squirrel Highly Suitable Habitat

Abert's Squirrel Highly Suitable Habitat - Below Minimum Patch Size (10 ha.)

Abert's Squirrel Suitable Habitat

High Low

E:\MapFiles\TSA\WestTSA\NaturalResources\MAPS\Indicators\AbertsHSH2.mxd

Map 7 West TSA - Abert's Squirrel Habitat with Trail Effect

West TSA Boundary
Other Government Land
OSMP Land
OSMP Conservation Easement
Trail Managed By OSMP
Undesignated Trails
Trail Not Managed By OSMP

0 0.5 1
Miles

revised:7/20/2009

Highly Suitable Abert's Squirrel Habitat with Trail Effect

Acres of Highly Suitable Habitat in WTSA (crosshatched area)	% of WTSA with Highly Suitable Habitat
538	5%

Abert's Squirrel Highly Suitable Habitat with Trail Effect

Abert's Squirrel Highly Suitable Habitat with Trail Effect - Below Minimum Patch Size (10 ha.)

Abert's Squirrel Suitable Habitat
High — Low

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Map 8 West TSA - Protection of Cliff Nesting Raptor Sites

West TSA Boundary

Other Government Land

OSMP Land

OSMP Conservation Easement

0 0.5 1
Miles

revised: 4/30/2009

Percent of Highly Suitable Raptor Nest Sites Protected

44%

Cliff Nesting Raptor Highly Suitable Habitat

Nest Site Protection Area (seasonal closure)

Cliff Nesting Raptor Suitable Habitat

Highest — Lower

E:\MapFiles\TSA\WestTSA\NaturalResources\MAPS\Indicators\ProtectionOfRaptorNestSites.mxd

Map 9 West TSA - Shrub-Nesting Bird Potential Habitat

West TSA Boundary

Other Government Land

OSMP Land

OSMP Conservation Easement

0 0.5 1
Miles

revised: 7/21/2009

Highly Suitable Shrub-Nesting Bird Habitat	
Acres of Highly Suitable Habitat in WTSA (crosshatched area)	% of WTSA with Highly Suitable Habitat
114	1%

Shrub-Nesting Bird Highly Suitable Habitat

Shrub-Nesting Bird Suitable Habitat

High Low

Map 10 West TSA - Shrub-Nesting Bird Habitat with Trail Effect

West TSA Boundary
Other Government Land
OSMP Land
OSMP Conservation Easement
Trail Managed By OSMP
Undesignated Trails
Trail Not Managed By OSMP

0 0.5 1
Miles

revised: 7/21/2009

Highly Suitable Shrub-Nesting Bird Habitat with Trail Effect	
Acres of Highly Suitable Habitat in WTSA (crosshatched area)	% of WTSA with Highly Suitable Habitat
25	0.2%

Shrub-Nesting Bird Highly Suitable Habitat with Trail Effect

Shrub-Nesting Bird Suitable Habitat
High — Low

N

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Map 11 West TSA - Bear Habitat Quality

West TSA Boundary

Other Government Land

OSMP Land

OSMP Conservation Easement

0 0.5 1
Miles

revised: 7/17/2009

Trail Density in Critical Bear Foraging Habitat

Type	Length in Miles	Density ft/acre
OSMP Designated Trail	**14.7**	**61**
Voice and Sight	*8.4*	*34*
Leash Required	*5.3*	*22*
No Dog	*1.0*	*4*
Undesignated Trail	**7.3**	**30**
Other Trails	**1.0**	**4**
Roads	**1.0**	**4**

Trails (designated & undesignated) and Roads in Critical Bear Foraging Habitat (24 Miles)

Black Bear Highly Suitable Habitat (1280 Acres)

N

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Map 12 West TSA - Preble's Meadow Jumping Mouse Habitat & Potential Regulatory Wetlands

West TSA Boundary
Other Government Land
OSMP Land
OSMP Conservation Easement
Trail Managed By OSMP
Undesignated Trails
Trail Not Managed By OSMP

0 0.5 1
Miles

revised: 4/30/2009

Preble's Occupied Range

Data from NDIS/CDOW
(NDIS = Natural Diversity Information Source)

Potential Regulatory Wetlands

Wetland and Riparian Vegetation

50 ft. Buffer of Wetland & Riparian Vegetation

Map 13 West TSA - Wild Turkey Potential Habitat

West TSA Boundary

Other Government Land

OSMP Land

OSMP Conservation Easement

0 0.5 1
Miles

revised: 7/20/2009

Highly Suitable Wild Turkey Habitat	
Acres of Highly Suitable Habitat in WTSA (crosshatched area)	% of WTSA with Highly Suitable Habitat
466	4%

Wild Turkey Highly Suitable Habitat

Wild Turkey Highly Suitable Habitat - Below Minimum Patch Size (7 ha.)

Wild Turkey Suitable Habitat

High — Low

N

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Map 14 West TSA - Wild Turkey Habitat with Trail Effect

West TSA Boundary
Other Government Land
OSMP Land
OSMP Conservation Easement
Trail Managed By OSMP
Undesignated Trails
Trail Not Managed By OSMP

0 0.5 1
Miles

revised: 7/20/2009

Highly Suitable Wild Turkey Habitat with Trail Effect	
Acres of Highly Suitable Habitat in WTSA (crosshatched area)	% of WTSA with Highly Suitable Habitat
145	1%

Wild Turkey Highly Suitable Habitat with Trail Effect

Wild Turkey Highly Suitable Habitat with Trail Effect - Below Minimum Patch Size (7 ha.)

Wild Turkey Suitable Habitat
High — Low

N

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Map 15 West TSA - Grasshopper Sparrow Potential Habitat

West TSA Boundary | Other Government Land | OSMP Land | OSMP Conservation Easement

0 0.5 1
Miles

revised: 7/21/2009

Highly Suitable Grasshopper Sparrow Habitat	
Acres of Highly Suitable Habitat in WTSA (crosshatched area)	% of WTSA with Highly Suitable Habitat
624	6%

Grasshopper Sparrow Highly Suitable Habitat

Grasshopper Sparrow Highly Suitable Habitat - Below Minimum Patch Size (30 ha.)

Grasshopper Sparrow Suitable Habitat

High — Low

E:\MapFiles\TSA\WestTSA\NaturalResources\MAPS\Indicators\GrasshopperSparrowHSH.mxd

Map 16 West TSA - Grasshopper Sparrow Habitat with Trail Effect

West TSA Boundary
Other Government Land
OSMP Land
OSMP Conservation Easement
Trail Managed By OSMP
Undesignated Trails
Trail Not Managed By OSMP

0 0.5 1
Miles

revised:7/21/2009

Highly Suitable Grasshopper Sparrow Habitat with Trail Effect	
Acres of Highly Suitable Habitat in WTSA (crosshatched area)	% of WTSA with Highly Suitable Habitat
212	2%

Grasshopper Sparrow Highly Suitable Habitat with Trail Effect

Grasshopper Sparrow Highly Suitable Habitat with Trail Effect - Below Minimum Patch Size (30 ha.)

Grasshopper Sparrow Suitable Habitat
High — Low

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Map 17 West TSA - Wildlife Monitoring Sites

West TSA Boundary

Other Government Land

OSMP Land

OSMP Conservation Easement

Trailhead

Trails Managed By OSMP

Trail Not Managed By OSMP

0 0.5 1

Miles

revised: 4/21/2009

Wildlife Monitoring Sites

- Forest Owl
- Forest Hawk
- Forest Bird
- Bat
- Tallgrass West Bird
- Leopard Frog

Raptor Closure

Map 1 West TSA - Historic Structure Preliminary Inventory

West TSA Boundary
Other Government Land
Cultural Resource
OSMP Land
OSMP Conservation Easement
Trailhead
Trail Not Managed By OSMP
Trails Managed By OSMP

0 0.5 1
Miles

revised: 7/13/2009

5BL.4173
5BL.4172
5BL.4183
5BL.4183
5BL.4183
5BL.4932
5BL.6199.
5BL.4182
5BL.5005
5BL.4175
5BL.4952.
5BL.4939
5BL.4940
5BL.4942
5BL.4938
5BL.4952.
5BL.4170
5BL.4952.
5BL.4952.
5BL.4944
5BL.4935
5BL.4952.
5BL.4952.
5BL.4952.
5BL.4936
5BL.4934
5BL.4941
5BL.3924
5BL.4952
5BL.3925
5BL.3926
5BL.3880
5BL.3881
5BL.3884
5BL.3885
5BL.3886
5BL.3901
5BL.3927
5BL.3903
5BL.3883
5BL.3865
5BL.3895
5BL.3897
5BL.3899
5BL.3887
5BL.3900
5BL.3865
5BL.3812
5BL.3898
5BL.3864
5BL.3863
5BL.3902
5BL.3459
5BL.3865
5BL.3865
5BL.3865
5BL.3866

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Map 1 West TSA - Trails

West TSA Boundary

Other Government Land

OSMP Land

OSMP Conservation Easement

Trailhead

Trailhead with Accessable Facilities (7)

Trail Not Managed By OSMP

0 0.5 1
Miles

revised: 4/22/2009

Trail Miles by Type

Type	Miles
Hiking, Equestrian	74.9
Multi-Use	0.0
Climbing Access	2.9
Paved Path	0.5
Service Road	*2.0*
Accessible	*1.1*
Total	**78.3**

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Map 2 West TSA - Dog Regulations

West TSA Boundary
Other Government Land
OSMP Land
OSMP Conservation Easement
Trailhead
Trail Not Managed By OSMP

0 0.5 1
Miles

revised: 6/05/2009

Miles of Trail by Dog Regulation

Dog Regulation	Miles
Leash or Voice& Sight	50.9
On-Corridor Voice & Sight	4.1
Leash Required	19.2
NoDogs	4.1
Seasonal Leash Required May 15 - July 31	*2.0*
Seasonal Leash Required Aug 15 - Nov 1	*3.3*

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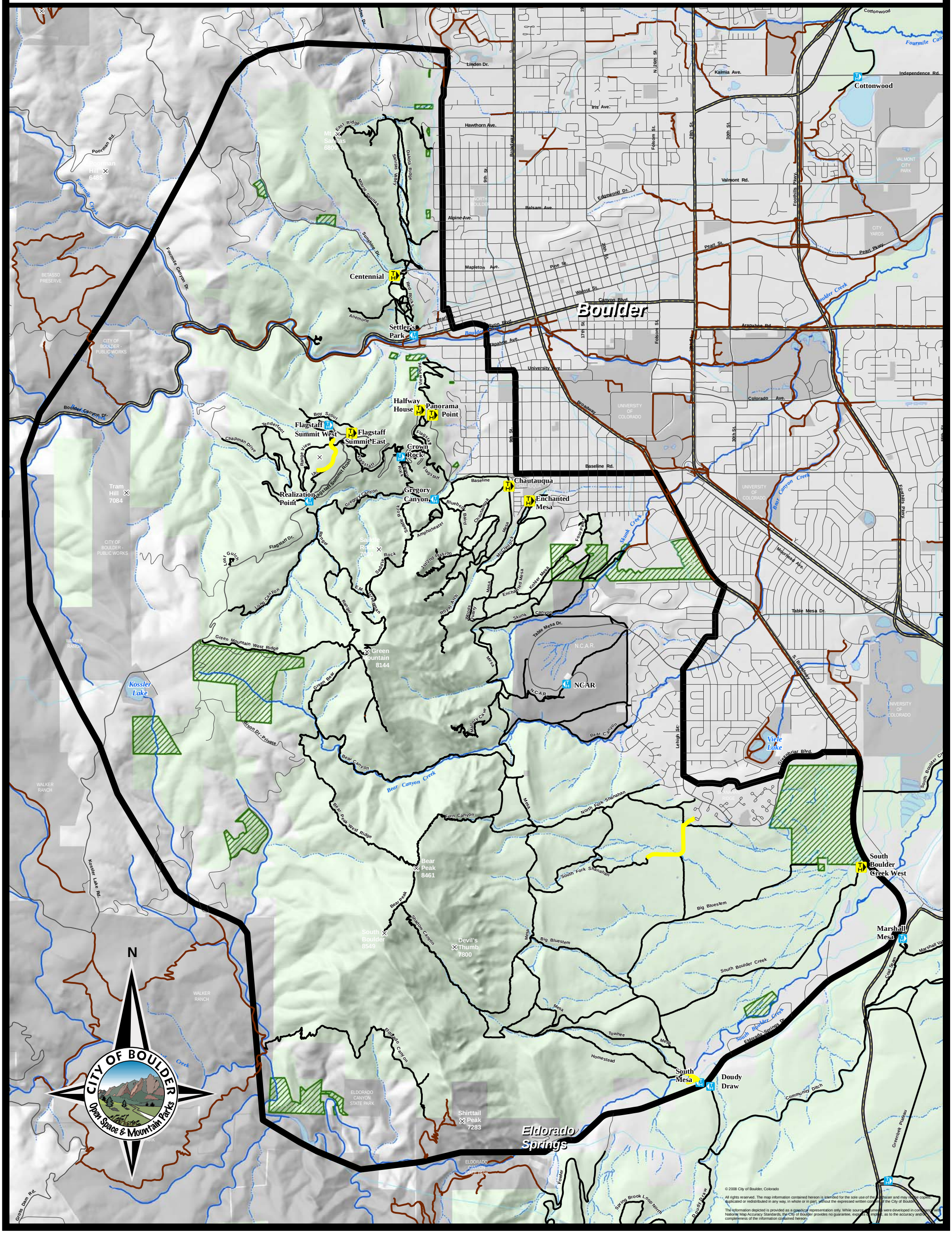
Map 3 West TSA - Accessibility

- Accessible Trails (1.1 miles)
- Trails Managed By OSMP
- Trail Not Managed By OSMP
- Trailhead with Accessable Facilities (7)
- Trailhead
- West TSA Boundary
- Other Government Land
- OSMP Land
- OSMP Conservation Easement

0 0.5 1
Miles

revised: 4/21/2009



Map 4 West TSA - Access to Key Destinations

- Habitat Conservation Area
- Natural Area
- Passive Recreation Area
- NIST and NCAR
- West TSA Boundary
- Other Government Land
- OSMP Conservation Easement
- Trailhead
- Trails Managed By OSMP
- Trail Not Managed By OSMP
- Undesignated Trails

0 0.5 1
Miles

revised:7/2/2009

Key Destinations Served

Yes No

Proportion of Key Destinations Served by a Designated Trail, Trailhead orAccess Point in Each Management Area

Management Area	Proportion of Destinations Served
Habitat Conservation Area	11 of 11
Natural Area	16 of 29
Passive Recreation Area	51 of 62
NIST & NCAR	3 of 4

Note : Served destinations are within 100ft of a designated trail, trailhead / access point or road.

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Map 5 West TSA - Climbing Activity

West TSA Boundary
Other Government Land
OSMP Land
OSMP Conservation Easement
Trails Managed By OSMP
Trail Not Managed By OSMP
Trailhead

0 0.5 1
Miles

revised: 7/08/2009

Climbing Activity Ratings

Walls	Boulders	
▲	●	Popular (over 500 Climber visits/year)
▲	●	Moderate (101- 500 climber visits/year)
▲	●	Infrequent (1-100 Climber visits/year)
▲	●	Not Rated

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Map 6 West TSA - Undesignated Trails

- Habitat Conservation Area
- Natural Area
- Passive Recreation Area
- NIST and NCAR
- West TSA Boundary
- Other Government Land
- OSMP Conservation Easement
- Trailhead
- Trails Managed By OSMP
- Trail Not Managed By OSMP
- Undesignated Trails

0 0.5 1
Miles

revised:4/22/2009

Miles of Undesignated Trails in each Management Area

Management Area	Miles of Undesignated Trails
Habitat Conservation Area	3.5
Natural Area	27.7
Passive Recreation Area	20.9
NIST & NCAR	6.2
Total	58.3

N

Map 7 West TSA - Key Connections not Served by a Designated Trail

- Habitat Conservation Area
- Natural Area
- Passive Recreation Area
- NISTand NCAR
- West TSA Boundary
- Other Government Land
- OSMP Conservation Easement
- Trailhead
- Trails Managed By OSMP
- Trail Not Managed By OSMP
- Undesignated Trails

0 0.5 1
Miles

revised:6/4/2009

Key Connections Not Served by a Designated Trail

Boulder

Eldorado Springs

N

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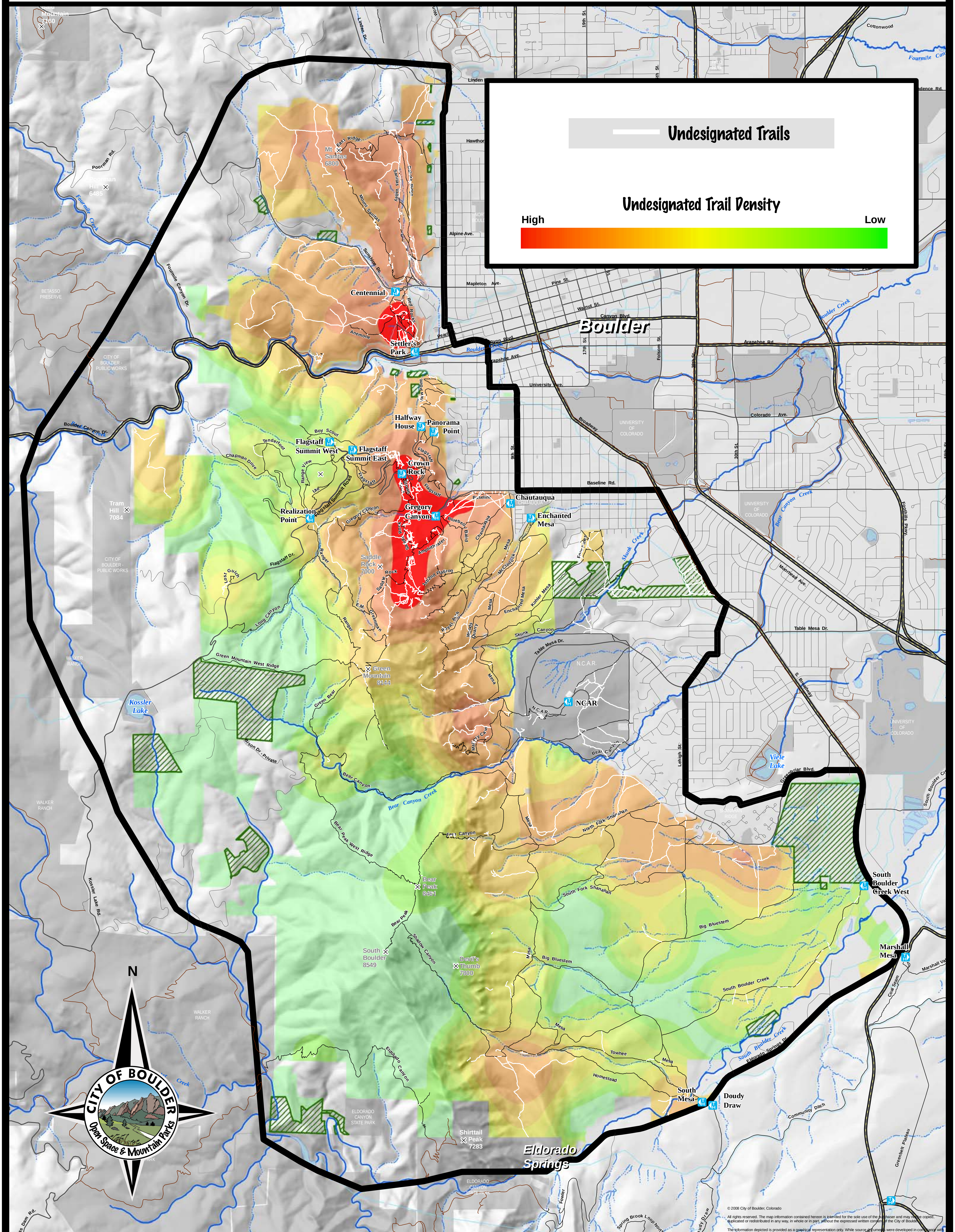
Map 8 West TSA - Undesignated Trail Density

OSMP Conservation Easement
Other Government Land
West TSA Boundary
Trailhead
Trails Managed By OSMP
Trail Not Managed By OSMP

0 0.5 1
Miles

revised:8/04/2009



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Map 9 West TSA - Undesignated Trail Impact Classes

OSMP Land
OSMP Conservation Easement
Other Government Land

West TSA Boundary
Trailhead

Trails Managed By OSMP
Trail Not Managed By OSMP

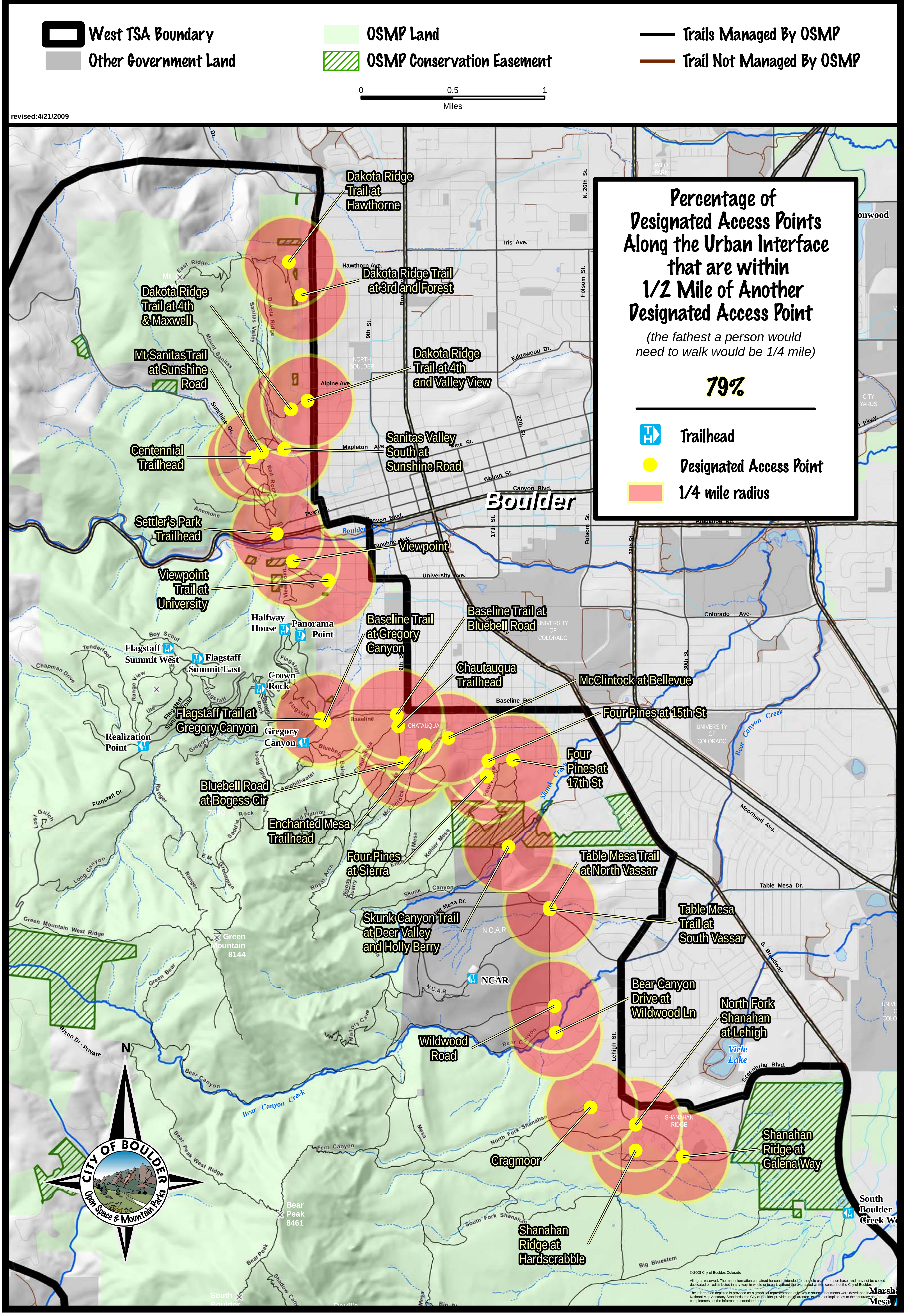
0 0.5 1
Miles

revised:6/01/2009

Miles of Undesignated Trails by Impact Class

Impact Class	Miles of Undesignated Trails
Least	0.8
Low - Mid	2.4
Moderate	29.6
High	3.2
Very High	15.5

Map 10 West TSA - Access Points



West TSA Boundary
Other Government Land
OSMP Land
OSMP Conservation Easement
Trails Managed By OSMP
Trail Not Managed By OSMP
0 0.5 1
Miles
revised:4/21/2009
Percentage of Designated Access Points Along the Urban Interface that are within 1/2 Mile of Another Designated Access Point
(the fathest a person would need to walk would be 1/4 mile)
79%
Trailhead
Designated Access Point
1/4 mile radius
Dakota Ridge Trail at Hawthorne
Dakota Ridge Trail at 3rd and Forest
Dakota Ridge Trail at 4th & Maxwell
Dakota Ridge Trail at 4th and Valley View
Mt SanitasTrail at Sunshine Road
Centennial Trailhead
Sanitas Valley South at Sunshine Road
Settler's Park Trailhead
Viewpoint
Viewpoint Trail at University
Baseline Trail at Gregory Canyon
Baseline Trail at Bluebell Road
Chautauqua Trailhead
McClintock at Bellevue
Four Pines at 15th St
Four Pines at 17th St
Flagstaff Trail at Gregory Canyon
Bluebell Road at Bogess Cir
Enchanted Mesa Trailhead
Four Pines at Sierra
Skunk Canyon Trail at Deer Valley and Holly Berry
Table Mesa Trail at North Vassar
Table Mesa Trail at South Vassar
Bear Canyon Drive at Wildwood Ln
Wildwood Road
North Fork Shanahan at Lehigh
Cragmoor
Shanahan Ridge at Galena Way
Shanahan Ridge at Hardscrabble
Boulder
Halfway House
Panorama Point
Flagstaff Summit West
Flagstaff Summit East
Crown Rock
Realization Point
Gregory Canyon
NCAR
South Boulder Creek West
Green Mountain 8144
Bear Peak 8461
Iris Ave.
Hawthorn Ave.
Alpine Ave.
Mapleton Ave.
Pine St.
Walnut St.
Canyon Blvd.
University Ave.
Colorado Ave.
Baseline Rd.
Table Mesa Dr.
Greenbriar Blvd.
Lehigh St.
S. Broadway
Moorhead Ave.
Edgewood Dr.
N. 26th St.
Folsom St.
17th St.
20th St.
28th St.
30th St.
9th St.
NORTH BOULDER
UNIVERSITY OF COLORADO
CHATAUQUA
N.C.A.R.
SHANAHAN RIDGE
CITY YARDS
PALO PARK
Viele Lake
Boulder Creek
Bear Canyon Creek
Skunk Creek
CITY OF BOULDER Open Space & Mountain Parks
N
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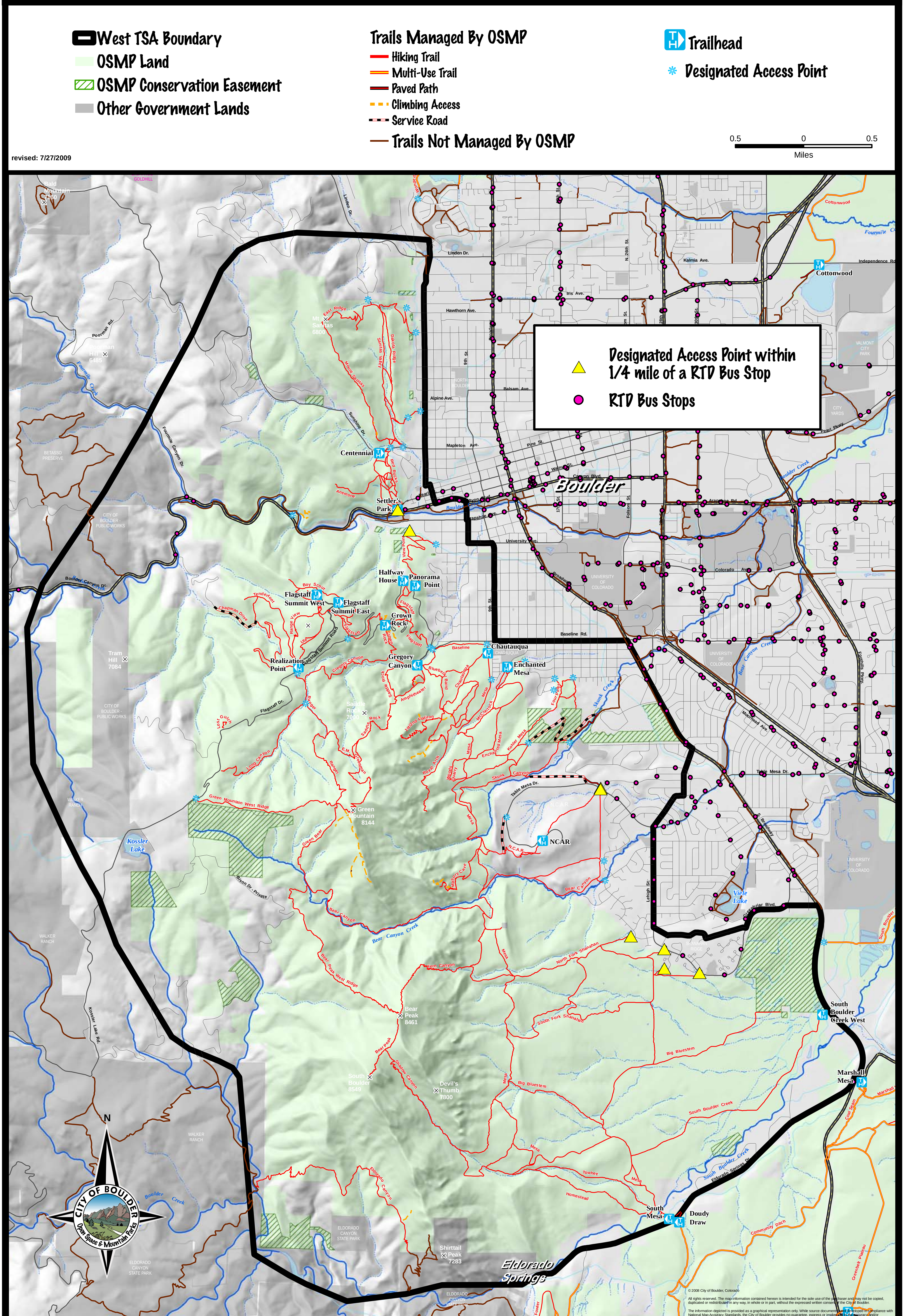
Map 11 West TSA - Bus Access



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Map 12 West TSA - Designated and Undesignated Access Points

West TSA Boundary
Other Government Land
OSMP Land
OSMP Conservation Easement
Trails Managed By OSMP
Trail Not Managed By OSMP

0 0.5 1
Miles

revised:6/2/2009

Trailhead
Designated Access Point

Undesignated Access Points by Class

Class	Number in Class
Class 1 - slight vegetation loss	13
Class 2 - some vegetation loss	21
Class 3 - trail center vegetation loss	17
Class 4 - nearly total vegetation loss	18
Class 5 - soil erosion	60

** see text for full class description*

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Map 13 West TSA - Wayfinding Signs at Designated Trail Intersections

West TSA Boundary
Other Government Land
OSMP Land
OSMP Conservation Easement
Trailhead
Trails Managed By OSMP
Trail Not Managed By OSMP

0 0.5 1
Miles

revised: 6/09/2009

Designated Trail Intersections with Wayfinding Signs

△	68%

N

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Map 14 West TSA - Patrol Frequency Q1 2009

West TSA Boundary
Other Government Land
OSMP Land
OSMP Conservation Easement
Trails Managed By OSMP
Trail Not Managed By OSMP
Trailhead

0 0.5 1
Miles

revised: 4/21/2009

Percent of Properties, Trailheads & Trails patrolled at established Frequencies

	% of Target Met	% of all Patrol Points
●	100+%	48.2
●	70-99%	24.1
●	0-69%	27.7

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Map 15 West TSA - Trail Management Objective (TMO) Compliance

West TSA Boundary
Other Government Land
OSMP Land
OSMP Conservation Easement
Trailhead
Trail Not Managed By OSMP

0 0.5 1
Miles

revised: 7/14/2009

Percent of Trail Segments that Comply with the TMO index

Condition Class	% of Segment length out of compliance	% of Trail Segments in class	Total Mileage of Trail in class
	0% - 19%	35%	27.3
	20% - 39%	28%	21.8
	40% - 59%	9%	7.0
	60% - 79%	10%	7.8
	80% - 100%	10%	7.8
	NA	8%	6.2

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