

Introduction Appendix

I-Appendix A: Planning and Policy Guidance Relevant to the North TSA Plan

Plans and Policies	Year Adopted	General Relevance to North TSA Plan	Relevant Management Objectives	Relevant Management Issues and Opportunities	Specific Guidance Relevant to North TSA Plan
<p>Open Space and Mountain Parks Visitor Master Plan (VMP)</p>	<p>2005</p>	<p>The VMP provides overall direction for the management of visitor activities and services and trail study areas. The VMP established goals, policies, strategies and management area designations for managing visitor access. The North TSA goal and subsequent outcomes should tier from VMP guidance. The VMP also includes recommended management actions for management areas or clusters of management areas, some of which are within the North TSA boundaries.</p>	<p>Enhance the experience Maintain or enhance the quality of the visitor experience when engaged in passive recreational activities such as hiking, climbing and bicycling.</p> <p>Improve access Provide and maintain highly functional and sustainable visitor facilities that support visitor access to appropriate destinations and add to the quality of their experience.</p> <p>Enjoy and protect Ensure that passive recreational activities and facilities are compatible with long-term protection of natural, agricultural and cultural resources.</p> <p>Partner with the community Partner with the community in passive recreation decision-making and stewardship efforts.</p>	<ul style="list-style-type: none"> · High and growing levels of visitation · OSMP is highly attractive regionally, in part because it's the only land management agency that allows off-leash dog opportunities · Increased popularity of outdoor recreation (national trend) · New types of recreation, creating new recreational demands on lands and resources · Concentrated impacts from certain recreational activities, including trail crowding, trailhead parking congestion, trampled soils/vegetation, undesignated trails and dispersal of visitors into the backcountry which creates further congestion, loss of solitude and degradation of wildlife habitat · Constrained land supply versus growing demand for recreation <p>Public suggestions for improvement included:</p> <ul style="list-style-type: none"> · Access for mountain biking, hang gliding and equestrians · Transit linkages, internal/external trail connections and minimize/remove dangerous road crossings · Longer continuous trails and universal accessibility · User conflicts, including unwanted dog encounters and dog waste, bicyclists' speed, etc. · Lack of clarity around regulations, commercial use and special use permits · Physical un-sustainability of trails, including visual scarring from erosion, backlog of designated trail improvements and trail design problems · Undesignated trails · Trailhead parking congestion · Habitat/agricultural impacts, including trampling, dogs harrassing wildlife/range animals, spread of invasive species, visitors leaving gates open and increased nighttime activity · Vulnerable cultural resources sites and insufficient information/education · Need for more education/compliance for low-impact techniques and dog regulations · Need for more protection of highly sensitive areas · Fewer opportunities for solitude · Insufficient staff, expertise and funding 	<ul style="list-style-type: none"> · Motivate the public to help ensure that educational and recreational activities are sustainable in the long term, using educational information and interpretive themes. · Continue to deliver consistent and on-going messages on low-impact visitor techniques. · Develop or continue outreach programs to community groups that influence visitor activity on OSMP lands. · Work with authors and publishers of maps and outdoor recreation guides to ensure OSMP opportunities are appropriately placed and described. · Voice and sight tag program/education, dog management monitoring and enforcement. · Improve the safety of "critical" road crossings. · Provide for safe interactions between livestock and visitors. · Enforce roadside parking prohibitions in cooperation with the County Sheriff's Office and the Colorado Department of Transportation. · Provide a consistent level of ranger patrol coverage, for enforcement and education. · As trail improvement projects are being planned, give consideration to the appropriateness of designating and constructing them to include bicycling. · Implement a permit system for off-trail use in Habitat Conservation Areas (HCAs). · Establish and advertise additional no-dog opportunities on some trails, using a collaborative process and suitability criteria. · Provide designated launch and landing area(s) for hang gliding and paragliding. · Increase services available to community members regardless of physical ability. · Implement a trail and facility routine maintenance program. · Collaborate to study and evaluate possible new trails and trail connections and their relationship to management area designations (TSA plans). · Address major trail reconstruction needs and construct sustainable trails to appropriate destinations and appropriate trail linkages in the overall trail system.

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<p>Open Space and Mountain Parks Grassland Ecosystem Management Plan (Grassland Plan)</p>	<p>2010</p>	<p>The Grassland Ecosystem Management Plan provides resource information and conservation guidance for TSA plans and will be implemented in part by integrating recommended strategies and actions related to visitor access and activities into TSA plans.</p>	<p>The Grassland Plan includes six initiatives that encompass 13 conservation objectives and 35 conservation strategies to guide the conservation and restoration of OSMP grassland resources.</p> <p>Grassland conservation targets were created to categorize the grassland system and serve as the basis for assessing conditions, setting desired future conditions, identifying conservation issues, developing and applying strategies and measuring success. Conservation Targets include mixed prairie mosaic and xeric tallgrass prairie, agricultural operations, black-tailed prairie dog, wetlands, riparian areas and mesic bluestem prairie.</p> <p>Best opportunity areas (BOAs) for conservation and restoration across multiple targets were identified to help set priorities for where conservation actions are likely to have the greatest benefit.</p>	<p>Most significant conservation issues relevant to TSA Planning:</p> <ul style="list-style-type: none"> · incompatible surrounding land uses · invasive non-native plant and animal species · incompatible recreational uses · incompatible dog management by guardians <p>The Grassland Plan includes an analysis of the OSMP land system to determine where the best opportunities exist to conserve each of the conservation targets identified in the plan. The analysis and associated maps include areas in the North TSA (See Chapter V of the Grassland Plan).</p>	<ul style="list-style-type: none"> · Minimize adverse effects of trail development in areas of special conservation value or sensitivity within the Grassland Planning Area, as part of TSA planning. · Identify high-value grassland bird nesting areas and consider seasonal protection measures through the TSA planning process and, when necessary, prior to TSA planning. · Create a large block of conserved grassland in the northern portion of the OSMP land system through acquisitions and management agreements. · Promote conservation of the Grassland Plan targets by increasing awareness of grassland values and conservation issues and considering actions for conservation in Best Opportunity Areas. · Consider closing, restoring and discouraging the (re)establishment of undesignated trails in areas of special conservation value or sensitivity as part of the TSA planning process. · Establish and support the survival of plains cottonwoods and diverse and abundant shrub communities in riparian areas. · Consider establishing on-leash requirements in areas of special conservation value or sensitivity as part of the TSA planning process. · Consider providing additional no-dog opportunities to protect areas of conservation value and sensitivity as part of TSA planning.

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<p>Open Space and Mountain Parks Acquisition Update 2013-2019</p>	<p>2013</p>	<p>The acquisition program is based upon the City Charter purposes for open space and is well aligned with the Sustainability Framework. As a way to link the charter purposes with the Sustainability Framework, OSMP has developed strategies for each strategy area and specific actions for each strategy.</p>	<p><u>Natural Environment</u> Preserve and protect the ecological systems and land resources that provide habitat for native plants and animals, as well as natural areas with special geologic features and terrain.</p> <p><u>Safety and Community Well-Being</u> Coordinate open space land acquisition with other compatible community needs (e.g. floodplain protection, local food production, emergency access, trail crossings).</p> <p><u>Economic Vitality</u> Enhance and strengthen the aesthetic value of Open Space in shaping and supporting an urban form that attracts employers and residents.</p> <p><u>Good Governance</u> Demonstrate a “best value approach” for the acquisition of open space and the management of public funds.</p> <p><u>Energy</u> Use land preservation to support the city’s Climate Action Plan by replacing existing or potentially consumptive land uses with less impactful OSMP management, including the functions of native vegetation as carbon sinks.</p> <p><u>Community Character</u> Recognize the importance of balancing the protection of Open Space near the city with acquisitions farther away.</p> <p><u>Mobility</u> Acquire the lands or interests necessary to provide access to the OSMP trail system, build local trail connections, complete approved regional trail connections and provide alternatives to areas of high visitation that may relieve the effects of crowding upon resources and the quality of visitor experience in more crowded areas.</p>	<p><u>The Northern Tier or Table Mountain acquisition area is within the North TSA. It is centered upon and dominated by a 1,700 acre block of grasslands owned by the federal government. Approximately 2,300 acres remain identified in this area for protection, the majority of which is Table Mountain, but also include Lefthand Creek and its riparian area.</u></p>	<ul style="list-style-type: none"> · Acquire management interest in riparian areas, wetlands and other areas of enhanced biological diversity. · Protect the few remaining large intact blocks of grassland habitat in the acquisition area. · Collaborate with other agencies in the preservation of floodplains. · Identify and acquire lands (and waters) suitable for local food production. · Acquire property interest necessary to provide emergency access and ensure safe trail crossings at roadways, railways, etc. · Identify and protect areas where development could adversely affect the city’s view shed or access to destinations (e.g., scenic gateways, mountain backdrop, and prairie vistas). Continue to provide a setting consistent with the culture of organizations and businesses associated with natural products, outdoor recreation, environmental conservation, scientific research and education. · Work in partnership with other agencies, identify the best opportunities to reduce the carbon footprint and establish land uses compatible with Open Space purposes and the city’s vision for climate action. · Integrate trail linkages compatible with Open Space and transportation planning objectives. · Consider the acquisition of properties farther from the city to address increasing demand for open space visitor services and when properties are especially well-suited for desired community services (e.g., local organic agriculture). · Preserve and protect buildings, sites and artifacts as determined by their archaeological, ethnographic, historic and architectural significance. · Partner with other agencies to develop acquisition priorities for passive recreational regional trail connections shown in the BVCP. · Investigate the acquisitions necessary to implement trail linkages identified in Trail Study Area (TSA) Plans. · Acquire passive recreational access to properties where such access would relieve the adverse effects of heavy visitation upon the quality of the visitor experience and the city’s open space resources.

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<p>City of Boulder Open Space North Boulder Valley Area Management Plan (NBVAMP)</p>	<p>1997</p>	<p>While the scope of the NBVAMP is broader than the North Trail Study Area (TSA) Plan, the geographic study areas are similar. The NBVAMP also contains a good deal of relevant guidance and management recommendations that remains timely today, including potential trail alignments, general trail design and construction principles, guidance on interpretation, and recommendations for management area designations.</p> <p>Three principal management themes frame the North Boulder Valley Area Management Plan: (1) protecting the land and the place, (2) keeping agriculture in a changing rural setting, and (3) recreating experiences on a landscape of remnants. Protecting the land comes first. Without the land there is no community and no place.</p>	<ul style="list-style-type: none"> · Acquire lands consistent with the Open Space Charter (Appendix 1.1) and the Area Management Plan goals and ensure proper management of easements and Open Space properties; · Manage and preserve the natural and cultural resources of North Boulder Valley; · Restore and improve natural, cultural, passive recreational and agricultural resources where suitable; · Manage and preserve land for passive recreation use, for its aesthetic or passive recreational value, and for its contribution to the quality of life of the community; · Maintain sustainable agricultural operations by balancing economic and natural resource considerations; and · Use education and outreach to accomplish the management goals of the NBVAMP. 	<p>Trails</p> <ul style="list-style-type: none"> · Increased visitation and types of use, undesignated trails, access issues, trail maintenance-steep portions, drainage, dog management, user conflicts, litter, vandalism and illegal fossil collection. · Commercial use: hang gliding, horse concessions. · Safety: Beech groundwater contamination, rattlesnakes and mountain lions, proximity for shooting range, crossing for Foothills trail at Lee Hill Road <p>Geology</p> <ul style="list-style-type: none"> · Protection of fragile paleontological resources and areas. · Illegal collection of fossils and erosion of sites. <p>Soils</p> <ul style="list-style-type: none"> · Agricultural land uses: Controlled by many soil characteristics other than nutrient status and irrigability. · Trails: Erodible soils present a significant erosion hazard if not specially engineered to take a path or road. Undesignated trails lack erosion control treatments. · Vegetation: Artificial disturbances should be minimized. Rare plants such as Bell's twinpod. · Wildlife: Invertebrate soil animals are fundamental. · Facilities: Erodible soils are unsuitable for heavy uses such as picnic areas unless specifically engineered. Shallow soils, areas with high seasonal water, slow permeability, or high shrink-swell potential are unsuitable for leach fields or septic systems. <p>Vegetation/Wetlands</p> <ul style="list-style-type: none"> · Species/communities of special concern: non-natives, recreational use and grazing in rare plant habitat or wetlands · Fire management: native plants need fire · Agricultural management: over-utilization contributes to non-native infestations, pesticides/fertilizers · Prairie dogs and IPM · Hydrology as it relates to trail construction, wells, native plants, wetlands and irrigation management. <p>Wildlife</p> <ul style="list-style-type: none"> · Maintaining animal diversity, critical habitat (connectivity and quality) <p>Cultural Resources</p> <ul style="list-style-type: none"> · Conflicts with other management objectives · Appropriate uses of historical structures 	<p>· See sections 10 (passive recreation) and 11 (education and outreach) for highly pertinent guidance. In addition, other specifics are called out below:</p> <ul style="list-style-type: none"> · Evaluate potential trail alignment along northern boundary of Axelson property, future potential trail and access opportunities from the north to south through West Beech, and a trail corridor along the Boulder Feeder Canal (<i>Boulder County is lead agency for this project</i>) · Interpret suitable sites (lots of guidance on this, including interpretation themes such as: "Coordinate with the education and outreach staff to initiate an educational and interpretive program with agriculture as a central theme" · Discourage public access in areas susceptible to damage and vandalism. · Plan trails to minimize the risk of invasive plant species introduction and spread. Do not place trails in areas with severe existing invasive plant species infestations. Keep trails out of wet areas. Minimize ongoing erosion in steep areas. Avoid creating a trail corridor that stretches from an invasive plant species infested area into an area with relatively few or no noxious invasive plant species infestations. · Use invasive plant species-free materials in trail construction. · Encourage use of pelletized feed or invasive plant species-free forage for horses before and during visits to Open Space. · Plan recreational development to avoid or minimize direct, indirect, and cumulative negative effects on rare species, communities, and potential habitat. · Develop and use a project checklist to identify and evaluate potential impacts to sensitive resources. · Implement trail maintenance project where the Hogback Ridge Trail crosses wetland #601 (montane spring-fed drainage). · Re-direct travel around, rather than through, wetland #444 (west of Lefthand Valley Reservoir; see Passive Recreation section). · Where wetland crossings are unavoidable, use boardwalks (with low water crossing for equestrians) to minimize impacts to surface flow and vegetation. · Provide a boundary fence around the Hart-Jones property to protect the globally imperiled Great Plains Salt Meadow plant community. · Encourage the protection of large tracts of unfragmented land, undisturbed from the effects of recreational trails (i.e., West Beech, central Axelson and East Beech properties). · Place educational signs along trails and at trailheads that interpret significant wildlife resources of the North Boulder Valley; specifically prairie dogs, raptors, amphibians and reptiles (see Education and Outreach section). · Assess trail access and development issues related to existing Open Space properties and future acquisitions. · Work with Boulder County and other departments within the City to provide trail linkages that meet regional recreational needs. Assist negotiations with other agencies for trail connections. · Ensure all facilities are safe and maintained to an acceptable standard.

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<p>City of Boulder Open Space Long Range Management Policies</p>	<p>1995</p>	<p>Open space will be managed in a way that provides for aesthetic enjoyment, minimizes cumulative impacts to the natural ecosystems and conflicts between users, considers user safety, preserves responsible agricultural use, provides for a quality passive recreation experience and protects natural areas.</p>	<p>Managing competing purposes: "Some proposals regarding management of Open Space properties may include consideration of competing purposes. The Charter does not specify the relative priorities of the purposes. Weighing of potential benefits and impacts of proposed management actions will include consideration of long-term viability and health of natural ecosystems" (City of Boulder 1995).</p>	<p>n/a</p>	<ul style="list-style-type: none"> · Natural areas will be managed to provide the greatest possible protection of site integrity. Activities and access to natural areas will be restricted to research, education and other activities that will not detract from the natural or research values of such areas. · Management actions will be taken to prevent illegal collecting [of paleontological resources] and may be taken to prevent damage from natural processes such as erosion. · VISITOR USE MANAGEMENT TOOLS: The open space department may utilize the full range of tools that are available to manage passive recreation impacts including: education, volunteer programs, site specific restrictions, signage, permit systems, reservation systems, public use limits, ordinances or special use regulations, trail relocation, temporary area closures, permanent area closures. · Trails will be designed and constructed to protect native ecosystems and to minimize impacts on the natural landscape and agricultural lands.

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<p>Boulder County Comprehensive Plan (BCCP)</p>	<p>1999 + updates to Environmental Resources section in 2014 and forthcoming update to Open Space element</p>	<p>Boulder County values and strives to preserve, conserve and restore the unique and distinctive natural features, ecosystems and landscapes of the county using sound resource management principles and practices at both a site-specific level and on a broader, landscape scale. Species of Special Concern are an integral component of this management approach. The list of Species of Special Concern includes locally threatened or endangered flora and fauna that the county seeks to protect. Habitat for these Species of Special Concern is particularly vital, since it often presents our best chance to protect native species.</p> <p>In addition to identifying Species of Special Concern, the Environmental Resources Element of the BCCP designates areas of important habitat at two scales: the “site-specific scale” and the broader, “landscape-scale.” At the site-specific scale, important environmental resources typically consist of an easily definable area such as an individual parcel of land or a distinct geographical location where specific resources exist. Designations at the site-specific scale include Critical Wildlife Habitats, Rare Plant Areas, Wetlands, Riparian Areas, and Significant Natural Communities (formerly referred to as Critical Plant Associations). Environmental resources designated at the landscape-scale are much larger and holistic in approach. At this scale, the designations of High Biodiversity Areas and Environmental Conservation Areas seek to preserve broader ecological processes and functions. These areas often encompass multiple resources also designated at the site-specific scale. Natural Areas and Natural Landmarks designations are intended to encompass and protect unique and distinctive natural features and landscapes in the county. The fundamental and essential sustaining resources of air, soil and water are also considered and addressed.</p>	<p>See Boulder County Comprehensive Plan Environmental Resources Element</p>	<p><u>The following BCCP maps were updated in 2014 and identify resources or areas of concern that fall within the North TSA:</u></p> <ul style="list-style-type: none"> · environmental conservation areas · high biodiversity areas · natural landmarks and natural areas · wetlands and riparian areas · rare plant areas and significant natural communities · critical wildlife habitats and migration corridors · habitat conservation areas for Preble’s meadow jumping mouse <p><u>In addition, other maps are relevant for the North TSA, including:</u></p> <ul style="list-style-type: none"> · archaeologically sensitive areas and travel routes · agricultural lands of statewide and local significance · geologic hazard and constraint areas · mineral resources <p><u>In addition, the open space element for the BCCP is undergoing an update concurrent with the North TSA process.</u></p>	<p>Proposals should generally comply with BCCP goals associated with relevant Maps Approved by Planning Commission 12/18/2013</p>

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Boulder Valley Comprehensive Plan (BVCP)	2010	<p>Outlines core values and guidance to achieve sustainability, intergovernmental cooperation, organized urban development, protection of open space and other policies.</p> <p>Boulder Valley Natural Ecosystems: are places that support natural ecosystems or native plants and animals that possess important ecological, biological or geological values. Most of the North Boulder Valley Area is designated as “natural ecosystems” on the Boulder Valley Natural Ecosystems Map.</p>	<p>3.01 Incorporating Ecological Systems into Planning The city and county will approach planning and policy decisions in the Boulder Valley through an ecosystem framework in which natural regions like airsheds and watersheds are considered and incorporated into planning.</p> <p>3.02 Adaptive Management Approach The city will employ an adaptive management approach to resource protection and enhancement. An adaptive management approach involves ongoing monitoring of resource conditions, assessment of the effectiveness of management actions, revision of management actions based on new information from research and learning from experience what works and what does not.</p>	n/a	<p>· Proposed trail alignments</p> <p>Policies:</p> <p>2.32: Physical Design for People The city and county will take all reasonable steps to ensure that public and private development and redevelopment be designed in a manner that is sensitive to social, health and psychological needs. Broadly defined, this will include factors such as accessibility to those with limited mobility; provision of coordinated facilities for pedestrians, bicyclists and bus-riders; provision of functional landscaping and open space; and the appropriate scale and massing of buildings related to neighborhood context.</p> <p>3.08 Public Access to Public Lands Certain city and county-owned or managed lands provide a means for educating users on the importance of the natural environment. Public lands may include areas for recreation, preservation of agricultural use, unique natural features, and wildlife and plant habitat. Public access to natural lands will be provided for, except where closure is necessary to protect areas from unacceptable degradation or impacts to agriculture, habitat or wildlife, for public safety, or limits on access necessary to preserve the quality of the visitor experience.</p> <p>8.12 Trail Functions and Locations Trails serve a variety of functions such as exercise, recreation, transportation, education and/or environmental protection. Trails should be designed and managed to minimize conflicts among recreational activities. Trailheads should be located so they are convenient and safe for those arriving by alternate modes of transportation as well as automobiles. In order to provide environmental protection, informal (visitor-created) trails and visitor caused widening of trails should be discouraged by ensuring that formal trails are well designed, monitored and adequately maintained. Trail and trailhead locations and alignments should avoid environmentally sensitive areas and minimize environmental impacts.</p> <p>8.13 Trails Network The city and county will coordinate with other trail providers and private landowners in trail system planning, construction, management and maintenance. Where compatible with environmental protection goals and conservation easement agreements, trail connections will be developed to enhance the overall functioning of the trails network.</p>

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<p>City of Boulder Sustainability Framework</p>		<p>Alignment across the organization with the wide range of community priorities, allows the city organization to evaluate whether or not expectations are being met and to more nimbly adjust, if necessary. Overall, the framework encourages holistic, systemic thinking and allows for more strategic decision-making as the city moves together in the same direction. Specific initiatives to achieve these outcomes and strategies are outlined in greater detail in master/strategic plans and the city's budget. Certain multiple-objective or cross-departmental projects will benefit from using the framework to guide strategies, but it may not be effective or applicable for all projects. Efforts are ongoing to align the framework with the budget process and key initiatives.</p>	<ul style="list-style-type: none"> · Safe community · Healthy and socially thriving community · Livable community · Accessible and connected community · Environmentally sustainable community · Economically vital community · Good governance 	<p>n/a</p>	<p>n/a</p>

Recreation Appendices

R-Appendix A: The Recreation Opportunity Spectrum Framework Steps

Recreation Opportunity Spectrum (ROS) summary (adapted from Clark and Stankey, 1979) answers the principle question “ What recreational settings exist and what should be provided? ”		
ROS Component	ROS Phase	Description
Component One - Establish current condition; inventory what is	Phase One	Define and describe the recreation setting (biophysical, social and managerial attributes determined to represent continuum of opportunities); continuum classified into “zones” of opportunity
Component Two - Prescriptions; what could be and what should be	Phase Two	Assess alternative management regimes including placing locations into potential zones
	Phase Three	Select the preferred alternative
Component Three - Monitor and manage; what will be back to what is	Phase Four	Implement the preferred alternative
	Phase Five	Monitor and evaluate

Land managers describe the setting by using specific setting attributes as the basis for inventory of the area. In many cases, these attributes (USDA FS, 1990) include:

- access (trail, road, paved, gravel);
- remoteness (distance from trails and roads);
- naturalness (visibility of resource management activities such as timber harvesting);
- presence of facilities and site management;
- amount and type of encounters with other people in the area;
- types and visibility of visitor impact; and
- visitor management activities such as rules, enforcement personnel, etc.

These inventories are then used to map the existing set of ROS classes across the landscape (McCool et al., 2007)

R-Appendix B: OSMP Management Area Designations, Their Primary Characteristics, Goals and Criteria for Inclusion (City of Boulder 2005, p. 48)

Passive Recreation Area Designation

Characteristics

- Generally in close proximity to city or county development.
- Higher level of visitor use and density of existing trails.
- More evidence of human use and impacts.
- May include some interspersed patches of high-quality habitat.

Goals

- Provide a high level of public access to destinations and connection through designated trails.
- Maintain or improve passive recreational and educational opportunities, while protecting and preserving natural lands and resources.
- Accommodate high levels of visitor use with appropriate management, trails and trailheads and services.
- Reduce conflicts among visitor activities.
- Minimize the number of undesignated or “social trails;” eliminate undesignated trails when they are duplicative or damaging to resources.

Criteria for Inclusion of Management Areas in the Passive Recreation Area Designation

- Higher level of visitation.
- Trails and trailheads that accommodate high levels of visitor use.
- High density of trails.
- Offers destinations for a wide range of different passive recreational activities.
- Compatibility with adjacent land use (i.e., opportunities to coordinate with neighboring or nearby landowners/managers in providing recreational services).

Natural Area Designation

Characteristics

- Locations can be both close to and remote from development.
- Varying levels of visitor use, types of activities and availability of facilities.
- Conditions of natural ecosystems are variable- many areas with ecological systems in good condition, some with evidence of human use and impacts.
- May be in proximity to agricultural production and operations.

Goals

- Accommodate low-impact visitor activities where adequate trails exist or can be built and resource impacts can be minimized.
- Provide opportunities for passive recreational and educational activities that require topographic relief or a natural setting (e.g., hang/paragliding, climbing/bouldering, nature study, scenic viewing).

- Protect the quality of natural and agricultural resources (especially where high value resources exist).
- Eliminate undesiguated trails when they are redundant or damaging to resources.

Criteria for Inclusion of Management Areas in the Natural Area Designation

- Interspersed recreational and natural values require that management determine the appropriate mix of open space purposes and manage multiple uses accordingly.
- Relatively high resource and recreation values.
- Compatibility with adjacent land use (i.e., opportunities for coordinating habitat protection and connections and passive recreational activities/trail linkages).

Agricultural Area Designation

Characteristics

- Rural areas in the Boulder Valley.
- May be in proximity to areas of either high or low visitor use.
- Areas of intensive agricultural production or operation.

Goals

- Maintain the efficiency of agricultural production and operation.
- Manage agricultural production and operation to ensure safety for operators and visitors in the vicinity.
- Provide, where appropriate, public access and passive recreational opportunities that have minimal impacts on agricultural production and operation or other resources.
- Manage visitor access in areas of intensive agricultural production or operation to ensure visitor safety.
- Eliminate undesiguated trails when they are redundant or damaging to resources.

Criteria for Inclusion of Management Areas in the Agricultural Area Designation

- Crop production and irrigated hay fields and grazing areas.
- Areas where conflicts with visitors and their pet companions could or do adversely affect the efficiency of agricultural production and operations or endanger visitor safety.
- Compatibility with adjacent land use (i.e., opportunities for coordinating agricultural protection and recreational activities/trail linkages).

Note: Areas of concentrated livestock activity (corrals, horse boarding, etc.), private residences, machinery storage areas, etc. will be addressed in a separate policy.

Habitat Conservation Area Designation

Characteristics

- Tend to be located in more remote areas.
- Typically represent the largest blocks of an ecosystem type with few, if any, trails or roads.
- Lower level of visitor use; no or few trails and trailheads.

- Naturally functioning ecosystems (but may contain areas with evidence of human use and impacts).

Goals

- Maintain, enhance and/or restore naturally functioning ecological systems.
- Maintain, enhance and restore habitat for species of concern identified in the Boulder County and the Boulder Valley Comprehensive Plans.
- 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 undesigned trails, unless they are made part of the designated trails system or provide specialized access to appropriate low-use destinations.
- Where sustainable infrastructure exists, continue to allow public access to appropriate destinations.

Criteria for Inclusion of Management Areas in the Habitat Conservation Area Designation

- Large habitat blocks with a low density of trails, roads or development.
- High potential for restoration of natural ecosystems (including areas with restoration underway).
- Plant communities that are rare or unique on Open Space and Mountain Parks lands.
- Habitat for species of concern such as threatened, endangered, rare and other species.
- Areas with high biodiversity such as wetlands and riparian areas (especially un-trailed riparian reaches).
- Comparatively lower visitation levels.
- Compatibility with adjacent land use (i.e., opportunities for coordinating habitat protection and connections and recreational activities/trail linkage

R-Appendix C: OSMP Management Area Designations and the VMP Guidance for Management Strategies Within Each Area (City of Boulder 2005, p. 50)

Management Strategies for Open Space and Mountain Parks Management Areas				
Management Issue	Passive Recreation Area Strategies	Natural Area Strategies	Agricultural Area Strategies	Habitat Conservation Area Strategies
<p>On-Trail Visitor Use</p> <p>Note: Management <i>in all areas</i> may include seasonal or local requirements for visitors to stay on-trail or seasonal/local closures to address environmental sensitivity or trail sustainability.</p> <p>All designated trails will be signed and indicated on trail maps.</p>	<p><u>Encourage on-trail use.</u> Require on-trail use in sensitive areas and/or at specific times, unless an off-trail permit is obtained.</p>	<p><u>Encourage on-trail use.</u> Require on-trail use in sensitive areas and/or at specific times, unless an off-trail permit is obtained.</p>	<p><u>Encourage on-trail use.</u> Require on-trail use in sensitive areas and/or at specific times, unless an off-trail permit is obtained.</p> <p>Consider/provide designated on-trail access to selected destinations.</p>	<p><u>Require on-trail use</u> except: 1) in a limited number of designated off-trail activity areas; or 2) if an off-trail permit is obtained for OSMP-sponsored activities or other limited and approved public use.</p> <p>Consider/provide designated on-trail access to selected destinations.</p>
<p>Trail Functions, New Trails and Interconnected Trail System</p> <p>Note: In all management areas, OSMP will provide different classes of trails. Trail classes are matched to the specific travel needs / opportunities and the environmental context in a given area. Trails will provide different levels of access, offer different types of travel experiences / challenges, and use different physical designs and materials. Trails will accommodate different types and levels of use, but all are intended to accommodate use</p>	<p>Build and maintain a hierarchy of trails that encourage visitors to travel on-trail and minimize impacts. New trails to important destinations will be considered.</p> <p>Improve and construct sustainable trail linkages to create an interconnected trail system.</p>	<p>Build and maintain a hierarchy of trails that encourage visitors to travel on-trail and minimize impacts. New trails to important destinations will be considered.</p> <p>Improve and construct sustainable trail linkages to create an interconnected trail system.</p>	<p>Minimize new trails and trail density; locate new trails to minimize impacts on agricultural operations.</p> <p>Consider designating/building trails that:</p> <ul style="list-style-type: none"> • Do not impinge upon agricultural operations • Provide appropriate access • Include appropriate linkages and connections 	<p>Minimize new trails and trail density; locate new trails to minimize impacts on habitat quality.</p> <p>Consider designating/building trails that:</p> <ul style="list-style-type: none"> • Do not impinge upon ecological systems • Provide appropriate access • Include appropriate linkages and connections

Management Strategies for Open Space and Mountain Parks Management Areas				
Management Issue	Passive Recreation Area Strategies	Natural Area Strategies	Agricultural Area Strategies	Habitat Conservation Area Strategies
without undue maintenance demands and to minimize impacts on the environment. OSMP will make management decisions based upon the best available information and evaluate the appropriateness and effectiveness of management actions.				
Trail Design for Level of Use	Design and construct trails and other facilities to sustain a <u>higher</u> level of visitor use.	Design and construct trails and other facilities to sustain a <u>variable</u> level of visitor use.	Design and construct trails and other facilities to sustain a <u>variable</u> level of visitor use.	Design and construct trails and other facilities to sustain a <u>low</u> level of visitor use.
Undesignated Trails	Lower priority for management of undesignated trails. Minimize new undesignated trails. Management actions for existing undesignated trails include: <ul style="list-style-type: none"> • Evaluate best management actions • Designate • Re-route • Close and reclaim • Retain undesignated trails • Monitor newly established or developing undesignated trails 	Variable priority for management of undesignated trails. Minimize new undesignated trails. Management actions for existing undesignated trails include: <ul style="list-style-type: none"> • Evaluate best management actions • Designate • Re-route • Close and reclaim • Retain undesignated trails • Monitor newly established or developing undesignated trails 	Variable priority for management of undesignated trails. Minimize new undesignated trails. Management actions for existing undesignated trails include: <ul style="list-style-type: none"> • Evaluate best management actions • Designate • Re-route • Close and reclaim • Retain undesignated trails 	High priority for management of undesignated trails. Minimize new undesignated trails. Management actions for existing undesignated trails include: <ul style="list-style-type: none"> • Evaluate best management actions • Designate • Re-route • Close and reclaim

Management Strategies for Open Space and Mountain Parks Management Areas				
Management Issue	Passive Recreation Area Strategies	Natural Area Strategies	Agricultural Area Strategies	Habitat Conservation Area Strategies
Access to Areas Normally Closed to Visitors	Provide guided educational hikes in areas normally closed to visitors.	Provide guided educational hikes in areas normally closed to visitors.	Provide guided educational hikes in areas normally closed to visitors.	Provide guided educational hikes in areas normally closed to visitors or require permits for off-trail use.
Dog Management	<p>Visitors are strongly encouraged to keep dogs on-trail.</p> <p>Dog management is predominantly voice-and-sight control. Dogs on-leash, dogs prohibited or seasonal dog requirements may be implemented.</p>	<p>Visitors are strongly encouraged to keep dogs on-trail.</p> <p>Dog management is predominantly voice-and-sight control. Dogs on-leash, dogs prohibited or seasonal dog requirements may be implemented.</p>	<p>Visitors are strongly encouraged to keep dogs on-trail.</p> <p>Dog management is predominantly voice-and-sight control. Dogs on-leash, dogs prohibited, dogs on-corridor voice-and-sight control or seasonal dog requirements may be implemented.</p>	<p>Dogs are required to be on-trail, with some exceptions allowing on-corridor voice-and-sight control.</p> <p>Dog management is predominantly on-leash. Dogs on-leash, dogs prohibited, dogs on-corridor voice-and-sight control or seasonal dog requirements may be implemented.</p>
Nighttime Use	Trailhead parking prohibited 11 p.m. to 5 a.m. (except Panorama	Trailhead parking prohibited 11 p.m. to 5 a.m.	Trailhead parking prohibited 11 p.m. to 5 a.m.	Trailhead parking prohibited 11 p.m. to 5 a.m. and a nighttime curfew encouraged one hour after dusk to one

Management Strategies for Open Space and Mountain Parks Management Areas				
Management Issue	Passive Recreation Area Strategies	Natural Area Strategies	Agricultural Area Strategies	Habitat Conservation Area Strategies
	Point and Halfway House).			hour before dawn.
Emphasis for Education and Enforcement Activities	Target educational and enforcement services to reduce visitor conflict, foster appreciation and protection of the OSMP environment and support resource protection.	Target educational and enforcement services to reduce visitor conflict, foster appreciation and protection of the OSMP environment and support resource protection.	Target educational and enforcement services to support on-trail visitor use and foster appreciation and protection of agricultural resources.	Target educational and enforcement services to support on-trail visitor use and foster appreciation and protection of natural resources.
Visitor Services and Facilities Matched to Level of Use	Provide a level of visitor services and facilities to support <u>higher use levels</u> and a quality visitor experience (interpretive signs, scenic pull-outs, picnic tables, toilets, etc.).	Provide a moderate level of visitor services and facilities.	Provide a variable level of visitor services and facilities matched to the levels of use encountered.	Provide a low level of visitor services and facilities, except those supporting basic protection and maintenance services.

R-Appendix D: 2004/2005 Visitation Study Hourly Visitation Distribution Across OSMP (Vaske et al. 2009); Gray Cells Indicate Hours not Sampled During 2014 North TSA Visitation Study

Hour	Weekday Person Visits	Weekday Percent	Weekend Person Visits	Weekend Percent	Holiday Person Visits	Holiday Percent	System-wide Average Hourly Sums
Midnight	3,544	0.16%	1,341	0.09%	161	0.07%	0.32%
1:00 a.m.	3,272	0.15%	1,190	0.08%	210	0.09%	0.32%
2:00 a.m.	1,475	0.07%	970	0.07%	70	0.03%	0.17%
3:00 a.m.	1,205	0.06%	968	0.07%	46	0.02%	0.15%
4:00 a.m.	1,664	0.08%	1,892	0.13%	72	0.03%	0.24%
5:00 a.m.	14,671	0.68%	2,718	0.19%	527	0.22%	1.09%
6:00 a.m.	80,108	3.70%	15,487	1.09%	2,742	1.13%	5.92%
7:00 a.m.	135,956	6.29%	50,127	3.53%	6,904	2.85%	12.67%
8:00 a.m.	156,254	7.22%	91,328	6.43%	12,181	5.03%	18.68%
9:00 a.m.	168,050	7.77%	119,710	8.43%	17,196	7.10%	23.30%
10:00 a.m.	165,694	7.66%	143,618	10.11%	22,073	9.12%	26.89%
11:00 a.m.	166,446	7.70%	150,683	10.61%	25,848	10.67%	28.98%
Noon	167,731	7.76%	144,396	10.16%	25,950	10.72%	28.64%
1:00 p.m.	152,305	7.04%	140,924	9.92%	26,611	10.99%	27.95%
2:00 p.m.	150,770	6.97%	144,015	10.14%	25,676	10.60%	27.71%
3:00 p.m.	154,492	7.14%	134,559	9.47%	23,748	9.81%	26.42%
4:00 p.m.	174,992	8.09%	107,215	7.55%	19,524	8.06%	23.70%
5:00 p.m.	168,274	7.78%	71,433	5.03%	13,180	5.44%	18.25%
6:00 p.m.	141,284	6.53%	44,144	3.11%	9,602	3.97%	13.61%
7:00 p.m.	91,425	4.23%	29,156	2.05%	5,276	2.18%	8.46%
8:00 p.m.	41,621	1.92%	13,826	0.97%	2,516	1.04%	3.93%
9:00 p.m.	12,195	0.56%	5,143	0.36%	993	0.41%	1.33%

10:00 p.m.	5,992	0.28%	3,604	0.25%	624	0.26%	0.79%
11:00 p.m.	3,458	0.16%	2,090	0.15%	432	0.18%	0.49%

R-Appendix E: 2010/2011 Visitor Survey Methodology Synopsis

Staff conducted a self-administered exit survey (**R-Appendix F**) of visitors leaving OSMP property from June 1, 2010 through May 31, 2011. The survey period consisted of four seasons: summer (June 1 through Aug. 31, 2010), fall (Sept. 1 through Nov. 30, 2010), winter (Dec. 1, 2010 through Feb. 28, 2011), and spring (March 1 through May 31, 2011).

Staff used a two-stage cluster sampling design to randomly sample exiting OSMP visitors. OSMP access points were the primary sampling units in this design and exiting visitors were the secondary sampling units.

For more detail, see VanderWoude, D. 2015.

R-Appendix F: 2010-2011 OSMP Visitor Survey Instrument



Open Space and Mountain Parks Survey

Your feedback on this survey enables city staff to better understand visitor's views and improve service delivery. Your participation is voluntary and your answers are anonymous. **Thank you — your input is appreciated!**

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 Other
3. How many people are in your group? _____
4. Which one of the following was the most important reason for visiting Open Space & Mountain Parks?
I came here to enjoy the place itself.
I came here because it is a good place to do the activities that I enjoy.
I came here because I wanted to spend more time with family or friends.
5. What activities did you do during this visit? (PLEASE CHECK ALL THAT APPLY)

<input type="checkbox"/> Climbing/Bouldering	<input type="checkbox"/> Walking dog(s)	<input type="checkbox"/> Viewing scenery
<input type="checkbox"/> Photography	<input type="checkbox"/> Picnicking	<input type="checkbox"/> Viewing wildlife
<input type="checkbox"/> Social gathering	<input type="checkbox"/> Contemplation/Meditation	<input type="checkbox"/> Horseback riding
<input type="checkbox"/> Hiking	<input type="checkbox"/> Biking	<input type="checkbox"/> Nature study
<input type="checkbox"/> Running	<input type="checkbox"/> Pleasure driving	<input type="checkbox"/> Other _____
6. Please **CIRCLE ONE** activity from **ABOVE** that you consider your **PRIMARY ACTIVITY** today.
7. How many dogs are with you today? 0 1 2 3 4 5+
8. What made your trip enjoyable today? (PLEASE CHECK ALL THAT APPLY)

<input type="checkbox"/> Scenery	<input type="checkbox"/> Close to home	<input type="checkbox"/> Get away from daily pressures
<input type="checkbox"/> Wildlife	<input type="checkbox"/> Family or friends	<input type="checkbox"/> Exercise/Health
<input type="checkbox"/> Plants/Wildflowers	<input type="checkbox"/> Being with my dog(s)	<input type="checkbox"/> Other _____
9. Where do you live?

<input type="checkbox"/> Boulder (within city limits)	<input type="checkbox"/> Longmont	<input type="checkbox"/> Other area in Colorado
<input type="checkbox"/> Louisville	<input type="checkbox"/> Unincorporated Boulder County	<input type="checkbox"/> Out of state
<input type="checkbox"/> Lafayette	<input type="checkbox"/> Other city in Boulder County	<input type="checkbox"/> Out of country
<input type="checkbox"/> Superior	<input type="checkbox"/> Metro Denver	
10. Please estimate how many times per month, on average, you have visited Open Space & Mountain Parks during the last 12 months? _____ Times per month

11. How many years have you been coming to Open Space & Mountain Parks?
 _____ Number of years

12. Please grade Open Space & Mountain Parks on the following, based on your recent experience.

PLEASE CHECK ONE FOR EACH CATEGORY.	A= Excellent				F= Failing	
	A	B	C	D	F	N/A
Restroom cleanliness	<input type="checkbox"/>					
Usefulness of signs and brochures	<input type="checkbox"/>					
Fixing eroded or trampled areas	<input type="checkbox"/>					
Trail conditions and maintenance	<input type="checkbox"/>					
Enforcement of rules	<input type="checkbox"/>					
Ability to access your destination	<input type="checkbox"/>					
Trailhead and nature education	<input type="checkbox"/>					
Trash cans and bag dispensers	<input type="checkbox"/>					
Overall satisfaction with Open Space & Mountain Parks	<input type="checkbox"/>					

13. Please rate your recent experience with the following visitor activities.

PLEASE CHECK ONE FOR EACH CATEGORY.	A= Excellent				F= Failing	
	A	B	C	D	F	N/A
Experience with runners	<input type="checkbox"/>					
Experience with bikers	<input type="checkbox"/>					
Experience with hikers	<input type="checkbox"/>					
Experience with horseback riders	<input type="checkbox"/>					
Experience with dogs and dog walkers	<input type="checkbox"/>					

14. Sometimes the behavior of others can interfere with your visit to OSMP. Examples include failure to share the trail, not picking up after dog, approaching without warning or shouting loudly. These types of situations are often referred to as *recreation conflict*.

DID YOU EXPERIENCE:	Today?		Last 12 months?	
	No	Yes	No	Yes
Recreation conflict?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If yes <i>today</i> , describe:				
Recreation conflict with dog walkers or dogs specifically?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If yes <i>today</i> , describe:				
Recreation conflict with mountain bikes specifically?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If yes <i>today</i> , describe:				

15. Are you using a particular Open Space and Mountain Parks area less often or have you even stopped using it entirely? No Yes **If yes, where?**

If yes, describe the reason _____

16. How old were you on your last birthday? _____ Years old

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 _____ (see map)

*Map available upon request.

R-Appendix G: North TSA Visitor Characteristics Compared with Other TSAs and OSMP System-wide

Table R4. OSMP visitor residency by TSA (2011)

Trail Study Area	Type of Measure	Visitor Residency						Total
		Boulder (in city limits)	Boulder County (outside city limits)	Metro Denver	Other area in CO	Out of State	Out of Country	
North	Count	312	73	13	9	19	2	428
	Percent	72.9%	17.1%	3.0%	2.1%	4.4%	.5%	100.0%
East	Count	292	133	10	7	11	1	454
	Percent	64.3%	29.3%	2.2%	1.5%	2.4%	.2%	100.0%
South	Count	111	78	47	23	17	1	277
	Percent	40.1%	28.2%	17.0%	8.3%	6.1%	.4%	100.0%
West	Count	778	187	150	53	162	33	1363
	Percent	57.1%	13.7%	11.0%	3.9%	11.9%	2.4%	100.0%
All TSAs Combined	Count	1493	471	220	92	209	37	2522
	Percent	59.2%	18.7%	8.7%	3.6%	8.3%	1.5%	100.0%

Table R5. Proportion of visitors in each age group by TSA (2011)

Trail Study Area	Type of measure	Age Category							Total
		<20	20-29	30-39	40-49	50-59	60-69	70+	
North	Count	2	34	94	94	110	65	20	419
	Percent	.5%	8.1%	22.4%	22.4%	26.3%	15.5%	4.8%	100%
East	Count	0	54	88	106	111	62	24	445
	Percent	0.0%	12.1%	19.8%	23.8%	24.9%	13.9%	5.4%	100%
South	Count	3	53	55	77	55	20	10	273
	Percent	1.1%	19.4%	20.1%	28.2%	20.1%	7.3%	3.7%	100%
West	Count	46	282	268	249	258	172	35	1,310
	Percent	3.5%	21.5%	20.5%	19.0%	19.7%	13.1%	2.7%	100%
All TSAs Combined	Count	51	423	505	526	534	319	89	2,447
	Percent	2.1%	17.3%	20.6%	21.5%	21.8%	13.0%	3.6%	100%

Table R6. Number of visits to OSMP per month by TSA (2011)

Trail Study Area	Type of Measure	Number of Visits per Month					Total
		0-1	>1-4	>4-12	>12-20	>20	
North	Count	36	49	110	106	126	427
	Percent	8.4%	11.5%	25.8%	24.8%	29.5%	100%
East	Count	24	61	138	125	112	460
	Percent	5.2%	13.3%	30.0%	27.2%	24.3%	100%
South	Count	56	63	102	38	17	276
	Percent	20.3%	22.8%	37.0%	13.8%	6.2%	100%
West	Count	316	262	326	249	202	1,355
	Percent	23.3%	19.3%	24.1%	18.4%	14.9%	100%
All TSAs Combined	Count	432	435	676	518	457	2,518
	Percent	17.2%	17.3%	26.8%	20.6%	18.1%	100%

Table R7. Number of years visiting OSMP by TSA (2011)

Trail Study Area	Type of Measure	Number of Years Visiting OSMP						Total
		1 or less	>1-2	>2-5	>5-10	>10-20	>20	
North	Count	54	19	60	71	107	118	429
	Percent	12.6%	4.4%	14.0%	16.6%	24.9%	27.5%	100%
East	Count	30	17	72	83	146	109	457
	Percent	6.6%	3.7%	15.8%	18.2%	31.9%	23.9%	100%
South	Count	34	25	41	51	67	54	272
	Percent	12.5%	9.2%	15.1%	18.8%	24.6%	19.9%	100%
West	Count	271	99	169	198	299	320	1,356
	Percent	20.0%	7.3%	12.5%	14.6%	22.1%	23.6%	100%
All TSAs Combined	Count	389	160	342	403	619	601	2,514
	Percent	15.5%	6.4%	13.6%	16.0%	24.6%	23.9%	100%

Table R8. Visitor self-reported primary activity by TSA (2011)

Trail Study Area	Type of Measure	Primary Activity							TSA Total
		Biking	Climbing/ Bouldering	Hiking	Horseback Riding	Running	Walking Dogs	Other *	
North	Count	57	1	141	1	103	77	26	406
	Percent	14.0%	.2%	34.7%	.2%	25.4%	19.0%	6.4%	100%
East	Count	68	0	56	0	126	135	22	407
	Percent	16.7%	0.0%	13.8%	0.0%	31.0%	33.2%	5.4%	100%
South	Count	102	0	59	0	33	33	25	252
	Percent	40.5%	0.0%	23.4%	0.0%	13.1%	13.1%	9.9%	100%
West	Count	14	45	684	0	150	182	135	1,210
	Percent	1.2%	3.7%	56.5%	0.0%	12.4%	15.0%	11.2%	100%
All TSAs Combined	Count	241	46	940	1	412	427	208	2,275
	Percent	10.6%	2.0%	41.3%	.0%	18.1%	18.8%	9.1%	100%

*Includes activities such as wildlife viewing, socializing or picnicking

Table R9. Number of people in group by TSA (2011)

Trail Study Area	Type of Measure	Number of People in Group				Total
		1	2	3 or 4	5+	
North	Count	264	143	23	2	432
	Percent	61.1%	33.1%	5.3%	.5%	100%
East	Count	283	130	29	16	458
	Percent	61.8%	28.4%	6.3%	3.5%	100%
South	Count	119	122	23	12	276
	Percent	43.1%	44.2%	8.3%	4.3%	100%
West	Count	521	539	207	93	1,360
	Percent	38.3%	39.6%	15.2%	6.8%	100%
All TSAs Combined	Count	1,187	934	282	123	2,526
	Percent	47.0%	37.0%	11.2%	4.9%	100%

Table R10. Number of dogs with visitor by TSA (2011)

Trail Study Area	Type of Measure	Number of Dogs				Total
		0	1	2	3+	
North	Count	303	110	19	3	434
	Percent	69.8%	25.3%	4.4%	.7%	100%
East	Count	288	129	35	7	457
	Percent	63.0%	28.2%	7.7%	1.5%	100%
South	Count	203	57	11	2	273
	Percent	74.4%	20.9%	4.0%	.7%	100%
West	Count	932	311	89	23	1,352
	Percent	68.93%	23.00%	6.58%	1.70%	100%
All TSAs Combined	Count	1,726	607	154	35	2,516
	Percent	68.6%	24.1%	6.1%	1.4%	100%

Table R11. Mode of transportation to OSMP (2011)

Trail Study Area	Type of Measure	Mode of Transportation					Total
		Car	Walk/Run	Bike	Bus	Other	
North	Count	167	217	46	0	1	431
	Percent	38.7%	50.3%	10.7%	0.0%	.2%	100%
East	Count	165	202	89	0	0	456
	Percent	36.2%	44.3%	19.5%	0.0%	0.0%	100%
South	Count	199	13	65	0	0	277
	Percent	71.8%	4.7%	23.5%	0.0%	0.0%	100%
West	Count	893	422	32	1	6	1,354
	Percent	66.0%	31.2%	2.4%	.1%	.4%	100%
All TSAs Combined	Count	1,424	854	232	1	7	2,518
	Percent	56.6%	33.9%	9.2%	.0%	.3%	100%

R-Appendix H: Designated Trails in the North TSA with Associated Mileage

Name	Mileage
Buckingham Park	0.23
Cobalt	0.89
Degge	0.90
Eagle	3.26
Foothills - Wonderland Lake spur	0.02
Foothills North	0.91
Foothills South	0.72
Foothills Spur	0.03
Hidden Valley	1.24
Hogback Ridge	1.79
Left Hand	2.91
Mesa Reservoir	1.01
North Rim	0.24
Old Kiln	0.80
Old Kiln Spur	0.37
Old Mill	0.21
Sage	1.83
Wonderland Hill	0.96
Wonderland Lake	0.87
Total Trail Miles in North TSA	19.19

R-Appendix I: Designated Entry Point with Associated Classification

Entry Point Name	Entry Point Type	Classification
Buckingham Park	Trailhead	T3
Lefthand	Trailhead	T1
Boulder Valley Ranch	Trailhead	T1
Eagle	Trailhead	T1
Four Mile Creek	Trailhead	T1
Foothills	Trailhead	T1
Wonderland Lake	Trailhead	T2
Cottonwood Picnic Area	Access to Recreational Facility	R2
Wonderland Lake and Poplar	Access Point	A2
Leftland Trail and Pebble Beach Ln.	Access Point	A1
Eagle Parking Coffee	Access Point	A3
Foothills access to Eagle	Access Point	A1
Wonderland Lake at Utica	Access Point	A3
Foothills at Second and Dakota Blvd	Access Point	A1
Foothills at Second and Denver	Access Point	A1

R-Appendix J: Regional Trail Concepts from Public Agency Plans and Efforts

Map Key	Regional Trail Concept	Lead Agency	Guiding Document(s) or Agreement(s)	General Concept
1	Rocky Mountain Greenway Project	Department of Interior – National Park Service	America's Great Outdoors and a partnership agreement between Secretary of the Interior and the Governor of Colorado	Create uninterrupted trail connections between Rocky Flats, Rocky Mountain National Park, other destinations and existing community trail networks.
2	Joder to Heil Ranch	Boulder County Parks and Open Space (BCPOS)	Boulder County Comprehensive Plan (BCCP) and 2013 OSMP Acquisitions Plan	Create long-distance mountain biking opportunities to connect with existing mountain bike trail networks.
3	Joder to Olde Stage Road	City of Boulder – Open Space and Mountain Parks (OSMP)	BCCP and temporary access agreements with Boulder County and others	Construct an interim trail to allow visitor access until final guidance is provided in North TSA Plan.
4	Joder to Lagerman Reservoir	BCPOS	BCCP	Create an east-west axis across grasslands connecting the Joder property, Lefthand Trailhead, Lagerman Reservoir and beyond to the City of Longmont.
5	North Rim to Left Hand connector	To be determined	Boulder Valley Comp Plan (BVCP)	Connect Lefthand Trail with North Rim Trail south of Loukonen Reservoir.
6	Axelson to North Rim	OSMP	<ul style="list-style-type: none"> BVCP and North Boulder Valley Area Management Plan 	Connect North Rim Trail with Boulder Reservoir and Boulder Valley Ranch trail network.
7	Lyons to Boulder (Boulder Feeder Canal Trail)	BCPOS	<ul style="list-style-type: none"> BCCP BVCP VMP 	Create multi-use path between Lyons and Boulder along Feeder Canal to provide gentle grades attractive to all ages/abilities. Planning is on hold indefinitely.
8	Lagerman Complex	BCPOS	BCCP and Lagerman/Imel/AHI Open Space Complex Management Plan	Provide internal trail network within open space complex and future connections into City of Longmont trail system.

Map Key	Regional Trail Concept	Lead Agency	Guiding Document(s) or Agreement(s)	General Concept
9	Colorado Front Range Trail	Colorado Parks and Wildlife	Colorado Front Range Trail Implementation Plan	The vision of this trail is to create an 876-mile multi-purpose trail from Wyoming to New Mexico, along the Front Range of Colorado.
10	Lyons to Boulder (North of reservoir on OSMP land)	OSMP	BVCP and VMP	The section of the stalled Lyons-to-Boulder Trail is on OSMP land.
11	Multi-Use Reservoir Trail	City of Boulder Parks and Recreation	Boulder Reservoir Master Plan	Create trail along 51st and 55th streets, and along the south shore, to provide access around entire reservoir.
12	IBM Connector	Boulder County (through construction, then managed by OSMP)	<ul style="list-style-type: none"> • BVCP • VMP • Reservoir Master Plan • 2003 Transportation Master Plan • Other reports 	A planned multi-use regional trail and underpass connecting Gunbarrel to the City of Boulder parks and trails system. Design and construction is underway in 2015.
13	Reservoir Road to Diagonal	Boulder County	BVCP and Greenways Master Plan	Create trail and underpass connecting Reservoir Road along the south shore of the reservoir with Gunbarrel.
14	Four Mile Canyon Creek Underpass	Boulder County	BVCP and Greenways Master Plan	Construct underpass under railroad to connect existing trail segments.

R-Appendix K: Key Destinations Served or Not Served

Passive Recreation Area			Total: 7
Map Number	Key Destination Name	Served/Not Served	
1	Wonderland Lake	Designated and Undesignated Trail	
2	Paragliding Launch Site 1	Designated and Undesignated Trail	
3	Paragliding Launch Site 2	Designated and Undesignated Trail	
4	Paragliding Launch Site 3	Designated and Undesignated Trail	
5	Old Kiln	Not Served	
7	Mesa Reservoir	Undesignated Trail	
8	BVR Pond	Designated and Undesignated Trail	
Natural Area			Total: 1
Map Number	Key Destination Name	Served/Not Served	
9	Beech Pavilion	Designated Trail**	
Habitat Conservation Area			Total: 4
Map Number	Key Destination Name	Served/Not Served	
6	Rock View Point	Undesignated Trail	
10	Six Mile Fold	Not Served	
11	Joder Peak	Not Served	
12	Palisades Climbing Area	Undesignated Trail	

** Served by City of Boulder Bike and Pedestrian System

R-Appendix L: Undesignated Trail Mapping Methodology Synopsis

All undesignated trails and road-like pathways meeting the mapping criteria on OSMP-managed properties through the Weiser acquisition of 2011 were surveyed between July 2011 and November 2012. Using a Global Positioning System (GPS), OSMP staff mapped and documented attributes of start, end and interior points spaced at approximately 200-foot intervals along undesignated trails and road-like pathways. A Geographic Information System (GIS) map of undesignated trails and road-like pathways was created by digitizing segments between the start, interior and end GPS points. The GIS map and associated database of attributes provided tools for visualization and analyses. GIS spatial analysis techniques were developed to determine the size of trail and road-free OSMP blocks, to quantify the density of undesignated trails and roads across the OSMP system and to evaluate spatial patterns of undesignated trails and roads in proximity to designated and undesignated access points.

For more detail, see Lezberg, A. 2015.

R-Appendix M: Dog Regulation Compliance Methodology Synopsis

The **Voice and Sight Regulations component** of the effectiveness monitoring was an observation study designed to evaluate dog guardian compliance with observable aspects of specific dog regulations from the voice and sight ordinances. During field monitoring, data was collected to describe visitor party attributes, dog behaviors and guardian responses. Observations were categorized as “pass” events where no dog behaviors were recorded, “interaction” events where the dog under observation exhibited a behavior toward another person, dog, wildlife or livestock and as “other” events describing situations where the dog was out of sight and/or the guardian issued a command *and* where these observations were not associated with a pass or interaction event. The resulting descriptive data were evaluated and interpreted using the collected information for each party. The use of these data provided context for each party’s recorded behaviors and interactions. Evaluation and interpretation was conducted by the monitoring staff. For some indicators, project management and ranger staff also participated in determining a final compliance outcome for each visitor party.

The **Leash Interview component** of the effectiveness monitoring was a visitor interview administered to visitor parties with at least one dog off-leash and without a leash visible to the observer for each off-leash dog. During the interview, each guardian was asked to demonstrate that the guardian possessed a leash for each dog they were managing under voice and sight control.

Additional measures of dog regulation compliance

Two additional measures of dog regulation compliance *not specific to the Tag Program* were monitored during the study period (described below). These two additional components included dog excrement removal and leash compliance on both year-round and seasonal leash-required trails. These measures were added to this project based upon direction received from the Open Space Board of Trustees (OSBT) and project team staff.

- The **Dog Excrement component** was an observational study designed to evaluate dog guardian compliance with dog excrement pickup and removal regulations. This component was executed simultaneously with the Voice and Sight component.
- The **Leash Required component** was an observational study designed to evaluate dog guardian compliance with seasonal and year-round leash laws on OSMP leash-required trails.

For more detail, see VanderWoude, D. & Bitume, E. 2015

R-Appendix N: Classes and Standards for Trailheads, Access Points and Recreation Sites

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 Street Shanahan Ridge - Hardscrabble Sawhill Access East	1. Wayfinding/regulatory sign post ***	1. Trailhead signs *** 2. Bike rack	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 3. Bike Rack	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 2. Bike rack	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 2. Bike rack 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 inches
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 2. Bike Rack 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 inches 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 6. Bike Rack	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 inches 6. Service restrooms 7. Power wash restrooms monthly or as needed
Class R1 Access to recreational facilities (No access to OSMP designated trail system)	N/A	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 5. Bike Rack	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 inches
Class R2 Access to recreational facilities (No access to OSMP designated trail system)	N/A	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 7. Bike Rack	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 inches

*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 "Trailhead signs and structures" document to view various signs used at each class of trailhead

OSMP Definitions of Trailhead Facilities

11-13-2008

Parking Areas Surfaces

Road base

Parking area surfaces using road base will be built to standards found in Colorado Department of Transportation (CDOT): Standard Specifications for Road and Bridge Construction (1999) CDOT standards.

CDOT standards for road base surfaced parking areas call for a road base thickness of six inches of Class 6 road base. OSMP parking areas shall be road base unless required by law or if there is significant erosion potential.

Asphalt

Parking area surfaces using asphalt will be built to CDOT standards found in Colorado Department of Transportation (CDOT): Standard Specifications for Road and Bridge Construction (1999).

CDOT standards for driveway pavement include: Type S from roadway pavement to right of way line, thickness = minimum 6 inches. Additional 6 inches of Class 6 road base shall be installed below the asphalt pavement.

Parking slots

Each slot will be 9 feet wide by 19 feet long.

Parking slots for the disabled will be 13 feet wide by 19 feet long and will meet disabled specifications found in USDA FSORAG.

Horse trailer parking

Horse trailer parking will be 'drive through' style. Horse trailer parking slot dimensions will be 12 feet wide by 50 feet long. A driveway entrance to parking slots will be maintained with an internal radius of 30 feet and an external radius of 50 feet.

Driveway pavement specifications

Will meet CDOT standards.

Drainage

Parking lots will be graded to drain to engineered detention pond with drain pipe to nearest drainage way.

Parking bollards

Parking bollards will be constructed and installed as follows. Parking bollards will be constructed of one 6"x6"x5' and two 6"x6"x2' treated lumber. These will be bolted together at each end of the 6"x6"x5' using two 10" timber locks fasteners on each end. This will form a U shaped structure. Two 8"x8"x 2' holes will be excavated so that each end of the U shaped form can be placed in the ground, leaving the 6"x6"x5' at ground level. Two ½ inch holes will be drilled through the 6"x6"x5' cross member, at a distance approximately 20" out from centerline, in each direction. A two foot section of number 4, (1/2") rebar will be used to secure the structure in the soil substrate.

Trailhead signs

Please see attached 'Trailhead Sign Structures', 'Parking Area Signs' and 'Visitor Information Kiosks'. All signs will be placed to ADA specifications found in USDA FSORAG.

Trash cans

All trash cans will be Bear Saver trash cans model # HB2G-P (phone #909-605-1697). All cans will be placed to ADA specifications found in USDA FSORAG. Mounting for these trash cans will use 4" x 6" x 34" timbers that are below ground level and installed with ½ rebar. The trash can will then be mounted to the timbers with four inch lag bolts.

Dog stations

Please see attached "Trailhead Sign Structures" sheet. All dog stations will be placed to ADA specifications found in USDA FSORAG.

Dog poop-bag tubes

All dog waste-bag tubes will be constructed using schedule 40, white 6"x 2' PVC tubing with a 4" tube reducer on bottom of tube. A 6" cap will be attached to the top using a 1/8" nylon lanyard. The tube will then be placed on dog stations using several washers to allow for cap removal and replacement using two 3" X 5/8" lag bolts at a height compliant with ADA standards. Tubes will be checked and stocked during trash runs.

Picnic tables and picnic areas

All picnic tables will be Pilot Rock model # PT/B-6PW (phone #800-762-5002). Any older cement tables will be maintained until they need to be replaced. All tables will be placed to ADA specifications found in USDA FSORAG. Tables will be installed with a 4 foot "clear space" ADA path on all sides. This makes the total foot print 13 feet wide x 14 feet long. Tables will be installed with a minimum of four bags of 80 pound Quickcreeet and 1/2" rebar will be placed in the holes provided to ensure stability and prevent theft.

Bike racks

All new bike racks will be Pilot Rock model #SRP/G-7 (powder coated black) (phone #800-762-5002). Bike racks will be installed with a minimum of four bags of 80 pound (two bags on each end) Quickcreeet and 1/2" rebar will be placed in the holes provided to ensure stability and prevent theft.

Outhouses

Where outhouses are installed at OSMP access points, the outhouse will be a vault evaporative restroom fabricated facility, model # R2-167 VE W/DC Power National Value Engineered Structure similar or equivalent to structures engineered by Biological Mediation Systems, Inc. (BMS) Fort Collins, CO 80526, 1-800-524-1097. (Please see "Standard OSMP Outhouses Specifications for Vault Evaporative Restroom Facility" document for exact specifications)

Fences

Exterior fences will be pin and rail with three horizontal wires for reinforcement. Materials are six inch diameter vertical treated wooden posts, five feet maximum above ground, with two-eight foot horizontal wooden posts between each vertical post. There shall be three high tensile, horizontal reinforcing wires between the horizontal wooden posts. Each vertical post shall be pounded into the ground a minimum of 20 inches and up to 30 inches, depending on soil conditions.

Interior fences will be pin and rail with one horizontal wire (HTF) reinforcement wire. Materials are six inch diameter vertical treated wooden posts, three feet maximum above ground, with one-eight foot horizontal wooden posts between each vertical post. There shall be one high tensile wire; horizontal reinforcing wires between the horizontal wooden posts. Each vertical post shall be pounded into the ground a minimum of 20 inches and up to 30 inches depending on soil conditions.

Buck and pole fence: Please refer to USDA Forest Service technology and development program Manual "FENCES" page 200 to see specifications and diagrams on how to build. Buck and pole fences will be used in the mountain backdrop and in areas where drilling or digging is not an option.

Gates

OSMP trailhead entrance gates (road access) will be a minimum of 24 feet in width and built to Colorado Department of Transportation (CDOT): Standard Specifications for Road and Bridge Construction (1999) CDOT standards. These gates may be pre-manufactured or built by OSMP staff if greater security is needed.

Agriculture gates and emergency access gates will be a minimum of 12 feet in width to allow for easy access of large farming equipment or large emergency vehicles to access roads and OSMP properties.

Pedestrian and equestrian gates to trails will be a minimum of five feet in width to allow for easy access for pedestrians, bikers and equestrian riders.

Benches

All new benches will be Pilot Rock model #SWRB/CB-4FR (powder coated black) (phone #800-762-5002). Any older benches will be maintained until a replacement is needed. (Please see photos below). All new benches will be placed to ADA specifications found in USDA FSORAG. The foot print for the bench is 6 feet long x 2 feet wide. Benches will be installed with a minimum of four bags of 80 pound (two bags on each end) Quickcreeet and 1/2" rebar will be placed in the holes provided to ensure stability and prevent theft. When possible, a four foot square area will be left on one side of the bench to provide access for a wheel chair user. If a bench is badly damaged (from vandalism or sun damage) all boards will be replaced to make sure all boards are consistent in color.

Grills

Grill will be replaced as need in the OSMP system (phone #800-762-5002).

Campgrounds

No new campgrounds will be installed on OSMP property. Fourth of July Campground improvements will comply with trailhead facility standards.

ADA access to facilities

OSMP will provide ADA access to all amenities for Class 3, 4 and 5 trailheads. All amenities will be placed to ADA specifications found in USDA FSORAG.

Parking Area Signs

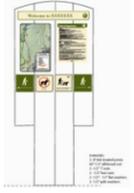
Sign type	Size	Materials	Hardware	Photograph	Notes	TH Class
No Parking	12"x18"	Reflective vinyl on aluminum. All signs mounted on 6x6 pressure treated posts.	¼"x3" Hex head lag screws, flat washers		Posts should be either 6' or 8' tall depending on whether 1 or 2 signs are displayed. Hours will vary at some areas.	A1-A3 T1-T3 R1, R2
ADA Parking	12"x18"	Reflective vinyl on aluminum. All signs mounted on 6x6 pressure treated posts.	¼"x3" Hex head lag screws, flat washers		1 ADA space should be provided for each 25 parking spaces at areas where ADA amenities are provided.	T1-T3
Dogs Must Be Leashed in Parking Area	12"x18" and 18"x24"	Digitally printed vinyl on aluminum. All signs mounted on 6x6 pressure treated posts.	¼"x3" Hex head lag screws, flat washers		Posts should be either 6' or 8' tall depending on whether 1 or 2 signs are displayed. 18"x24" signs at parking area entrances. 12"x18" at parking area perimeters.	T1-T3
Various Other Traffic Signs as Determined by Area						

All posts treated with Behr Premium semi-transparent stain. Color: "Coffee"

Visitor Information Kiosks

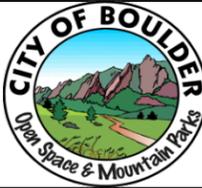
Structure type	Size	Materials	Signs displayed	Photograph	Notes	TH Class
Visitor Information Kiosk #1	72"x51" total board. 42"x45" display grid. 19"x45" bulletin cabinet. Arched roof is 140"x 62". Minimum height to bottom of arch is 80" from grade.	Powder coated steel structure. Skatelite roof. Signs mounted to 1" powdered coated steel grid. Bulletin cabinet, cork display with locking polycarbonate door. 6x6" Douglas Fir posts as visual accents.	5"x39" Welcome Banner. 22"x24" landscape oriented map. 9"x12" rules & regulations 4x4" regulation icons.		Posts treated with Olympic sealant #57504 Redwood natural tone. All signs mounted to 3/4" MDO blocks, with 1/4" T nut inserts painted flat black. Blocks mounted to screen with tamper resistant 1/4x20 stainless screws and 2"flat washers.	T3
Visitor Information Kiosk #2	48"x36" total board. 44"x32" display grid. 63" post to post width. 90" Arched roof width. Minimum height to bottom of arch is 80" from grade.	Powder coated steel structure. Signs mounted to 1" powdered coated steel grid. Square steel collars slide onto 6"x6" Douglas Fir posts.	5"x39" Welcome Banner. 11"x17" landscape oriented map. 9"x12" rules & regulations 4x4" regulation icons.		Posts treated with Olympic sealant #57504 Redwood natural tone. All signs mounted to 3/4" MDO blocks, with 1/4" T nut inserts painted flat black. Blocks mounted to screen with tamper resistant 1/4x20 stainless screws and 2"flat washers.	T2
Visitor Information Kiosk #3	48"x36" total board. 44"x32" display grid. 63" post to post width.	Powder coated steel structure. Signs mounted to 1" powdered coated steel grid. Square steel collars slide onto 6"x6" Douglas Fir posts.	5"x39" Welcome Banner. 11"x17" landscape oriented map. 9"x12" rules & regulations 4x4" regulation icons.		Posts treated with Olympic sealant #57504 Redwood natural tone. All signs mounted to 3/4" MDO blocks, with 1/4" T nut inserts painted flat black. Blocks mounted to screen with tamper resistant 1/4x20 stainless screws and 2"flat washers.	T1
Interpretive Kiosk Module	48"x36" total board. 44"x32" display grid. 63" post to post width.	Powder coated steel structure. Signs mounted to 1" powdered coated steel grid. Square steel collars slide onto 6"x6" Douglas Fir posts.	Interpretive display panels, size and number may vary. May be joined with multiple units to create an interpretive center.		Posts treated with Olympic sealant #57504 Redwood natural tone. All signs mounted to 3/4" MDO blocks, with 1/4" T nut inserts painted flat black. Blocks mounted to screen with tamper resistant 1/4x20 stainless screws and 2"flat washers.	T1 - T3

Trailhead Sign Structures

Structure type	Size	Materials	Hardware	Signs displayed	Photograph	Notes	TH Class
Trailhead Identification	36"x 64"	High density foam backed with 1/2" MDO sign grade, plywood. Mounted to 6x6 x 12' - 16' pressure treated posts	2"x 1/4" steel angle 1/2" x 5" hex head lag screws, 1/2"x 1" hex head lag screws	Highway trailhead name sign.		Post length will vary depending on location and should be set 3' deep in concrete. Two perpendicular 1" holes should be drilled through posts within 1' of ground for break-away safety.	T1 - T3
Quad-wide Post	24"x 96" (66-68" above ground)	4x6x8' pressure treated	1/2" all-thread rod, 1/2" T nuts, 1/2" hex nuts, 1/2' flat washers	Trailhead/trail name sign. May also display regulatory information and map. May have an acrylic covered holder for temporary information.		Top is cut on a 40" rad. arch	A1-A3 T1-T3 R1, R2
Double-wide Post	11"x 96" (66-68" above ground)	4x6x8' pressure treated	1/2" all-thread rod, 1/2" T nuts, 1/2" hex nuts, 1/2' flat washers	Trailhead/trail name sign. May also display regulatory information. May have an acrylic covered holder for temporary information.		Post tops cut at 15 degree angle to make "pitched roof".	A1-A3 T1-T3 R1, R2
Dog Station	14-15"x 96" (66-68" above ground)	4x4x8' pressure treated	1/2" all-thread rod, 1/2" T nuts, 1/2" hex nuts, 1/2' flat washers	Dog Station banner, dog regulation signs appropriate to area, brochure box mounted to post for dog regulation brochures and bag tube. May have an acrylic covered holder for temporary information and/or map.		Requires three 8' posts. Post tops cut at 15 degree angle to make "pitched roof".	A1-A3 T1-T3 R1, R2
Wayfinding/Regulatory Sign Post	5.5"x 96" (54" above ground)	6x6x8' pressure treated	N/A	May contain a combination of 5.5"x 5.5" wayfinding and/or regulatory signs.		Top cut at 15 degree angle, 4 sides to make "hip roof",	A1-A3 T1-T3 R1, R2

All posts treated with Behr Premium semi-transparent stain. Color: "Coffee"

R-Appendix O: Trail Design and Management Guidelines Matrix

Trail Design and 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	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
Class 0	Example:													
	Climbing Access	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 Trail Management Objectives (TMOs) for the trail.

* Accessible is currently a separate Trail Class. If assessing/designing trails for accessibility, refer to current Agency trail accessibility guidance.

R- Literature Cited

Bowie, M. 2010. Boulder County Parks and Open Space 5-Year Visitor Study. Boulder County, Colorado.

Byers, B., J. Ebersole, and M. Hesse (consultants). 2000. Garden of the Gods. Restoration report implementation guide. Prepared by Rocky Mountain Field Institute for the Parks & Recreation Department, City of Colorado Springs, Colorado. Available from http://files.rmfi.org/gog_summary_web.pdf (accessed November 2011).

City of Boulder. 1997. North Boulder Valley Inventory Report. City of Boulder, Open Space Department, Boulder Colorado.

City of Boulder. 2005. Visitor Master Plan. City of Boulder, Open Space and Mountain Parks Department, Boulder, Colorado.

Clark, R., Stankey, G. 1979. The Recreation Opportunity Spectrum: A Framework for Planning, Management, and Research. General Technical Report PNW-98. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station; 1979.

Cottrell, S., Raadik, J. 2015. Open Space and Mountain Parks North Trail Study Area Visitation Study. Report for Boulder Open Space and Mountain Parks. Fort Collins, CO: Cottrell and Associates Environmental Consulting.

D'antonio, A. L. 2010. Recreation resource impacts in the Bear Lake Road corridor of Rocky Mountain National Park, Colorado, USA: An assessment of resource conditions and visitor perceptions. M. S. thesis, Utah State University, Logan, UT. Available from [http://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1813&context=etd&sei-redir=1#search="D'antonio+bear+lake"](http://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1813&context=etd&sei-redir=1#search=) (accessed April 2013)

Giolitto, M. 2012. City of Boulder Open Space and Mountain Parks Department 2010-2011 Visitor Survey Report. City of Boulder, Open Space and Mountain Parks Department, Boulder, Colorado.

Graefe, A. G., & Thapa, B. 2004. Conflict in natural resource recreation. In Manfredo, M.J., Vaske, J.J., Bruyere, B.L., Field, D.R. & Brown, P. (eds.), *Society and natural resources: A summary of knowledge* (209 - 224). Jefferson, Missouri: Modern Litho.

Hockett, K., Clark, A., Leung, Y., Marion, J. L., and L. Park. 2010. Deterring off-trail hiking in protected natural areas: Evaluating options with surveys and unobtrusive observation. Final Report. Virginia Polytechnic Institute and State University College of Natural Resources, Forestry/Recreation Resources Management. C&O Canal National Historical Park, Hagerstown, Maryland.

Jacob, G. R., Schreyer, R. 1980. Conflict in outdoor recreation: A theoretical perspective. *Journal of Leisure Research*, 12, 368-380.

Jefferson County Open Space Division. 2006. Jefferson County Open Space Division Management Report. Jefferson County, Colorado.

Leung, Y-F., Shaw, N., Johnson, K., and Duhaime, R. 2002. More than a database: Integrating GIS data with the Boston Harbor Islands visitor carrying capacity study. *The George Wright Forum*, 19:69-78.

Lezberg, A. 2015. Draft Monitoring protocol – System-wide Undesignated Trail Mapping on Open Space and Mountain Parks Lands. Unpublished document prepared for the City of Boulder Open Space and Mountain Parks Department. Boulder, Colorado.

Marion, J. L., Leung, Y-F., and Nepal, S. K. 2006. Monitoring trail conditions: New methodological considerations. *The George Wright Forum*, 23:36-49.

Marion, J. L., Wimpey, J., and Park, L. 2011. Informal and formal trail monitoring protocols and baseline conditions: Acadia National Park. NPS Final Research report. U.S. Department of the Interior, National Park Service. Blacksburg, VA: Virginia Tech, College of Natural Resources.

McCool, S., Clark, R., Stankey, G. 2007. An Assessment of Frameworks Useful for Public Land Recreation Planning. Gen. Tech. Rep. PNW-GTR-705. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 125 p.

Minnesota Department of Natural Resources, Trails and Waterways. (2006). Trail Planning, Design, and Development Criteria. Minnesota: Brauer & Associated, Ltd.

Monz, C., and Y-F. Leung, 2006. Meaningful measures: Developing indicators of visitor impact in the National Park Service Inventory and Monitoring Program. *The George Wright Forum* 23:17-28.

National Park Service. 2008. Field monitoring guide. User capacity management monitoring program. Yosemite National Park. U. S. Department of the Interior, National Park Service, Yosemite, California.

National Park Service. 2010. Visitor use and impacts monitoring. Yosemite National Park. U. S. Department of the Interior, National Park Service, Yosemite, California.

Park, L. O., J. L. Marion, R. E. Manning, S. R. Lawson, and C. Jacobi. 2008. Managing visitor impacts in parks: A multi-method study of the effectiveness of alternative management practices. *Journal of Parks and Recreation Administration* 26: 97-121.

Stankey, George H.; Cole, David N.; Lucas, Robert C.; Petersen, Margaret E.; Frissell, Sidney S. 1985. The Limits of Acceptable Change (LAC) System for Wilderness

Planning. Gen. Tech. Rep. INT-176. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 37p.

Turner, R, and LaPage, W. 2002. Visitor behavior and resource impacts at Cadillac Mountain, Acadia National Park. In: Todd, S. (Comp. Ed.) Proceedings of the 2001 Northeastern Recreation Research Symposium. (Gen. Tech. Rep. NE-289). Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. Available from <http://www.treesearch.fs.fed.us/pubs/17371> (accessed April 2013).

U.S. Department of the Interior, National Park Service. 1997. VERP: A summary of the Visitor Experience and Resource Protection (VERP) framework. Denver, CO. 103 p.

VanderWoude, D. 2015. Draft monitoring protocol - 2010-2011 OSMP Visitor Survey. Unpublished document prepared for the City of Boulder Open Space and Mountain Parks Department. Boulder, Colorado.

VanderWoude, D. and Bitume, E. 2015. Voice and Sight Tag Program and Leash Regulations on Open Space and Mountain Parks Lands DRAFT Monitoring Report. The City of Boulder, Department of Open Space and Mountain Parks. Boulder, Colorado.

Vaske, J. J., Shelby, L. B., & Donnelly, M. P. 2009. Estimating visitation to Boulder Open Space and Mountain Parks. (HDNRU Report No. 80). Report for Boulder Open Space and Mountain Parks. Fort Collins: Colorado State University, Human Dimensions of Natural Resources.

Wimpey, J., & Marion, J. L. 2011. A spatial exploration of informal trail networks within Great Falls Park, VA. *Journal of Environmental Management*, 92: 1012-1022.

Zeller, M., Zinn, H. and Manfredo, M. 1993. Boulder Open Space Visitation Study. City of Boulder Open Space Department, Boulder, Colorado.

Natural Resources Appendices

N-Appendix A: Wildlife Resources

Habitat Suitability Indices

All of the habitat suitability indices (HSI) were built using existing, system-wide GIS data. Datasets used include vegetation mapping, stream data, digital elevation models and existing trails infrastructure. Each model was run in two phases. The first identified all highly 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 such as vegetation characteristics, slope, aspect and size of habitat patch.

The second phase of modeling attempted to account for impacts to wildlife and habitat related to visitor access and activity by providing 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 the ecology and behavior of similar species.

The products of the habitat suitability models are intended to be just one tool for making management decisions. 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 in finding a balance between visitor access and natural resource protection.

Grassland-dependent Butterflies

Three species of grassland-dependent butterflies were chosen as the indicator species group for the Xeric Tallgrass Prairie Conservation Target because of their specific, but similar, habitat needs.

All three species depend on big bluestem, little bluestem or side-oats grama to complete their lifecycle. Female skippers will lay eggs on these grasses and the grasses serve as larval host plants. Therefore, vegetation containing big bluestem, little bluestem or sideoats grama scored higher in the habitat suitability index than other vegetation classes in the North TSA. Further, scoring within bluestem-containing vegetation associations was scaled based on whether bluestem was a major or minor component.

In terms of topography and habitats, skippers use hillsides and ridgetops to display and riparian areas to feed on plant nectar and obtain water (i.e., puddling). Further, research in the North TSA indicates that butterflies use riparian areas disproportionately to their availability. As such, these areas were scored higher in the HSI than other habitat types.

Little information exists on optimal habitat patch size for these species. However, research suggests that larger patches allow for better resiliency against large-scale fires and weed infestations as well as provide adults sufficient enough habitat to breed successfully (Selby 2005, Swengel and Swengel 2007). Staff combined adjacent primary and secondary bluestem

vegetation associations and assessed the distribution of patch sizes to score this variable. Because 90 percent of the skipper detections were in grassland habitat patches larger than two acres, staff used this as a minimum patch size to create Highly Suitable Habitat before and after trail impacts were included. These inputs created Highly Suitable Habitat without Trail Effect (**Map N17**).

Research suggests that recreational trails are avenues for weed infestations, and that, if left unmanaged, colonization by weeds can completely change the composition and structure of vegetation within a habitat (Cole 1978, Benninger-Truax 1992, Pineda and Ellingson 1998, Jordan 2000, Sovell 2014). Because of the dependent relationship between this group of skippers and their larval host plants, a 25 meter buffer was removed from highly suitable habitat adjacent to all designated and undesignated trails in the North TSA to create Highly Suitable Habitat with Trail Effect (**Map N18**).

Finally, although this did not occur in this model, trails and their associated impact zones (i.e., buffers) would split highly suitable habitat into separate patches.

Table NA1. Habitat suitability index inputs for grassland (bluestem)-dependent butterflies.

Variable	Attributes	Ranks	Weight
Vegetation	Vegetation associations with primary bluestem component	9	4
	Vegetation associations with secondary bluestem component	4	4
	Vegetation associations with tertiary bluestem component	2	4
	Other grassland vegetations associations/alliances	3	1
Habitat Modifier	2014 Prairie Dog Colonies	0	0
Topography of Habitat	Elevational Gradient	Valley = 2 Ridgetop = 5 Lower Slope = 7 Riparian = 7 Upper Slope = 9	1 (except Riparian:2x)
Patch Size	Habitat block size of rare skipper observations (acres)	>11 = 9 7-11 = 7 <7 = 5	1
Minimum Patch Size (applied before and after trail effects modeling)			
Only patches ≥ 2 acres remain highly suitable			
Trail Impacts			
Remove 25 meters of each side of roads, designated trails and undesignated trails Trails that completely bisect a habitat block will split patches			

Prairie Rattlesnake

OSMP staff has consistently observed prairie rattlesnakes, sometimes in groups of six or more, on the grasslands adjacent to Hwy 36 north of Boulder. Because the TSA process involves improving visitor experience, OSMP staff chose prairie rattlesnakes as an indicator species for the Mixed-grass Prairie Mosaic Conservation Target, and one which required further study to effectively manage important rattlesnake habitat and increase visitor safety. Staff incorporated information from a two year study on snake distribution and abundance in the North TSA (Vernalis 2015) to rank vegetation communities and ultimately identify a variety of important habitats (foraging, sunning and over-wintering). This study included the use of radio telemetry on prairie rattlesnakes, which allowed staff to assess rattlesnake habitat use and locate hibernacula of over-wintering rattlesnakes (See snake summary in Wildlife Monitoring Summaries section).

Although prairie rattlesnakes use almost all grassland habitats for foraging, prairie dog colonies are of particular importance as a food source and protection from extreme weather. Exposed rocks and cliffs provide opportunities for cold-blooded organisms to obtain warmth and increase their metabolic rate. Slope aspect also contributes to an increase in available sunlight and heat. Telemetry provided unique insight into habitat preferences of rattlesnakes in the study area. For instance, shrublands accounted for 23 percent of the observations of marked snakes, but the habitat only comprises 11 percent of the study area. Similarly, although prairie dog colonies covered 26 percent of the study area, they averaged 38 percent of the spatial home ranges of marked rattlesnakes (See snake summary in Wildlife Monitoring Summaries section). Habitat scoring in the habitat suitability index reflects these habitat preferences.

The minimum patch size was calculated by integrating the mean home range of radio-marked snakes in the North TSA snake study and identification of important habitat patches by staff. These inputs were used to create the Prairie Rattlesnake Highly Suitable Habitat Without Trail Effect (**Map N14**).

In recognition of the role roads and development play in blocking snake movement across the landscape and the potential for human and dog visitors to modify snake movement and behavior, 25 meters of habitat was removed adjacent to all trails and roads in the with trail effect models. The results of this are shown in the Prairie Rattlesnake Highly Suitable Habitat With Trail Effects (**Map N15**). Below are the complete inputs for the model.

Table NA2. Habitat suitability index inputs for prairie rattlesnake.

Variable	Attribute	Ranks	Weight
Vegetation	Exposed rock or sparse vegetation alliances	9	2
	25 meter buffer around these alliances	5	2
	Choke Cherry Shrubland Alliance (A.919) , Skunkbush shrub savannah herbaceous alliance (A.1537), Wax current shrubland alliance (A.923)	9	2
	Slope within this group slope (%)	30-80 = 5 0-29 or 80-100 = 1	1
	Western Wheatgrass Herbaceous Alliance	9	2
	Shrubland and grassland vegetation alliances with high-	7	2

	use rattlesnake habitat		
	Shrubland and grassland vegetation alliances with moderate-use rattlesnake habitat	5	2
	Shrubland and grassland vegetation alliances with low-use rattlesnake habitat	3	2
	Other vegetation alliances in grassland conservation targets	3	1
Habitat modifier	2014 Prairie dog colonies	9	3
Habitat use	Hibernacula locations	9	3
Topography	Aspect (degrees)	135-225 = 9 45-134.9 = 7 225.1-315 = 5 0-44.9 & 315- 360) = 1	1
Minimum Patch Size (applied before and after trail effects modeling)			
Only patches > 3 acres remain highly suitable			
Trail Impacts			
Remove 25 meters of each side of roads, designated trails and undesignated trails Trails that completely bisect a habitat block will split patches			

Lark Sparrow

The grassland portions of the North TSA provide habitat for a diverse mix of wildlife species. Although lark sparrows are just one of the many bird and animal species that use this area, they were selected as a focal species for the North TSA because of their abundance in these grassland habitats and association with shale communities (Hair et al. 2000).

Highly suitable lark sparrow habitat in the North TSA represents areas dominated by mixed grass vegetation types, often with shale communities or a shrub/yucca component. Two main components that are required for lark sparrows to nest are a variety of vegetation heights and open views (Kingery 1998). Within these habitats, both low to moderate density herbs and grasses and scattered woody vegetation are required. Lark sparrows nest on the ground, often at the base of bunchgrass, cactus, or shrubs, or up to 3 meters high in a tree (Kingery 1998). This makes their nests susceptible to disturbance by off-trail human and dog use.

Grassland vegetation alliances with a mostly native grass component including those associated with shrub communities and with other woody vegetation present were included in the model. Non-native, or semi-native vegetative alliances within the grassland were included, but scored lower than native vegetation types because previous studies have found lark sparrows to be much more abundant on native grass than non-native grass sites (Knopf 1994, Flanders et al. 2006). Areas of current (2014 mapping) prairie dog occupation was included as a negative habitat modifier because successful lark sparrow nests have been found to be located in areas with less bare ground and more litter cover, both of which are not typical of occupied prairie dog areas (Lusk 2003).

Larger patches of habitat were given a higher rank because of their increased ability to support breeding grassland birds. In addition, a minimum patch size of 10 hectares (~25 acres) was applied to this model to account for territory requirements and the areas sensitive nature of many ground nesting grassland bird species. Results are shown in the lark sparrow Highly Suitable Habitat Without Trail Effects (**Map N12**).

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 more abundant in interior grasslands than those near development.

Because of this, recreational trails were buffered up to 300 feet, and habitat quality was scored higher with increasing distance from the trail. Human development was buffered up to 600 feet and scored using similar methods. These results can be seen in **Map N13**.

Table NA3. Habitat suitability index inputs for lark sparrow.

Variable	Attribute	Ranks	Weight
Vegetation	Native grassland habitats, including those with yucca or other shrub components and shale communities	9	3
	Semi-native or non-native grassland habitats	4	3
Habitat Modifier	2014 Prairie dog colonies	0.5 multiplier	1
Patch Size	Acres of contiguous preferred vegetation	0-2 = 1 2-8 = 3 8-30 = 5 30-100 = 7 100-1283 = 9	1
Minimum Patch Size (applied before and after trail effects modeling)			
Only patches > 24.7 acres (10 hectares) remain highly suitable			
Trail and Road Impacts			
Habitat Edges	Distance (feet) from urban edges and roads	0-100 = -8 100-200 = -6 200-300 = -3 300-600 = -1	1
Trail Effects	Distance (feet) from designated and undesignated trails	0-150 = -6 150-300 = -3	1

Lazuli Bunting

This model accounts for a suite of bird species that depend on the shrub cover provided by the vegetation communities within the upland shrublands and wetland and riparian targets. Species like lazuli bunting, gray catbirds, blue-gray gnatcatchers, yellow-breasted chats, black-headed grosbeaks and blue grosbeaks are all species that depend on riparian and upland 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 includes areas dominated by upland or riparian shrubland vegetation. Lazuli buntings are associated with shrublands between 5,500-7,000 feet and riparian areas that intersect the transitional area from the plains that provide a diversity of shrub and tree species and vegetative structure (Andrews and Righter 1992, Kingery 1998). Within these areas, lazuli buntings show no affinity to specific shrubland habitat and use a variety of different shrubland alliances within the transitional zone (Berry and Bock 1998, Kingery 1998). As a result, all vegetation alliances with high shrub components were included in the model as the base habitat layer. 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 25 meters of a stream were ranked higher than those beyond 25 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. Because the model in intended to call out nesting habitat, a lower size threshold for highly suitable habitat was set at three acres based on the minimum territory size for a pair of lazuli buntings (Greene et al. 2014). The results from this analysis are displayed in the map Lazuli Bunting Highly Suitable Habitat without trail effect (**Map N23**)

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. In addition, within riparian areas, species such as lazuli buntings may avoid riparian areas with high levels of recreational activity that favor human-adapted species such as corvids (Blakesly and Reese 1988, Miller et al. 2003). 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 meter area adjacent to trails where bird densities showed a decrease in the Miller (1998) 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. **Map N24** displays the results of this analysis.

Table NA4. Habitat suitability index inputs for lazuli bunting.

Variable	Attribute	Ranks	Weight
Vegetation	Shrubland alliances, both upland and riparian	48-85 ac= 9 24-48 ac = 6 12-24 ac = 3 3-12 ac = 1	1
	Riparian corridor habitat blocks ≥ 3 acres and ≤ 25 meters from a perennial or intermittent stream	5	1
Minimum Patch Size (applied before and after trail effects modeling)			
Only patches > 3 acres remain highly suitable			

Trail and Road Impacts
Remove 20 feet + 50 meters on each side of Voice and Sight designated trails
Remove 50 meters on each side of all other trails and roads

N-Appendix A: Wildlife Monitoring Summaries

This section summarizes all of the wildlife monitoring projects and surveys either conducted by OSMP staff or contractors in the North TSA. OSMP wildlife staff surveys songbirds nesting in native grasslands and in irrigated hayfields, amphibians, bats, raptors, prairie dogs and waterfowl. OSMP staff has also assisted Colorado Parks and Wildlife during fish surveys, and has recently partnered with CNHP to assess butterfly abundance and distribution and with Vernalis, Inc. to learn more about snake ecology in the North TSA.

Snake Distribution and Abundance and Prairie Rattlesnake Telemetry in the North Boulder Grasslands

Background and Methods

The OSMP-managed lands directly north of Boulder contain high-quality habitat for snakes as the grasslands and associated prairie dog colonies provide shelter and food while the hogbacks and exposed rocks, intermingled with shrub patches create ideal hibernacula locations (OSMP 1996). To learn more about snake distribution and abundance and identify important snake habitats in the North Boulder Grasslands (NBG), OSMP partnered with Vernalis, Inc., a non-profit organization specializing in studying herpetiles, to conduct snake surveys and attach radio transmitters to prairie rattlesnakes.

In years past, OSMP staff has consistently observed prairie rattlesnakes, sometimes in groups of six or more, on the grasslands adjacent to Hwy 36 north of Boulder. Because the TSA process involves improving visitor experience, OSMP staff chose prairie rattlesnakes as a focal conservation species and one which required further study to effectively manage important rattlesnake habitat and increase visitor safety. Although observations of snakes is useful for planning purposes, the use of radio telemetry allowed staff to learn more about rattlesnake habitat use and locate hibernacula of over-wintering rattlesnakes.

From 2012-2014, OSMP staff assisted Vernalis with snake surveys on the properties north of Boulder along both sides of Hwy 36, although greater time was spent surveying the properties west of the highway. Visual encounter surveys were employed to detect snakes. When snakes were encountered, they were captured and marked so as to avoid counting the same individual in subsequent surveys. In 2013 and 2014, Vernalis attached radio transmitters with a 10 week lifespan (model HB-2, Holohil, Inc.) to the dorsa of a subset of prairie rattlesnakes using carpet tape, then a layer of camouflaged duct tape. Although snakes will lose the transmitter when they shed, staff chose this method of attachment over surgical implantation to minimize disturbance to the individual. OSMP staff obtained visuals of each marked snake every two to five days.

Staff created minimum convex polygons (MCP) for each tracked rattlesnake to represent individual home ranges. OSMP's vegetation map was then used to characterize habitat within

each MCP. The “study area” was created using a 95 percent kernel estimator around all snake observations in the NBG.

Results and Discussion

Snake Detections: Six species were detected on the NBG—prairie rattlesnake, milk snake, plains black-headed snake, wandering garter snake, eastern racer and bullsnake. Prairie rattlesnakes were most numerous, whereas bullsnake and garter snake were rarely observed (Vernalis 2015, **Table NA5, Map N10**). Almost 90 percent of prairie rattlesnake (n=60) and plains black-headed snake (n=16) detections occurred in grassland habitat types (**Table NA5**), a value equal to the proportion of grassland habitats in the study area (89 percent).

Unlike other snake species, about half of the prairie rattlesnake detections in grassland habitat types occurred in prairie dog colonies, suggesting that prairie dog colonies provide important habitat for rattlesnakes. Further, although the western wheatgrass herbaceous alliance constituted 57 percent of the study area, more than $\frac{3}{4}$ of all prairie rattlesnakes and 70 percent of all eastern racers were detected here, suggesting that this grassland habitat type may also be important for snakes in the NBG.

Within the study area, prairie rattlesnakes exhibited a clumped spatial distribution significantly different from random (Vernalis 2015). Plains black-headed snakes; however, exhibited a highly clumped distribution, with most individuals located at mid-elevations in rocky areas on the southeast-facing sides of the hogbacks (**Figure NA1**, Vernalis 2015). It is unclear whether the observed close proximity between individual plains black-headed snakes is communalism or preference for a limited habitat type.

Records for plains black-headed snake in Colorado are relatively few, and the species distribution in Boulder County is thought to be limited (Vernalis 2015). Because of the species clustered distribution in two separate areas on the slopes of the hogbacks on the study site (**Figure NA1**), habitat protective measures should be taken to avoid disturbing natural surface objects (primarily rocks at these two areas). All detections of plains black-headed snakes were beneath rocks. Rocks serve as critical refugia during the warmer months when this species is surface active and the primary prey of plains black-headed snakes (centipedes and other crawling insects) are most plentiful beneath rocks (Vernalis 2015). Although plains black-headed snakes were not located near intermittent creeks on the NBG, the close proximity of individuals to these areas and the species reliance on moist microhabitats suggests protection of intermittent creeks and rock outcroppings is warranted (Vernalis 2015).

Prairie Rattlesnake Radio Telemetry (OSMP unpublished data): In 2013-2014, 15 prairie rattlesnakes were outfitted with radio transmitters. Transmitters remained on each snake for an average of 46.8 ± 6.4 days (range: 7-119 days) and each snake was observed 10.6 ± 1.4 times (range: 2-24). Average daily movement was $41.5 \text{ meters} \pm 9.4$ (range: 4.5-147 meters). One snake moved at least 399 meters in two days, and one traveled at least 133 meters and gained 70 meters in elevation in two days across an intermittent stream en route to an over-wintering site (**Map N11**). These observations suggest that rattlesnakes can move relatively long distances in a short time frame. On average, marked rattlesnakes travelled 124 ± 38.8 meters from initial

capture location, and averaged 529.9 ± 142.4 meters in total distance travelled (range: 9-2218 meters) further reinforcing that some rattlesnakes move substantial distances. Although eight rattlesnake home ranges were < 1 acre, four of which were < 0.2 acres, one was as large as 23.6 acres (mean: 4.3 [1.6] acres). Prairie rattlesnake home ranges in this study were substantially smaller than that documented for the same species in Arapahoe County, Colorado (mean: 38 acres; Shipley et al. 2013).

In terms of habitat use, 23 percent (n=44) of the observations of marked snakes were in shrublands (**Table NA6**). This suggests that opportunistic sightings of snakes in shrublands using visual encounter techniques was difficult (because only 10 percent of rattlesnake detections using this method occurred in shrublands) and that rattlesnakes are using this habitat type disproportionately to its availability in the study area (shrublands comprise 11 percent of the study area).

More than half of observations of marked rattlesnakes were in the western wheatgrass herbaceous alliance (**Table NA6**), and this grassland type constituted, on average, 62 percent of the snakes' home ranges. This was to be expected; however, as this alliance covered 58 percent of the study area (**Table NA5**). Although prairie dog colonies covered 26 percent of the study area, they represented 38 percent of the home ranges of marked rattlesnakes, suggesting that prairie dog colonies provide important habitat to rattlesnakes in the study area.

Seven rattlesnake hibernacula were identified during this study—two were located in the choke cherry shrubland alliance, four in the western wheatgrass herbaceous alliance, and one in the smooth brome/western wheatgrass herbaceous alliance (**Map N10**). Rattlesnakes were using prairie dog burrows as over-wintering sites in all five of the grassland locations, and two of these sites supported more than one prairie rattlesnake. This observation supports the findings of Shipley et al. (2013)—prairie rattlesnakes are strongly attracted to prairie dog burrows and favor the shorter sparser vegetation characteristics of prairie dog colonies.

Telemetry provided unique insight into habitat preferences of rattlesnakes in the study area. The information gleaned from this study highlights the importance of shrublands and prairie dog colonies in providing key habitat for rattlesnakes. Potential management actions involving protecting shrublands and prairie dog colonies should be considered to conserve this resource and maintain visitor safety in the North TSA.

Plains Black-headed Snake Core Areas

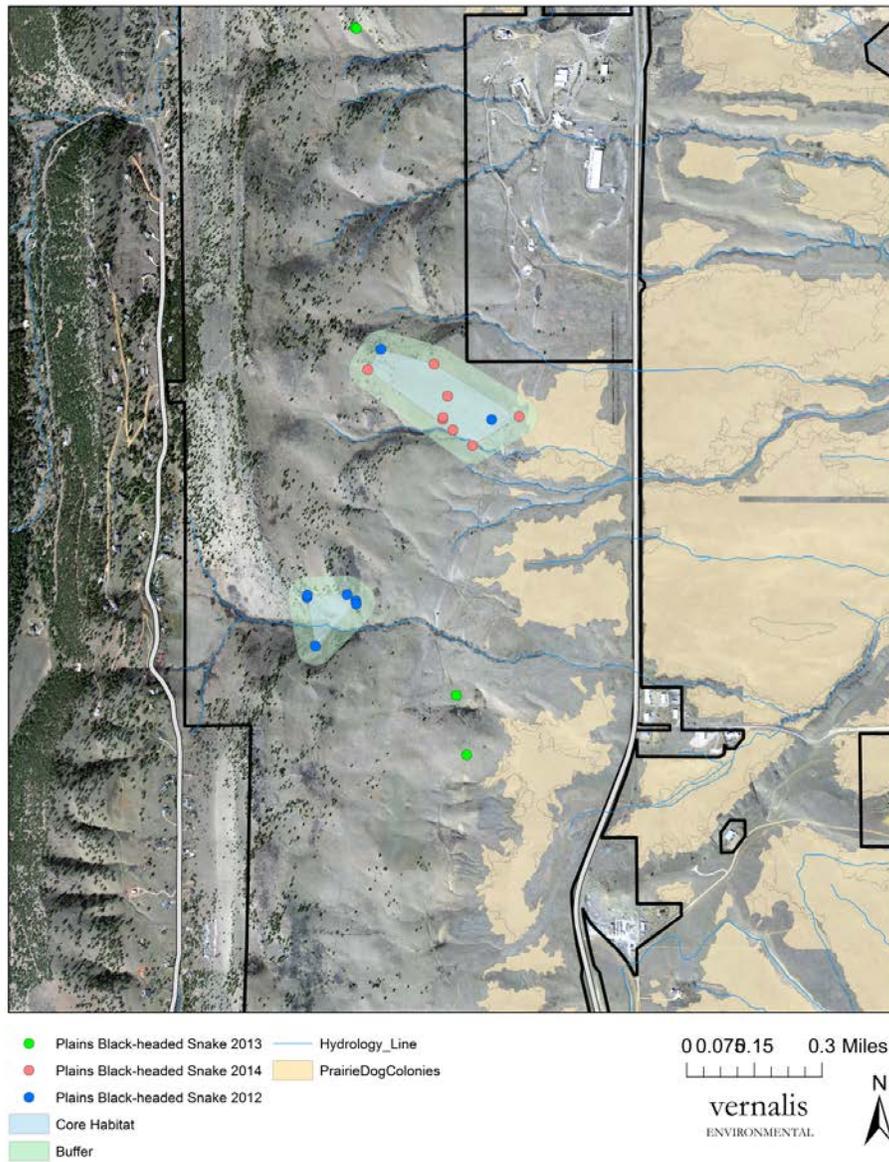


Figure NA1. Plains black-headed snake core areas as identified by clumped observations of the species in the North Boulder Grasslands.

Table NA5. Vegetation classes contained in the study area and snake observations (2012-2014) by OSMP staff and Vernalis, Inc.

	Western Wheatgrass	Intermediate Wheatgrass	Big Bluestem - (Yellow Indiangrass)	Needle and Thread-Blue Grama	New Mexico Needlegrass	Smooth Brome Semi-Natural	Ponderosa Pine Tallgrass Savannah	Baltic Rush Seasonally Flooded	Mountain-Mahogany	Choke Cherry	Netleaf Hackberry	Soapweed Yucca Evergreen	Skunkbrush Shrub Savannah	Shale Barrens	
Acres in Study Area	137	13	24	10.5	7.5	10.0	1.4	0.2	2.0	10.9	0.9	*	2.2	*	
% of Study Area	58	5.6	10.1	4.4	3.1	4.2	0.6	0.1	0.9	4.6	0.4	-	0.9	-	
															Total #
Prairie rattlesnake	47	-	4	2	1	1	1	1	2	4	1	2	-	2	68
Eastern racer	17	-	2	2	-	-	-	-	-	2	-	-	1	-	24
Plains black-headed snake	11	-	4	1	1	-	-	-	1	-	-	-	1	-	19
Bullsnake	1	1	-	-	-	-	-	-	-	-	-	-	-	-	2
Milk snake	1	-	1	-	-	-	-	-	-	-	-	-	-	-	2

*Some habitat types where snakes were detected fell outside of the Study Area, but were still included in this table

Table NA6. Observations of marked prairie rattlesnakes by vegetation type in the North Boulder Grasslands in 2013-2014.

Level	Count	%
Big Bluestem - (Yellow Indiangrass) Herbaceous Alliance	7	3.7
Choke Cherry Shrubland Alliance	27	14.4
Crested Wheatgrass Semi-Natural Herbaceous Alliance	5	2.7
Indian Ricegrass Herbaceous Alliance	1	0.5
Intermediate Wheatgrass Semi-natural Herbaceous Alliance	6	3.2
Needle-and-Thread - Blue Grama Herbaceous Alliance	11	5.9
New Mexico Needlegrass Herbaceous Alliance	4	2.1
Peachleaf Willow Temporarily Flooded Woodland Alliance	4	2.1
Skunkbush Intermittently Flooded Shrubland Alliance	11	6.0
Skunkbush Shrub Savannah Herbaceous Alliance	2	1.1
Smooth Brome Semi-Natural Herbaceous Alliance	4	2.1
Western Wheatgrass Herbaceous Alliance	106	56.4
Total	188	

Raptor Monitoring

Background and Methods

The North TSA provides nesting habitat for four species of raptors—golden eagles, osprey, Northern harriers and burrowing owls (**Map N25**). All raptors are protected under the Migratory Bird Treaty Act. Golden eagles are also afforded additional protection under the Federal Bald and Golden Eagle Protection Act. Burrowing owls and golden eagles are considered threatened in Colorado. Burrowing owls and Northern harriers are considered sensitive by the US Forest Service and BLM. The Boulder County Comprehensive Plan also designates all of these species as species of special concern. To minimize human-caused disturbance to nesting pairs and manage for a protective buffer around occupied nest sites, OSMP institutes seasonal closures surrounding nest sites. Instituting these protective measures at nesting sites as well as managing for natural areas, which provide foraging opportunities for raptors, has helped OSMP provide high-quality nesting habitat for a wide variety of raptor species. Nest monitoring is conducted on a regular basis by staff and a dedicated team of volunteers. Closures are lifted early when monitoring indicates that raptors are no longer occupying the site.

Results and Discussion

Golden Eagle

The North TSA management area contains one golden eagle nesting territory—Lefthand Palisades. Occupancy of Lefthand Palisades by golden eagles was first described by Denis Gale in the 1880s and a handful of known nesting outcomes date as far back as 1904. The Lefthand territory was one of 10 Front Range golden eagle territories described by Jollie in his masters thesis, published in 1943. These sources suggest that the Lefthand Palisades has been consistently occupied by golden eagles for over 130 years.

Two metrics are commonly used to compare raptor population health among sites—nesting success (fledging at least one nestling) and productivity (number of fledglings produced). Nesting success by golden eagles at Lefthand Palisades was lower than that documented for golden eagles nesting elsewhere on OSMP (e.g. Skunk Canyon [91 percent] and Flagstaff [100 percent]), but higher than that reported by Kochert et al. (2002) for golden eagles nesting along the Snake River in Idaho (62 percent).

Golden eagle productivity at Lefthand Palisades was lower than at other sites on OSMP (Skunk: 1.4; Flagstaff: 1.2) and in Idaho (1.6), but still reached the biologically important threshold of 1.0 fledgling per nesting attempt similar to golden eagles studied in Alaska (McIntyre and Adams 1999).

Unfortunately, golden eagles nesting at the Lefthand Palisades have failed in their nesting attempts seven out of the last 10 years, although 2015 looks promising as the pair currently has one healthy fledging.

Osprey

Two artificial structures serve as osprey nesting substrates on OSMP property near Boulder Reservoir. Two additional poles are located on lands surrounding Boulder Reservoir managed by City of Boulder Parks and Recreation (PNR). Artificial nesting structures were established in the area to mitigate against osprey building nests on poles used by Xcel Energy to deliver electricity. According to Xcel, stick nests on poles which support “charged lines” are considered hazardous to the welfare of the birds, represent a potential fire hazard and could disrupt the delivery of electricity. Thus, alternate nesting substrates are provided nearby.

Osprey nesting success and productivity on OSMP has been low since the birds began nesting attempts. Osprey nesting attempts at Axelson North have not been successful since 2010 and only two of the last five nesting attempts (2010 thru 2014) at Axelson South have been successful. Comparatively, osprey nesting closer to the Reservoir on PNR property have been successful four of the last five years, and osprey nesting on other OSMP-managed properties and been successful at least three of the last four years. Causes of the comparatively low reproductive rate observed at Axelson are unknown.

Table NA7. Nest site information for osprey and golden eagles nesting in the North TSA.

Species	Site	1 st year of seasonal closure	First year of monitoring (total # yrs)	# of nesting attempts	Nesting Success*	Mean Productivity**
Golden Eagle	Lefthand Palisades	1992	1974 (41)	39	72% (n = 28)	0.97 ± 0.119
Osprey	Axelson North (AX1)	2006	2006 (9)	9	55% (n = 5)	0.89 ± 0.31
Osprey	Axelson South (AX2)	2005	2005 (10)	7	57% (n = 4)	1.71 ± 0.644

* Success in fledging at least one nestling

** Number of fledglings/nesting attempt

Northern Harriers

The North TSA contains all of the known Northern harrier nesting attempts on OSMP and three of the four known 2015 nesting attempts in Boulder County. Northern harriers require large, undisturbed blocks of wetland habitat to nest and grasslands for foraging. Because of this, they may be habitat-limited in Boulder County. In 2014, a pair of Northern harriers nested successfully (three nestlings fledged) on OSMP property near Nelson Road and 51st Street. In 2015, a new pair of Northern harriers attempted to nest west of BVR pond 1 on Boulder Valley Ranch (outcome currently unknown).

These recent additions to the Boulder County breeding population of Northern harriers is an encouraging development because the historical nesting site on property managed by PNR has only supported nesting attempts in five of the last 10 years and only two of these have been successful in fledging young. Further, the other known Northern harrier nesting attempt in

Boulder County in 2015 is on land managed by Boulder County Parks and Open Space. This site has not been occupied by harriers since 2010, and that year the nesting attempt failed.

It is clear that this species is a rare breeder in Boulder County and struggles to successfully nest here. It is possible that fragmentation of potential nesting habitat by roads, agriculture and other human activities limits Northern harrier nesting opportunities and nesting success in Boulder County (Jones 2014). Nests situated in smaller, fragmented marshes may be more susceptible to predation by carnivores and raptors (Smith et. al. 2011). Jones (2014) reports that volunteers monitoring the nesting pair on PNR property have consistently observed coyotes accessing the harrier nesting site west of the reservoir and harriers defending territories from red-tailed hawks.

Amphibian Monitoring

Background and Methods

Since 2006, OSMP staff has employed Visual Encounter Survey (VES) methods to survey for amphibians. The focal species of interest is the northern leopard frog—a native species in marked population decline in the western US and considered a species of greatest conservation need in 21 states, including Colorado.

Threats to leopard frog populations are numerous and likely interact. They include: habitat loss and degradation, pesticide use, fungal pathogens, the spread of non-native species like predaceous fish and bullfrogs into otherwise suitable breeding habitats, changes in the hydrological regime and increased variability in temperature and precipitation.

Because leopard frogs compete with American bullfrogs for resources and are sometimes predated by this invasive species, bullfrogs have been linked to population declines of western ranid frogs. Therefore, understanding the distribution and abundance of bullfrogs on OSMP is essential. From 2006-2008, volunteers and staff worked together to conduct VES to survey for amphibians on OSMP wetlands. From 2009 to the present, VES has been conducted by OSMP staff only.

Results and Discussion

Of the 163 VES sites throughout OSMP, 51 are located in the North TSA (**Map N20**). Of these sites, 53 percent (n=27) supported non-native bullfrogs, 33 percent (n=17) supported native Woodhouse's toads, 14 percent (n=7) supported native western chorus frogs and only one site supported native tiger salamanders (**Table NA8**).

In 2008, a single northern leopard frog was detected at Bennett pond. Unfortunately, this individual was never actually observed by the surveyor (i.e., detection was auditory) and subsequent surveys did not detect a leopard frog at Bennett. Thus, the accurate identification of this individual is questionable and it is probable that northern leopard frogs are entirely absent from waters in the North TSA.

Staff detected native amphibians only in 16 percent (n=6) of the 37 North TSA VES sites that supported amphibians. This is similar to what was found system-wide during 2012 surveys, when 22 percent of VES sites supported native amphibians only. However, bullfrog site occupancy was substantially higher in the North TSA than was found systemwide in 2013, when 31 percent of VES sites supported bullfrogs.

In the mid 1990s, northern leopard frogs were detected at three locations in the North TSA—Mesa Reservoir, Axelson pond #1 and a pond on the Hart-Jones property. The most northern OSMP property that currently supports northern leopard frogs is Ertl, along Boulder Creek. Northern leopard frogs prefer natural landscapes (e.g., less habitat fragmentation and human development) with less agricultural pressure. Most sites supporting leopard frogs on OSMP are ephemeral ponds surrounded by native grasslands located in the south half of the system. It is probable that the pressure introduced by the presence of bullfrogs, increased habitat

fragmentation near wetlands, as well as the availability of permanent water sources which favor bullfrogs has affected the ability of leopard frogs to populate OSMP properties north of Boulder. However, restoration opportunities exist at some sites in the North TSA that would improve northern leopard frog habitat conditions. Managing water levels is key to disrupting bullfrog breeding cycles; therefore, only sites where this is possible would qualify as candidates for restoration.

Table NA8. Numbers of years that amphibians were detected at ponds in the North TSA. *AMTI* = Tiger Salamander; *BUWO* = Woodhouse's Toad; *PSTR* = Western Chorus Frog; *RACA* = American Bullfrog; *RAPI* = Northern Leopard Frog

Site Number	Site Description	Years sampled	Number of years surveyed	AMTI	BUWO	PSTR	RACA	RAPI
005	Wonderland Lake	2006, 2013-14	3	-	-	-	2	-
018	Beech Intermittent Creek	2008	1	-	-	-	-	-
021	Waldorf Pond	2008-09, 2013-14	4	-	-	-	1	-
022	Suitts Pond West	2008, 2012-13	3	-	-	-	2	-
023	Suitts Pond East	2008, 2012-13	3	-	2	-	2	-
024	Bennett Reservoir	2008-14	7	-	4	-	7	1
025	Bennett SW Pond	2008-10, 2012-14	6	-	3	1	2	-
029	Waldorf Irrigation Ditch	2008-09, 2013-2014	4	-	-	-	-	-
032	Stratton North Pond	2008-09, 2011, 2013-14	5	-	2	-	4	-
034	Stratton South Pond	2008-09, 2011, 2013-14	5	-	2	-	1	-
036	Axelsson Pond 2	2008, 2010, 2014	3	-	-	-	3	-
037	Axelsson Pond 3	2008, 2010, 2014	3	-	-	-	1	-

038	Axelson Pond 4	2008, 2010, 2014	3	-	1	-	2	-
040*	Ellison Pond	2008, 2010, 2014	3	-	1	-	-	-
042	Schneider Intermittent Creek	2008	1	-	-	-	-	-
043	BVR Pond 1	2008, 2013-14	3	-	-	2	2	-
045	BVR Pond 2	2008-09, 2013-14	4	-	2	1	2	-
047	Papini Pond 5	2008, 2012-14	4	-	-	-	-	-
048	Papini Pond 4	2008, 2012-14	4	-	-	-	1	-
049	Papini Pond 3	2008, 2012-14	4	-	-	-	1	-
051	Papini Pond 2	2008, 2012-14	4	-	-	-	1	-
052	Papini Pond 1	2008, 2012-14	4	-	-	-	-	-
053	BLIP II Pond 1	2011-14	4	-	-	-	-	-
054	BLIP II Pond 2	2008-14	7	-	1	-	7	-
055	BLIP II Pond 4	2008-09, 2013-14	4	-	-	-	3	-
056*	Seigle Pond	2008-09, 2013-14	4	1	3	-	-	-
057	BLIP II Pond 3	2008- 2009, 2011, 2013-14	5	-	-	-	4	-
058	Lousberg Pond 1	2008-09, 2012-14	5	-	-	-	5	-
059	Lousberg Pond 2	2008, 2012-14	4	-	-	2	2	-
060*	Papini Intermittent Stream 2	2008, 2013-14	3	-	-	1	-	-
061*	Papini Irrigation Ditch 1	2008, 2013	2	-	2	-	-	-
066	Mesa Reservoir	2006, 2008-09, 2011-14	7	-	4	1	5	-

072	Waldorf Creek	2008-09, 2013-14	4	-	-	-	-	-
075	Ryan Intermittent Creek	2008, 2013-14	3	-	-	-	-	-
076	Suits Intermittent Creek	2008, 2012-13	3	-	-	-	-	-
077	Suits Creek	2008, 2012-13	3	-	1	-	1	-
078	Steele Intermittent Creek 1	2008-09, 2012-13	4	-	-	-	-	-
079	Bennett Intermittent Creek 1	2008-09, 2014	3	-	1	-	1	-
081*	Steele Intermittent Creek 2	2008-09, 2014	3	-	1	-	-	-
082	Bennett Intermittent Creek 2	2008-09, 2014	3	-	-	1	1	-
083	Bennett Intermittent Creek 3	2008-09, 2013-14	4	-	-	-	-	-
084*	Steel Irrigation Ditch	2008-09, 2013-14	4	-	2	-	-	-
085	Johnson Irrigation Ditch	2008, 2013-14	3	-	-	-	-	-
086	Bruning Irrigation Ditch	2013-14	2	-	-	-	-	-
087	IMEL South – Left Hand Creek	2008-09, 2012	3	-	2	-	2	-
088	Stratton Irrigation Ditch	2011	1	-	-	-	-	-
135	Stratton NW Pond	2009, 2011-14	5	-	-	-	3	-

*only native species detected during surveys

Fish Surveys

Background and Methods

OSMP staff has historically assisted Colorado Parks and Wildlife (CPW) fish biologists in sampling ponds and creeks on OSMP to determine fish species distribution and abundance, identify important resources to sustain native fish populations, assess sport fish opportunities and direct aquatic habitat improvement projects.

Of particular interest to CPW is the conservation of Iowa darter, northern redbelly dace and plains topminnow—three native fish species considered by CPW to be of greatest conservation need (CPW 2014)—and continuing to provide high-quality sport fishing opportunities in Boulder County. Survey methods depended on the type of water, but included deploying seines and electrofishing using a boat or backpack.

To better inform CPW's fish management program on OSMP and to provide specific information to drive aquatic habitat restoration, OSMP staff collected bathymetric measurements at 20 ponds throughout the system in 2014 using a Hummingbird 386 fishfinder (Techsonic Industries, Inc. Eufaula, AL. USA) attached to a canoe. The area of each pond was covered in its entirety by paddling transects across the pond while the Hummingbird unit collected depth measurements and geographic coordinates.

Results and Discussion

In the North TSA, CPW sampled 31 sites from 1968-2013 (**Map N21**). Although northern redbelly dace and Iowa darter were not detected in the North TSA, CPW surveys identified five ponds on three properties in the North TSA that supported plains topminnow (Lappin, Axelson and BLIP). Because the North TSA contains five of the seven ponds on OSMP that support plains topminnow, habitat protection and improvement measures should be considered to conserve this species.

Plains topminnow were once common in transitional creeks and streams in the South Platte River Basin, but populations have substantially declined for a variety of reasons including changes in creek hydrology, water temperature, and in-stream habitat caused by dams and introduction of non-native fish. To mitigate the effects of habitat loss and interspecies competition on populations of native fishes, CPW routinely manages isolated ponds that meet specific habitat requirements as broodstock refugia with the ultimate goal of transplanting individuals from artificial ponds to creeks. In recent conversations with CPW, several ponds were identified as either already acting as important native fish refugia or provided compelling opportunities for habitat restoration to act as native fish refugia.

One of the goals of recording bathymetric measurements on OSMP ponds and reservoirs was to identify waters that were shallow and thus better suited to act as native fish (and amphibian) refugia and those that were deep, which would better support a recreational fishery. Introduced fish like largemouth bass and tiger muskie require colder water with higher oxygen levels, thus deeper ponds act as more effective fisheries for sport fish. One of the deepest reservoirs that OSMP manages is Wonderland Lake (deepest depth: 17 feet). Therefore, along with other

fishing opportunities on public lands north of Boulder like Coot Lake, Boulder County Fairgrounds Lake, Lagerman Reservoir, and Boulder Reservoir, Wonderland Lake may present an opportunity to provide a high-quality fishing experience in the North TSA.

Lepidoptera Surveys

Background and Methods

Butterflies and skippers (i.e., lepidopterans) are excellent indicators of ecosystem health and integrity. In particular, the presence of grassland-dependent species which rely on native grasses to feed their larvae provide an effective proxy in identifying high-quality habitat. In the Grassland Plan (OSMP 2011), a list of 20 grassland-specialist lepidopterans were identified as important species to track grassland health. Some of these species are considered vulnerable to extinction or imperiled statewide by CNHP, or are considered a species of conservation interest by the US Forest Service, and in the Boulder County Land Comprehensive Plan. Their unstable conservation status is largely due to the loss of about 99 percent of tallgrass prairie since European settlement in North America (Swengel and Swengel 2013).

The North Boulder Grasslands is identified as a potential conservation area by CNHP with a B2 ranking—very high biodiversity significance—because of the presence of intact native mixed-grass prairie and the associated rare grassland-dependent skippers that require the presence of native prairie grasses to complete their life cycle (**Map N2**).

Various butterfly surveys have occurred in the North TSA throughout the years. These include surveys from 1997 (Pineda and Ellingson 1998), 1999-2000 (Collinge et al. 2003), 2001-2002 (Armstead 2003), and 2007-2008 (Robinson et al. 2012). In 2013 and 2014, OSMP partnered with CNHP to conduct lepidoptera surveys in the North Boulder Grasslands to assess the distribution and abundance of rare skippers in the area. Unlike previous surveys in the area, which used either pre-established transects or plots to sample butterflies, CNHP employed Pollard-Yates walkabouts (Pollard 1977) to survey Lepidoptera in the North Boulder Grasslands in 2013 and 2014. The walkabout or “checklist” survey is an alternate methodology in which the survey route is not fixed (Royer et al. 1998). It involves an unrestricted comprehensive search and has the advantages of being fairly simple and focusing the effort in the habitats of targeted rare species.

Results and Discussion

Species richness increased from 32 to 45 from 2013 to 2014 and there were 394 unique observation locations for butterflies within the study area in 2014, almost 400 percent more than the 79 unique observation sites recorded in 2013 (Sovell 2013, 2014). Taken together, these data suggest that conducting lepidopteran surveys for two consecutive years, as outlined in the Grassland Plan, addresses interannual changes in weather and detection probability and provides a more accurate account of butterfly populations.

During 2013-2014, there were 59 observations of rare butterflies that are tracked by CNHP including 20 records of the globally-vulnerable Arogos skipper (G3S2), two state-imperiled Crossline skipper (G4G5S2), 34 state-imperiled Dusted skipper (G4G5S2) and three records of the globally-vulnerable Ottoe skipper (G3G4S2) [**Table NA9, Map N16**]. All of these skippers were observed on the west portion of the study area, west of Hwy 36, even though surveys were conducted on the east side of the highway (Sovell 2013, 2014). One two-spotted skipper was detected in the wetland near Lefthand Valley Reservoir in 1997, but none were observed in 2013

or 2014. Habitat for other rare grass skippers was present throughout the study area including blue grama, the host plant for the simius roadside skipper (G4S3) and rhesus skipper (G4S2S3), but no individuals were observed.

Grassland was the most dominant habitat type where rare butterflies were observed during our surveys and in surveys conducted by Pineda and Ellingson (1998). The rare butterflies observed in the North Boulder Grasslands require large patches of native grasses like big bluestem, little bluestem and side-oats grama to complete their life cycle as these plants are the sole food sources for their larvae (i.e., host plant). The distribution of these insects suggests that high-quality native grassland habitat is fairly well distributed throughout the study area west of the highway. However, non-random clumping of individuals is associated with riparian areas as well as on the Buckingham property (**Map N16**).

In 2014, 20 percent (78 unique observation sites) of all butterfly sightings were located within riparian areas, similar to the 25 percent (20 unique observation sites) that were recorded in riparian areas in 2013. Riparian areas only occupy about 230 acres, or nine percent, of the 2,500 acre study area. This concentration of observations within drainages indicates not only that a moderate number of host plants are dependent upon riparian zones, but also that moist, mesic sites within an otherwise dry landscape, support higher proportions of nectar resources for adult butterflies (Sovell 2014).

The results of the surveys conducted by CNHP demonstrate the importance of the North Boulder Grasslands to the ecological integrity of the butterfly community along the Front Range. As noted earlier, some of the rare species observed in the study area are not only imperiled in Colorado, but also threatened globally. The Front Range offers highly desirable areas to live and recreate, and human-caused loss of native tall- and mixed-grass prairie habitats will continue to be a major threat to the stability of grassland-dependent species.

The North Boulder Grasslands represent one of OSMP's best opportunities to conserve threatened butterfly species and their native grassland habitats. Future management actions in the study area should consider this. Potential management considerations to conserve the habitat that supports rare skippers in the study area include (Sovell 2014):

- 1) Introduce prescribed fire— Prescribed fire is one of the principal tools used to manage native prairies. It benefits prairie-specialist butterflies such as the Arogos skipper, Crossline skipper, Dusted skipper, and Ottoo skipper and by helping to control habitat loss to cool season exotics and woody vegetation, increasing the vigor of native species (including larval food plants), and increasing flowering rates of important nectar sources (Selby 2005). In January 2009, the Olde Stage Fire burned the majority of the study area, yet many species that were detected before the fire were also detected after, suggesting that the intensity and coverage of the Olde Stage Fire did not severely impact the populations of CNHP-tracked, grassland-dependent butterflies in the study area.
- 2) Manage habitat loss via exurban development and intensive recreation— Intensive recreation including trail development should be avoided within tallgrass, mixedgrass and riparian habitats with habitats supporting tall grasses and the common hop being particularly important for rare butterfly populations. Problems associated with concentrated recreation and butterfly diversity include trampling by humans and pets;

run-off from trails, roads, and parking lots; increased fire risks; and introductions of weeds that can completely change the composition and structure of vegetation within a habitat. The current presence of nonnative plants is a concern within the study area and recreational trails are known to be avenues for weed infestations (Pineda and Ellingson 1998). If host plants and nectar resources are lost due to the effects of crowding by invasive plants, then butterfly diversity and abundance will decline. Mixed- and tallgrass prairie habitat important to rare grass skipper butterflies is spread throughout the study area. Important pockets of this important habitat exist in the northwest, central and south portions of the study area. Maintaining connectivity among these locations of important habitat and between these areas and areas with similar habitat outside of study area will be important.

Table NA9. Count of rare butterflies and skippers by habitat type detected during studies conducted by the CNHP in the North Boulder Grasslands in 1997, 2013 and 2014.

	CNHP Rank	Yucca Shrubland Alliance	Baltic Rush	Big Bluestem - Little Bluestem	Big Bluestem - Prairie Dropseed	Choke Cherry - (American Plum) Shrubland	Mountain-mahogany /Needle-and-Thread Shrubland	Needle-and-Thread Herbaceous Vegetation	New Mexico Needlegrass Herbaceous Vegetation	Ponderosa Pine/Big Bluestem Xeric Tallgrass	Ponderosa Pine/Needle-and-Thread Woodland	Skunkbush / Big Bluestem Xeric Tallgrass Shrub Savannah	Skunkbush /Needle-and-Thread Mixedgrass Shrub Savannah	Western Wheatgrass - Blue Grama Herbaceous Vegetation	Western Wheatgrass - Needle-and-Thread	Western Wheatgrass Herbaceous Vegetation	Mountain-mahogany Shrubland Alliance	Ponderosa Pine Woodland Alliance
Arogos skipper	G3 S2	-	-	5	6	-	1	-	1	1	-	-	-	2	-	7	1	-
Dusted skipper	G4G5 S2	-	-	12	10	-	-	-	-	2	-	2	-	3	2	2	-	-
Orangeheaded roadside skipper	OSMP-tracked	1	-	-	1	3	-	-	-	-	-	1	-	2	-	-	-	-
Ottoo skipper	G3G4 S2	-	-	-	2	-	-	-	-	-	-	-	-	-	-	1	-	-
Uncas skipper	OSMP-tracked	-	-	-	-	-	-	2	1	-	-	-	-	1	-	-	-	-
Two-spotted skipper	G4 S2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crossline skipper	G4G5 S2	-	-	-	1	-	-	-	-	-	-	-	1	1	-	-	-	-
Indra swallowtail	OSMP-tracked	-	-	-	4	1	-	-	-	-	2	-	-	-	-	-	-	1

CNHP rankings (CNHP 2014)

Each species is provided a Global (G) Ranking and a State (S) Ranking

- 1 = critically imperiled
- 2 = imperiled
- 3 = vulnerable to extirpation or extinction
- 4 = apparently secure
- 5 = demonstrably widespread, abundant, and secure.

Bat Monitoring

Background and Methods

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. Threats to conservation include habitat loss, human persecution and the recent impacts of white-nose syndrome on bat populations. White-nose syndrome (WNS), caused by a cold-tolerant fungus (*Pseudogymnoascus destructans*), affects bats during hibernation. Bats with WNS awaken more often and use up fat reserves needed for winter survival. They may also emerge from hibernation too early and ultimately starve or freeze to death.

WNS has killed more than 5.7 million bats since the discovery of the disease in a New York cave in 2006. In April 2015, Iowa became the 26th state with a confirmed case of WNS; western Missouri is currently the furthest west the disease has been confirmed. Among those bat species most susceptible are little brown bats (*Myotis lucifugus*) and big brown bats (*Eptesicus fuscus*)—once two of the most common species in North America. In 2014, Canada listed the little brown bat as endangered in response to the impacts of WNS, and populations of both of these species have suffered precipitous declines in the US.

Unlike species that OSMP manages for in the Flatirons like fringed myotis and Townsend's big-eared bat, little brown and big brown bats are generalist species that can readily adapt to human landscape alteration. Because of this, staff expects that the majority of bat activity in the North TSA is comprised of little brown and big brown bats. It is important to note that with the onset of WNS, Colorado may become essential habitat and a population source for these declining species. Thus, continued management to provide roosting habitat and water sources for these species may be vital to their conservation.

In partnership with CPW and the Colorado Bat Society, the OSMP bat monitoring program began in 1995. For two consecutive nights per month from June through September, trained volunteers perform emergence counts at known roost sites and assess bat activity levels using visual counts and auditory monitoring (with a Heterodyne D100 bat detector) at select ponds throughout OSMP-managed lands. Ponds are surveyed for two hours following sunset and roosts are surveyed until dark. Some sites are surveyed each year, whereas others are surveyed every four or five years, depending on volunteer commitment. These survey data may be important in tracking trends of bat activity in the wake of climate change, changes in hydrology caused by the September 2013 flood event and the emergence of WNS.

Results and Discussion

Volunteers surveyed bat activity at ponds (n=9) and roosts (n=1) in the North TSA (**Map N19**). The number of big brown bats using the BATR-JH roost has been steady throughout the years and peaks in the summer months of June and July (**Table NA10**). Bats seek out water before they begin nocturnal foraging, and all ponds surveyed in the North TSA provided this much-needed resource to bats. The most effective method for assessing bat activity at ponds depended on the location. At some locations, "listening" to the bat detector proved to be a more effective

method, whereas counting bat passes was more effective at others. This suggests that collecting data using both methods is valuable. At larger ponds, like BLIP and BVR, audio was a more effective indicator of bat activity, while at smaller ponds like SchP and AxP, counting bat passes provided a better proxy of bat activity (**Table NA11**). It is notable that bat activity was recorded for almost ¼ of the entire survey period at BLIP, BVR, LoP and WL, suggesting that these sites may not only serve as a watering hole for bats, but also act as a foraging location.

Table NA10. Average number \pm SE of big brown bats counted by volunteers emerging from a roost in the North TSA. Number of monitoring visits during each month is in parenthesis.

Site Name	Years Surveyed	May	June	July	August	September	Overall
BATR-JH	2004, 2006-2014	147 \pm 24.0 (4)	216 \pm 12.1 (18)	210 \pm 20.0 (20)	102 \pm 9.2 (20)	35 \pm 6.3 (11)	152 \pm 10.5 (73)

Table NA11. Summary of data collected by volunteers at ponds in the North TSA.

Site Name	Years Surveyed	Number of Surveys	Avg Audio (min)	Avg Number of Bat Passes
BATW-AxP	1998, 1999	12	9.2 \pm 2.2	20.4 \pm 11.1
BATW-BLIP	2009, 2010	13	28.7 \pm 4.2	2.1 \pm 1.0
BATW-BVR	1995, 1998, 2000, 2001, 2010	26	26.3 \pm 3.2	7.0 \pm 2.0
BATW-HP	2002-2005	24	14.8 \pm 2.7	29.8 \pm 7.1
BATW-LoP	2004	4	26.0 \pm 19.0	3.8 \pm 0.9
BATW-MarkP	2004	4	4.8 \pm 2.8	2.5 \pm 0.9
BATW-MR	2003-2006, 2008, 2010-2013	53	8.3 \pm 2.1	5.4 \pm 2.1
BATW-SchP	1995-1998	12	6.3 \pm 1.6	20.3 \pm 6.3
BATW-WL	1996, 1999, 2000, 2004, 2006-2013	65	22.2 \pm 2.1	23.9 \pm 5.6

Grassland Bird Monitoring

Background and Methods

As part of the Grassland Plan, staff designed a system-wide project to monitor birds in grassland habitats across OSMP- managed lands. Grassland birds are sensitive to a number of factors, many that are influenced by management including those that are applicable to OSMP grasslands. They are sensitive to changes in grazing and fire regimes, the establishment of exotic plant species, increased predation by dogs, human travel on trails, incompatible nearby land uses and reduction of habitat block size by a variety of sources of fragmentation (Vickery et al. 1994, Johnson 1996, Brennan and Kuvlesky 2005, Knick and Rotenberry 1995). These sensitivities combined with the ease of detectability and precipitous declines across their range for many species make these species convenient and informative focal species.

All monitoring was done along 200 meter transects that were placed randomly within identified survey locations. Selection was stratified by habitat block, with crossing of roads and trails avoided. Transects were placed so as to ensure sufficient coverage of an area while still maintaining independence between transects. Staff surveyed birds along each transect twice during the breeding season (mid-May to mid-June). Staff 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. Staff recorded all bird species seen or heard along the transects and estimated their distance to the nearest meter, calibrated with a laser rangefinder (Bushnell Corporation, Overland Park, Kansas; Nikon USA, Melville, New York) and sighting angle. These detectability-based density estimates are more reliable than traditional index counts (Rosenstock et al. 2002). Sampling occurred between sunrise and three hours after sunrise and was not conducted in inclement weather.

System-wide, 119 transects are monitored annually. Of these, 36 transects are located in the North TSA. Three other transects were added in 2014 with the purchase of the Joder property. Twenty transects are located on West Beech and Joder, 12 are located on East Beech, two on IBM conservation easement, and two on Boulder Warehouse (**Map N9**). The North TSA transects include habitats that are interesting and distinct from other areas on OSMP-managed lands. The eastern portions of the area include mixedgrass prairie mosaic, including large blocks of this habitat on East Beech. These areas support the suite of grassland specialist bird species including grasshopper sparrows, which were a conservation focal species in previous TSAs and the Grassland Plan. Grassland bird protective seasonal closures have been included in all of the last three TSAs to help protect these grassland specialist species. While the North TSA supports these species, it is not at the highest concentrations seen on the system. As a result, focus in the North TSA is on species not found as frequently on grassland transects outside the TSA.

Results and Discussion

Results from surveys are presented in **Table NA12** below.

Species Richness-

Transects in the North TSA have been monitored since 2008 with expansions in the number of transects in 2009/2010 as part of the Grassland Plan implementation and in 2014 with the

purchase of the Joder property. Staff have found native species richness at two sets of transects to be extremely high. North Boulder (area west of US 36 Foothills Highway) has the highest species richness detected on the system with 63 native species. The next highest areas for species richness are Tallgrass West and Southern Grasslands with 50 and 48 species respectively. This result highlights the unique nature of this area, particularly the area west of Foothills Highway. This area supports a mixture of habitats with rock outcroppings, shrubby drainages, upland shrub patches and shale barrens intermixed with the grassland habitats. This close juxtaposition of habitats found along the hogback areas supports higher biodiversity of birds than found throughout grasslands elsewhere on the system.

To highlight this uniqueness, we analyzed data related to three species- lark sparrow, rock wren and lazuli bunting. Lark sparrows are detected frequently in the North TSA, but only infrequently anywhere else on the OSMP system. Likewise, rock wrens are detected frequently in the rock outcropping and hogback communities. While rock wrens occur elsewhere outside the grasslands on OSMP, the North TSA represents the areas they are most frequently seen and where their habitat is embedded in surrounding grassland and shrub communities. Finally, lazuli bunting, while not typically a species seen on grassland transects, is common in the heavily vegetated drainages embedded in the grassland habitats of the western portion of the North TSA. This species helps us to monitor the shrub nesting bird community.

Lark Sparrow

We detected lark sparrows at three of the five areas surveyed in the North TSA. These areas represented three of the top four areas for lark sparrow abundance. Joder and IBM did not have lark sparrows. Where lark sparrows were detected, they were found in high abundance. East Beech and Boulder Warehouse had the highest abundance of lark sparrows on the system, followed by Tallgrass West (included in West TSA with grassland bird protective seasonal closure) and North Boulder (areas west of the Foothills Highway) (**Table NA12**). Overall, the North TSA transects had an average abundance of .74 lark sparrows per transect as compared to a system wide average of 0.28. Breeding Bird Survey data shows lark sparrow populations declining slightly within Colorado and more substantially across the United States in the period between 1966-2013. Across the United States, this species has declined nearly 1 percent each year during that timeframe (Sauer et al. 2014). As a result, given the unique habitat in the North TSA that is able to support this species and the conservation concern surrounding lark sparrows, lark sparrows have been selected as a conservation focal species for the North TSA.

Rock Wren

Rock wrens were detected in only two areas of OSMP on grassland transects- both in the North TSA. Relatively high abundance was noted on the North Boulder transects and Joder transects (**Table NA12**). As discussed above, rock wrens do occur elsewhere on the system, but similar habitat patches interspersed with grassland and shrubs which provide ideal habitat are restricted to the North TSA. Rock wrens are also a focal species due to the unique North TSA habitat for them, and substantial declines both in Colorado and across the United States (-2.32 percent per year over timeframe of 1966-2013) (Sauer et al. 2014). Rock wrens are included as a focal species in the Target Description for Exposed Rock and outcroppings.

Lazuli Bunting

Lazuli buntings occur in areas with substantial shrub and riparian vegetation. Over most of our system, this species is tied to permanent or semi-permanent water sources with appropriate associated vegetation. Lazuli buntings within the North TSA occur in vegetated ephemeral drainages that occur along the face of the hogbacks. Although more widespread system-wide than rock wrens, lazuli buntings similarly are found in unique pockets of appropriate habitat surrounded by grasslands. Lazuli bunting is a focal species for the North TSA because it is a species in decline (-2.75 percent annually between 1966-2013) and is representative of a suite of shrub nesting birds that are important conservation indicators on OSMP. Lazuli buntings were detected most frequently in areas of the North TSA during grassland bird surveys. East Beech, North Boulder and Joder transects showed the highest abundance of lazuli buntings. Buntings were also detected in very low abundance at West Rudd and Tallgrass West (**Table NA12**).

The grassland bird transects within the TSA show extremely high species richness in comparison to transects system-wide. This is likely due to the close spatial association of diverse habitats in the area- particularly in areas such as West Beech and Schneider. Focal species for this TSA include lark sparrows, rock wrens and lazuli buntings. Each of these species is in decline and represents a different habitat type within the grassland ecosystems of the North TSA.

Grassland bird monitoring allows examination of the nature of the bird community within the North TSA as well as what is special or unique about these habitats on a system-wide scale.

Table NA12. Summary of Grassland Bird monitoring data.

Property/Area	Number of transects	Years surveyed	North TSA?	Native Species Richness (# spp. Detected)	Average Abundance of Lark Sparrows	Average Abundance of Lazuli Buntings	Average Abundance of Rock Wrens
East Beech	12	2009*-2012	Yes	43	1.49	0.31	0
North Boulder	17	2008*-2014	Yes	63	0.34	0.37	0.25
Boulder Warehouse	2	2010-2014	Yes	27	0.80	0	0
IBM	2	2009-2014	Yes	17	0	0	0
Joder	2	2014	Yes	13	0	0.67	0.33
West Rudd	11	2008*-2014	No	39	0.15	0.05	0
Southern Grasslands	20	2008*-2014	No	48	0.09	0	0
Damyonovitch	2	2010-2014	No	22	0	0	0
Jewell Mtn	15	2008*-2014	No	26	0.08	0	0
Aweida	2	2010-2014	No	18	0.05	0	0
Steinbach	2	2009-	No	26	0	0	0

		2014					
Gunbarrel Hill	12	2008-2014*	No	34	0	0	0
Wood Brothers	3	2009-2014	No	27	0	0	0
Tallgrass West	30	2008-2014* *	No	50	0.36	0.03	0
Jafay	3	2009-2014	No	16	0.06	0	0
System-Wide	97			96	0.28	0.07	0.04
North TSA	72			69	0.74	0.22	0.14

Hayfield Bird Monitoring

Background and Methods

Bobolinks are ground-nesting songbirds which nest primarily in wet meadows in the Boulder Valley (Thompson and Strauch 1987). They are protected under the Migratory Bird Treaty Act and are considered “vulnerable to extirpation” (“S3B”) by the CNHP and “rare breeding species” by the BCCP. Bobolink populations in the western United States are unique in that they are separated from the main breeding range of bobolinks further to the east (Hamilton 1962).

Bobolinks originally nested in tallgrass or mixedgrass prairie of the mid-western United States and southcentral Canada (Bent 1958), but because of land conversion, have now increased their use of irrigated hayfields throughout their range (Martin and Gavin 1995). The use of this habitat creates a potential management conflict as most irrigated hayfields are managed under maximum yield principles, which translates to several harvests (i.e., mowing) each season. The bobolink is of particular interest to land managers because of its extreme population decline during the past thirty years and its affinity to breed late in the summer when much of the mowing typically occurs (Martin and Gavin 1995). Bollinger et al. (1990) documented a 90-100 percent failure rate of bobolink nests because of hayfield mowing. On OSMP hayfields, Roeder (1998) documented no breeding bobolink mortality at four nests and attributed this to the fact that mowing did not occur until after the young had fledged and parental activity ceased.

Efforts by OSMP staff to manage irrigated hayfields to conserve bobolinks began in 1993 when the Burke II property was closed to visitor use. However, records date to 10 years before that which document successful breeding attempts by bobolinks on the Burke II property. Thompson and Strauch (1987) reported a mean fledgling date of July 8 for nests on the Burke I, Burke II and Gebhard OSMP properties, but the general consensus is that postponing mowing until July 15 will allow for the majority of fledglings to be able to sustain flight and hence avoid mowing impacts (Thompson and Strauch 1987, Vierling 1997, Roeder 1998). The incubation period for bobolinks is about two weeks and nestlings leave the nest between 10 and 14 days later (Martin and Gavin 1995). Male bobolinks usually arrive in Boulder County around the end of May and

females tend to arrive one week later (Thompson and Strauch 1987). However, exact time of nesting is not known for OSMP-managed lands.

OSMP managers seek to maintain traditional agricultural land use (haying, grazing) while preserving and maintaining natural systems and native species. In order to identify key bobolink breeding sites and thus inform management decisions, OSMP initiated a hayfield bird monitoring program in 2000. Using these data, staff identified key breeding sites in terms of abundance and density of singing male bobolinks, a common metric used to assess grassland bird abundance. These highest density breeding areas were designated as “Class A Bobolink Management Areas”. OSMP staff also designated a set of second tier breeding areas as “Class B Bobolink Management Areas” (**Map N22**).

Results and Discussion

OSMP staff and volunteers survey 43 hayfields in the North TSA, encompassing 921 acres. This is 1/3 of the hayfield habitat managed by OSMP. Over the past five years (2010-2014), these fields have supported, on average, 35 percent of the total population of bobolinks on the OSMP system (**See Table NA13**). Field number 19 on the Deluca property supports the highest density of bobolinks (5.7 per 10 acres) of any hayfield managed by the department (**See Table NA14**). Other important hayfields that support large numbers and densities of bobolinks in the North TSA include Deluca (13, 14), Hester (18), Campbell (459) and Lore/Ellison (80). Over the course of this project, 81 percent of the fields in the North TSA have supported bobolinks in at least one year. A total of 60 bird species have been found during hayfield surveys in the study area from 2010-2014 (**See Table NA15**).

Table NA13. Bobolink population counts in the North TSA compared to the entire system.

Year	System-wide Bobolink Count	North TSA Bobolink Count	% of Total Population
2010	213	68	31.9
2011	304	89	29.3
2012	219	108	49.3
2013	270	96	35.6
2014	227	73	32.2

Table NA14. A comparison of North TSA bobolink abundance and density between the 2008 Grassland Plan data and more recent years (2010-2014).

Property	Field #	Grassland Plan designation	Acres Surveyed (in 2010)	Number of visits from 2010-2014	BOBO avg abundance (2010-2014)	BOBO density in Grassland Plan (2008)	Avg BOBO per 10 acres (2010-2014)
Deluca	13	B candidate	32	5	14	1.4	4.4
Lore Ellison	80		93	5	10.8		1.2
Deluca	19	B candidate	18	5	10.2	3.3	5.7
Deluca	14	B candidate	27	5	8.8	2	3.3
Campbell	459	B candidate	29	5	6.4	2.6	2.21
Axelson West	49		21	5	4.2		2
Hester	18	B candidate	25	5	4	2.6	1.8
Axelson West	42		41	5	3		0.7
Terre Bison	2		18	4	3		1.67
Johnson	36		39	5	2.4		0.62
Bruning	15		22	4	2		0.91
Johnson	46		26	4	2		0.77
Axelson West	38		13	5	1.6		1.2
Axelson West	48		14	5	1.4		1
Gallagher	133	B	39	5	1.4		0.4
Boulder Valley Ranch	93		37	3	1.33		0.4
Axelson East	56		20	5	1.2		0.6
Johnson/Dawson	37		32	5	1.2		0.38
Lousberg	145		28	5	1.2		0.43
Axelson East	61		19	5	1		0.5
Boulder Valley Ranch	102		28	4	1		0.36
Johnson	57		10	4	1		1
Axelson West	51		11	5	0.8		0.7
Johnson	35		12	5	0.8		0.67
Johnson	58		14	4	0.75		0.54
Johnson	33		4.8	3	0.67		1.4
Johnson	34		11	5	0.6		0.54
Axelson West	54		4	4	0.5		1.3
Siegle	441		18	2	0.5		0.3
Axelson West	55		23	5	0.4		0.2
Axelson West	41		17	3	0.33		0.2
Terre Bison	3		10	4	0.25		0.3
Ditzel	127		31	5	0.2		0.6
Johnson	44		13	5	0.2		0.15
Axelson West	40		10.79	2	0		0
Axelson West	52		8.5	2	0		0
Axelson West	59		8	4	0		0
Axelson West	65		2	4	0		0
Johnson	64		9	4	0		0
Johnson	66		13	4	0		0
Siegle	440		15	3	0		0
Steele	10		26	4	0		0
Terre Bison	4		12	4	0		0

Table NA15. List of bird species observed in North TSA hayfields from 2010-2014.

Species Name	Species Name
American Bittern	Great Horned Owl
American Crow	Grasshopper Sparrow
American Goldfinch	House Finch
American Kestrel	Horned Lark
American Robin	House Wren
American White Pelican	Indigo Bunting
Bank Swallow	Killdeer
Barn Swallow	Lark Bunting
Black-billed Magpie	Mallard
Black-capped Chickadee	Mountain Bluebird
Black-crowned Night-Heron	Mourning Dove
Brown-headed Cowbird	Northern Flicker
Blue Grosbeak	Northern Harrier
Blue Jay	Osprey
Bobolink	Rock Pigeon
Brewer's Blackbird	Red-tailed Hawk
Broad-tailed Hummingbird	Red-winged Blackbird
Bullock's Oriole	Say's Phoebe
Canada Goose	Savannah Sparrow
Cliff Swallow	Song Sparrow
Common Grackle	Spotted Towhee
Common Yellowthroat	Turkey Vulture
Double-crested Cormorant	Vesper Sparrow
Dickcissel	Violet-green Swallow
Downy Woodpecker	Western Kingbird
Eastern Kingbird	Western Meadowlark
Empidonax flycatcher species	Western Wood-Pewee
Eurasian Collared-Dove	Wilson's Phalarope
European Starling	Wilson's Snipe
Great Blue Heron	Yellow Warbler

Burrowing Owl Monitoring

Background and Methods

The Western burrowing owl (*Athene cunicularia hypugaea*) is a small ground-dwelling owl of open habitats throughout the western US. It is listed as a Threatened species in Colorado. The burrowing owl is on the CNHP's Watch List, meaning they are not a substantial conservation concern, but their populations should be monitored. On the whole, populations of burrowing owls have been on the decline throughout their range, but especially on the periphery (USFS 2003). The North American Breeding Bird Survey data suggest that in some areas, like the central Great Plains, they are doing well and populations are growing, while in other areas they are on the decline. All sources stress the need for more adequate monitoring of breeding populations so that proper assessments of their status can be made.

Burrowing owls rely upon fossorial mammals like prairie dogs and ground squirrels for the creation of appropriate shelter and breeding sites. In the breeding season, they occupy abandoned burrows that were created by these mammals. The wide-spread and dedicated efforts to eradicate species like the black-tailed prairie dog are often cited as a primary driver in the population decline of the owls. Vehicle strikes and predation by badgers and avian predators like Great horned owls are often cited as major sources of mortality. In the West, large-scale alterations of grasslands habitats have been recognized as one of the primary drivers of this species' population decline (Bent 1958).

Each spring, OSMP staff survey appropriate habitat for burrowing owls. This includes most active black-tailed prairie dog colonies on the system, as well as several inactive colonies where the owls have been known to occur in the past and where the burrow structures are still intact. Site visits are prioritized by management category (Prairie Dog Conservation Areas and Grassland Preserves are surveyed more often than Removal Areas) and previous owl occurrence. Staff systematically search for burrowing owls during daylight hours by scanning prairie dog colonies with binoculars from multiple vantage points. If a nesting pair is found, OSMP enacts seasonal closures that run from March 15 -October 31. Closures remain in effect for three years after a breeding attempt in order to provide a disturbance-free environment for the owls if they choose to return to a site.

Results and Discussion

In Boulder County, burrowing owls are a rare and isolated breeding species. Despite extensive habitat for the owls (3,052 acres of black-tailed prairie dog colonies in 2014), they remain a rare breeding species on OSMP. The number of breeding pairs on the system varies from two to five, with an average fledgling count of 13 per year over the past seven years (see **Figure NA2**).

The black-tailed prairie dog colonies in the North TSA have historically supported nesting burrowing owls. In 2009, a pair nested on the Walker property. They fledged two young. In 2008, a pair nested on the Axelson property northwest of Boulder Reservoir, rearing seven young. This site was occupied again in 2010 and 2011, but no successful nesting attempts were documented. Burrowing owls have been spotted in the North TSA several other times (**Map N8**). Most of these sightings have been of transitory individuals seen while mapping prairie dog

colonies or performing other activities in and around prairie dog colonies. In 2014, there were 2,073 acres of black-tailed prairie dog colonies in the planning area. Despite this abundance of habitat for burrowing owls, there have not been any successful breeding attempts in the planning area since 2009.

Table NA16. Survey Effort and Breeding Output of Burrowing Owls on OSMP Lands 2008-2014.

<i>Year</i>	# Colonies Surveyed	# Site Visits	# Active Nests	# Fledglings	# Site Visits with BUOW Detection
2008	26	83	4	19	26
2009	42	134	4	7	30
2010	35	107	4	10	50
2011	38	140	5	19	57
2012	40	191	3	13	63
2013	40	167	3	13	58
2014	43	190	2	13	36

Burrowing Owl Nesting Success

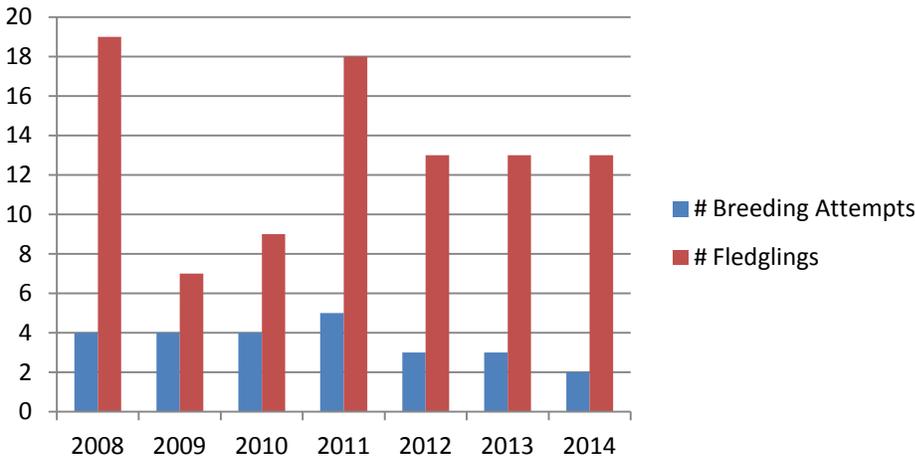


Figure NA2. Burrowing owl nesting success on OSMP 2008-2014.

Table NA17. Burrowing Owl Presence by North TSA property

Property	Date	Count
Axelson	4/27/2010	2
Axelson	4/21/2011	1
Axelson	10/1/2011	1
B.L.I.P.	10/13/2010	1

Boulder Valley Ranch	4/21/2011	1
East Beech	4/28/2010	1
Johnson/Monarch	5/2/2013	1
Steele South	9/18/2014	1

Remote Wildlife Cameras

Background and Methods

OSMP Wildlife staff deployed cameras at eight locations in the North TSA since 2012 (see **Table NA18 and Map N27**). Five camera deployments covered the West Beech and Schneider properties from March 2012 through November 2013. Three locations on the Joder property have been monitored continuously since August 2013.

Remote digital cameras are an important tool utilized by wildlife staff to monitor wildlife throughout the OSMP system. In the North TSA, remote cameras have been deployed in order to obtain baseline data on the presence of wildlife species in anticipation of this planning effort. Since they operate continuously for many months at a time, these cameras are optimal for long-term monitoring of all types of wildlife. OSMP staff installed the cameras at ideal locations, such as game trails or drainage bottoms, where various types of animals may be expected to pass.

Two models of camera were used in the study area. The Cuddeback Attack IR cameras use an infrared flash which reduces the visibility of the camera at night. They also have a dual photo/video mode in which a single photo is taken and then the camera immediately takes a 20-30 second video. There is a five second delay between each trigger, plus the video time. It is apparent from the videos that some animals would be missed by just a camera trigger. For instance, there is a pack of coyotes which roams the area near the Joder 1 camera. The first animal triggers the camera and a photo is taken, then the video mode turns on. The video often captures two other animals following closely behind the first. These would not be picked up by just the camera mode due to the delayed trigger inherently built in to the camera. The second model used, Moultrie D-555i, just takes photos or videos, but not both. This model has a much more sensitive motion-sensing trigger, resulting in many thousands of erroneous photos. The camera is triggered by the slightest movement of vegetation. The field of view on the Moultrie cameras is much wider than on the Cuddebacks, but the image quality is inferior. The Moultrie cameras do provide good information, but the added time involved with sorting through the misfires and the poor image quality makes them a less desirable choice. The Cuddebacks have proven to be accurate and sturdy, and at the price they seem to work well for projects such as these.

With their use, wildlife staff can easily monitor and collect data on wildlife that inhabits the North TSA with a limited commitment of staff time. The photos and the associated data (time stamp, some weather info on certain models) are stored in a user-friendly database that was developed by researchers at CSU. The database can be searched for particular species, locations, date ranges, etc.

Results and Discussion

Remote cameras in the North TSA have taken over 5,400 photographs of 34 different species of mammals and birds (See **Table NA19**). Notable are the abundance of mule deer, coyote and red fox. Shrubby drainages are utilized by black bears in the fall. Wild turkeys inhabit the upland Ponderosa pine forests on the Buckingham property. White-tailed deer, typically a species associated with riparian floodplains, wander into the uplands on the north end of the

Buckingham property. On one occasion, a secretive ringtail was captured traveling along a social trail on the Joder property. There is an abundance of red fox on the Joder property, and gray foxes have been found on several occasions. Elk detections are limited, but there is evidence that the remote grasslands on the Beech property support cows and calves in the summer months. Although only one mountain lion has been detected in the area, bobcats were detected at almost all of the camera locations.

Some species are ubiquitous at all location, such as coyote and mule deer (**See Table NA18**). Red fox wasn't detected at every location, although at the Joder location they have been photographed 426 times, demonstrating their propensity to use this particular social trail. Use of these areas by people is rather low and is concentrated near established undesignated trails. An undesignated trail on Joder had the largest number of people and dogs detected. In addition to hiking which was the most common activity recorded, there was also a low level of horseback riding, mountain biking and one instance of illegal dirt bike riding observed.

Table NA18: Remote camera species captures at eight locations in the North TSA 2012-2015.

Species	NOBO 1	NOBO 2	NOBO 3	NOBO 4	NOBO 5	Joder 1	Joder 2	Joder 3
American Robin	X							X
Bald Eagle								X
Black Bear	X				X	X	X	X
Black-billed Magpie	X			X	X	X		X
Bobcat	X	X		X	X	X	X	X
Brown Thrasher	X							
Cooper's Hawk				X				
Cottontail sp.	X	X		X	X	X		X
Coyote	X	X	X	X	X	X	X	X
Dark-eyed Junco								X
Dog	X				X	X	X	X
Elk	X			X			X	X
European Starling								X
Fox Squirrel	X					X		
Gray Fox						X		X
Horse	X					X		
Human	X			X	X	X	X	X
Lark Sparrow								X
Mountain Lion		X						
Mule Deer	X	X	X	X	X	X	X	X
Northern Flicker					X	X		X
Raccoon	X			X	X	X		X
Red Fox	X	X			X	X	X	
Ringtail						X		
Rock Pigeon								X
Rock Squirrel	X				X	X		X
Spotted Towhee					X			
Steller's Jay						X		
Striped Skunk	X	X	X	X	X	X		X
Western Scrub-Jay	X							X
White-tailed Deer	X					X	X	
Wild Turkey							X	
Wilson's Snipe					X			
Woodrat sp.	X				X			
# of Species	20	7	3	10	16	19	10	21

Table NA19: Number of camera captures at each deployment location 2012-2015.

Species	NOBO 1	NOBO 2	NOBO 3	NOBO 4	NOBO 5	Joder 1	Joder 2	Joder 3
American Robin	3							3
Bald Eagle								1
Black Bear	7				2	4	6	45
Black-billed Magpie	12			5	106	12		190
Bobcat	19	4		1	21	14	1	34
Brown Thrasher	1							
Cooper's Hawk				1				
Cottontail sp.	41	12		7	1	28		41
Coyote	228	25	6	46	113	124	2	180
Dark-eyed Junco								6
Dog	1				3	54	5	13
Elk	23			50			1	1
European Starling								6
Fox Squirrel	1					120		
Gray Fox						5		1
Horse	16					7		
Human	22**			4*	17****	126**	2****	21**
Lark Sparrow								1
Mountain Lion		1						
Mule Deer	194	21	39	291	234	69	104	1696
Northern Flicker					1	1		12
Raccoon	7			4	7	20		11
Red Fox	6	2			3	426	7	
Ringtail						1		
Rock Pigeon								2
Rock Squirrel	5				20	2		27
Spotted Towhee					1			
Steller's Jay						3		
Striped Skunk	117	8	1	21	78	28		5
Western Scrub-Jay	3							6
White-tailed Deer	3					1	39	
Wild Turkey							14	
Wilson's Snipe					1			
Woodrat sp.	1				1			
# of Species	20	7	3	10	16	19	10	21

*OSMP staff or contractors only

** OSMP staff as well as visitors

*** Visitors only

Waterfowl Monitoring

Background and Methods

Waterfowl (ducks and geese) have traditionally been of interest to wildlife managers because of their value as game species. Continent-wide conservation efforts have successfully bolstered the populations of most North American waterfowl species in the past decades, reversing historical trends. Only one species, the Barrow's goldeneye, is tracked by the CNHP. It is considered to be threatened in Colorado because of its limited breeding distribution in alpine lakes. It has been extirpated as a breeding bird from Boulder County but occurs in small numbers in larger water bodies on the plains during the winter. The ring-necked and wood ducks are considered to be Species of Special Concern in the BCCP. Ring-necked ducks are a rare breeder in high-elevation ponds, but are common in almost any open water habitat in the county during the winter. Wood ducks breed in tree cavities along riparian corridors, limiting their breeding distribution in the county. Eight species of waterfowl breed in Boulder County (Kingery 1998).

OSMP staff has performed waterfowl surveys at several small ponds in the North TSA. This includes data collected for the Mid-Winter Waterfowl Survey, a nation-wide population survey organized by the U.S. Fish and Wildlife Service each winter. Since 2013, wildlife staff has made occasional visits to North TSA water bodies to conduct waterfowl surveys in an effort to collect baseline data for a pilot project that may grow into an organized volunteer survey. Additionally, some sightings from Wonderland Lake were mined from a publically accessible online database (ebird.org). Waterfowl are identified and counted by scanning water bodies from advantageous vantage points. Efforts are made not to disturb the birds. The Mid-Winter Waterfowl Count is typically conducted in early January. Most surveys by staff have been conducted from fall through spring as time allows. These surveys have been opportunistic and the program has not yet been developed in a way that water bodies are surveyed systematically on a regular schedule.

Results and Discussion

Six ponds in the North TSA have been surveyed by staff and volunteers (See **Table NA20**). Fifteen species of waterfowl have been observed during these visits. Canada geese have been observed on nests at Mesa Reservoir, but otherwise there have been no direct observations of nesting ducks in the study area during these surveys. Presumably, common species like mallard and Canada goose can be expected to breed at any of these locations. There have been no observations of Barrow's goldeneye or wood duck at ponds in the North TSA, although they have been observed at other water bodies within the study area but not on OSMP-managed lands (e.g. Boulder Reservoir). Of interest is one sighting of a long-tailed duck at the Lappin Pond on May 3, 2012, a rare sighting anywhere in Colorado.

Wonderland Lake and Mesa Reservoir (Conservation Easement) provide some of the best habitat for wintering waterfowl in the study area. Depending on the water levels, Mesa Reservoir is also a likely breeding site for several species of dabbling duck. Both of these sites are in close proximity to trails, so negative effects from recreation should be considered when developing management strategies. Water management at some of the smaller water bodies is also important. Mesa Reservoir occasionally dries up, which may have an adverse effect on the

ecosystem; however, lack of fee ownership at Mesa Reservoir limits management options for OSMP in this location.

Table NA20. North TSA waterfowl sightings.

Site	# of Visits	Species Count	Total Number of Birds Detected
Mesa Reservoir	9	12	202
Wonderland Lake	18	7	486
Lappin Pond	2	4	15
Anderson Pond	1	4	19
Bennett Pond	2	6	133
BVR Pond 1	1	1	1

Table NA21. Species observed in the North TSA.

Waterfowl observed in TSA
American Wigeon
Blue-winged Teal
Bufflehead
Canada Goose
Cinnamon Teal
Gadwall
Green-winged Teal
Lesser Scaup
Long-tailed Duck
Mallard
Northern Pintail
Northern Shoveler
Redhead
Ring-necked Duck
Ruddy Duck

Prairie Dog Mapping

Background and Methods

Black-tailed prairie dogs have far-reaching impacts on the grassland that they inhabit and their presence provides prey and landscape structure necessary for the presence of associated species. Because of these far-reaching effects, prairie dogs are often considered "keystone" species (Kotliar et al. 1999, Hoogland 2006). They are a species that defines the basis of a unique animal community on OSMP-managed lands: The "Black-tailed Prairie Dog and Associates" which is one of the conservation targets included in the Grassland Ecosystem Management Plan (2011).

The black-tailed prairie dog is a medium-sized, diurnal, colonial ground squirrel inhabiting subterranean burrows in suitable grassland habitat. The black-tailed prairie dog historically inhabited much of the central plains, but through loss of habitat and direct extermination, populations have been significantly reduced (Miller et al. 1990). Black-tailed prairie dogs exist on OSMP throughout grassland areas with large complexes of colonies clustered on the northern half of OSMP-managed lands.

In 2005, approximately 3,500 acres of OSMP grassland habitat was inhabited by black-tailed prairie dogs. Since then, an active epizootic of sylvatic plague reduced the number of acres occupied by approximately 2,000 acres based upon colony mapping conducted in 2008. By 2013, the population had rebounded to an occupied acreage of 3,090 acres. The conditions present on OSMP prairie dog towns varies widely. Some colonies support a healthy native plant community and several animal species associated with prairie dogs. Others are characterized by a high density of burrows, diminished native vegetation, localized soil loss and no evidence of the vertebrate species considered dependent upon prairie dogs. In many cases, surrounding land use, underlying vegetation communities and other factors are important contributing factors to the ecological status of the colony.

The existence of several other closely associated species that rely on black-tailed prairie dogs contributes to their function as a keystone species. These species benefit from the prairie dogs directly as prey, indirectly through use of their burrows, or both. These associated species are considered nested targets and include species that are common on OSMP as well as some less common, and several extirpated species.

Burrowing owls, American badgers, ferruginous hawks and golden eagles are animal species associated with intact prairie dog colonies. These species include predators (American badger, ferruginous hawk and golden eagle) which are sensitive to human disturbance and are frequently found to be using only prairie dog towns distant from development and human disturbance. Other associated species use prairie dog burrows as habitat, most notably burrowing owls. Burrowing owls are most frequently found using abandoned prairie dog burrows for shelter and nesting. Many other species, including a variety of insects, small mammals, reptiles and amphibians, may also use the burrows in prairie dog colonies.

Each fall, OSMP staff map all of the black-tailed prairie dog colonies on fee properties, as well as a select number of conservation easements (those which OSMP manages). This allows staff to track the total acreage of colonies on the system as well as in certain Grassland Preserves.

During the mapping effort, evidence of other wildlife species that are associated with prairie dog colonies is also recorded.

Results and Discussion

In 2014, staff mapped a total of 2,072.7 acres of prairie dogs in the North TSA (**Map N8**). These occupied areas occurred within all of the management designations, including Removal Area (148.3 acres), Transition Area (323.4 acres), Multiple Objective Area (180.5 acres), Prairie Dog Conservation Area (26.7 acres) and Grassland Preserve (1,393.9 acres). Results in **Table NA22** show associated species detected on prairie dog colonies during mapping or other site visits.

Table NA22. Sensitive associated species observations at North TSA prairie dog colonies

<u>Property Name</u>	<u>Burrowing Owl</u>	<u>Northern Harrier</u>	<u>Golden Eagle</u>	<u>Ferruginous Hawk</u>	<u>Bald Eagle</u>	<u>Horned Lark</u>	<u>Prairie Rattlesnake</u>	<u>Tiger Salamander</u>
Abbot	-	-	-	-	-	-	-	X
Axelson- Coot Lake	-	-	-	-	-	-	-	-
Belgrove- North	-	-	-	-	-	-	-	-
Belgrove- South	-	-	-	-	-	-	-	-
BLIP, East Beech- South	-	-	X	X	-	X	X	-
BLIP- Boulder Warehouse	X	X	X	-	X	X	X	-
BLIP Southwest	-	-	-	-	X	X	X	-
Axelson, BVR, Lore, Ellison	X	X	X	X	X	X	X	-
BVR 103 Corp-L pasture South	-	X	X	X	-	-	X	-
BVR 103 Corp-East	-	-	-	-	-	-	-	-
BVR 103 Corp-South	-	X	-	-	-	X	X	-
Axelson-Northwest	-	X	-	-	-	-	-	-
BVR 103 Corp-North	-	-	-	-	X	-	-	-
Campbell	-	-	-	-	-	-	-	-
Cowles	-	-	-	-	-	-	-	-
Johnson/Dawson- North	-	-	-	-	-	-	-	-
Johnson/Dawson- South	-	-	-	-	-	-	-	X
Ditzel	-	-	-	-	-	-	-	-
Dodd	-	X	-	-	-	-	-	-
East Beech	-	-	X	-	-	-	X	-
East Beech-Horseshoe	-	-	-	-	-	-	-	-

<u>Property Name</u>	<u>Burrowing Owl</u>	<u>Northern Harrier</u>	<u>Golden Eagle</u>	<u>Ferruginous Hawk</u>	<u>Bald Eagle</u>	<u>Horned Lark</u>	<u>Prairie Rattlesnake</u>	<u>Tiger Salamander</u>
ERNI Moore	-	-	X	-	-	-	-	-
Gallagher	-	-	-	-	X	-	-	-
Gilbert	-	-	X	-	-	-	X	-
Hart- Jones	-	-	-	-	-	-	-	-
IBM CE	-	-	-	-	-	-	-	X
Johnson- Boulder Reservoir North	-	-	-	-	-	-	-	-
Johnson- Boulder Reservoir South	-	X	-	-	-	-	-	-
Johnson- Monarch	X	X	-	-	-	-	-	-
Johnson- North	-	-	-	-	-	-	-	-
Mann	-	-	-	-	-	-	X	-
Mesa Reservoir	-	-	-	-	-	-	-	-
Moore	-	-	-	-	-	-	X	-
NU- West	-	-	-	-	-	-	-	-
Oasis	-	-	-	-	-	-	-	-
Ryan- Middle	-	-	-	-	-	-	-	-
Ryan- North	-	X	-	-	-	-	-	-
Ryan- South	-	-	-	-	-	-	-	-
Schneider- East	-	-	X	-	-	X	-	-
Schneider- West	-	-	X	-	-	-	-	-
Schooley	-	-	-	-	-	-	-	-
Seigel	-	-	-	-	-	-	-	-
Steele- North	-	-	-	-	-	-	-	-
Steele- South	X	X	-	-	-	-	-	-
West Beech	-	-	-	X	-	-	-	-
Waldorf	-	X	-	X	-	-	-	-
Bennett	-	X	X	X	X	X	-	-
Brewbaker	-	X	-	X	X	-	-	-
Jacob/Andrea	-	-	-	X	-	-	X	-
Eisenberg	-	-	-	-	-	X	X	-
Schneider Family	-	X	-	-	-	-	-	-

<u>Property Name</u>	<u>Burrowing Owl</u>	<u>Northern Harrier</u>	<u>Golden Eagle</u>	<u>Ferruginous Hawk</u>	<u>Bald Eagle</u>	<u>Horned Lark</u>	<u>Prairie Rattlesnake</u>	<u>Tiger Salamander</u>
Abbot North	-	-	-	-	-	X	-	-
Joder	-	-	X	-	-	-	-	-

N-Appendix A: Literature Cited

Andrews, R., and R. Righter. 1992. Colorado Birds. Denver Museum of Natural History, Denver, CO.

Armstead, S. B. 2003. A Butterfly Monitoring Program for Assessing the Composition and Distribution of Butterfly Communities in the City of Boulder Open Space and Mountain Parks. MS Thesis, University of Colorado, Boulder, CO, USA.

Benninger-Truax, M. J.L. Vankat, and R.L. Schaefer. 1992. Trail corridors as habitat and conduits for movement of plant species in Rocky Mountain National Park, Colorado, USA. *Landscape Ecology* 6: 269-278

Bent, A.C. 1958. Life histories of North American blackbirds, orioles, tanagers, and their allies. *United States National Museum Bulletin* 211:28-52.

Berry, M.E., and C. E. Bock. 1998. Effects of habitat and landscape characteristics on avian breeding distributions in Colorado foothills shrub. *The Southwestern Naturalist* 43: 435-461.

Bock, C.E., J. H. Bock, and B. C. Bennett. 1999. Songbird abundance in grasslands at a suburban interface on the Colorado High Plains. *Ecology and Conservation of Grassland Birds of the Western Hemisphere*. Book Series: Studies in Avian Biology, Issue 19, pp. 131-136.

Blakesley, J. A. and K. P. Reese. 1988. Avian use of campground and noncampground sites in riparian zones. *The Journal of Wildlife Management* 52: 399-402.

Bollinger, E.K., P.B. Bollinger, and T.A. Gavin. 1990. Effects of hay-cropping on eastern populations of the Bobolink. *Wildlife Society Bulletin* 18: 142-150.

Brennan, L.A., and W.P. Kuvlesky. 2005. North American grassland birds: an unfolding conservation crisis? *Journal of Wildlife Management* 69: 1-13.

CNHP. 2014. Biodiversity Tracking and Conservation System (BIOTICS). Colorado Natural Heritage Program, Colorado State University, Fort Collins.

Cole, D.N. 1978. Estimating the Susceptibility of Wildland Vegetation to Trailside Alteration. *Journal of Applied Ecology* 15: 281-286.

Collinge, S. K., K. L. Prudic and J. C. Oliver. 2003. Effects of local characteristics and landscape context on grassland butterfly diversity. *Conservation Biology* 17: 178-187.

OSMP. 2011. Grassland Management Plan. City of Boulder Open Space and Mountain Parks.

Colorado Parks and Wildlife (CPW). 2014. State Wildlife Action Plan. Accessed 19 May 2014 <http://cpw.state.co.us/aboutus/Pages/StateWildlifeActionPlan.aspx>

- Flanders, A. A., W. P. Kuvlesky, D. C. Ruthven, R. E. Zaiglin, R. L. Bingham, T. E. Fulbright, F. Hernandez, and L. A. Brennan. 2006. Effects of exotic grasses on Texas rangeland breeding birds. *The Auk* 123: 171-182.
- Greene, E., V. R. Muehter, and W. Davison. 2014. Lazuli Bunting (*Passerina amoena*). *The Birds of North America online* (A. Poole, Ed.) Ithaca: Cornell Lab of Ornithology. Available: <http://bna.birds.cornell.edu/bna.species.232>.
- Haire, S. L., C. E. Bock, B. S. Cade and C. Bennett. 2000. The role of landscape and habitat characteristics in limiting abundance of grassland nesting songbirds in an urban open space. *Landscape and Urban Planning* 48: 65-82.
- Hamilton, W.J., III. 1962. Bobolink migratory patterns and their experimental analysis under night skies. *Auk* 79: 208-233.
- Harrison, H. H. 1979. A field guide to western birds' nests. Houghton Mifflin Company, Boston, MA., USA. 279pp
- Hoogland, J.L., editor. 2006. Conservation of the Black-tailed Prairie Dog. Island Press, Washington, D.C.
- Johnson, D.H. 1996. Management of northern prairies and wetlands for the conservation of Neotropical migratory birds. Pages 53-67 in F.R. Thompson, III, editors. Management of midwestern landscapes for the conservation of Neotropical migratory birds. General Technical Report NC-187. U.S. Department of Agriculture Forest Service North Central Forest Experiment Station, St. Paul, Minnesota.
- Jones, S. R. 2014. Boulder Reservoir 2014 Birds of Special Concern Monitoring Report. Available: [https://wwwstatic.bouldercolorado.gov/docs/Boulder_Reservoir_2014_report_with_figures_\(2\)-1-201410210942.pdf](https://wwwstatic.bouldercolorado.gov/docs/Boulder_Reservoir_2014_report_with_figures_(2)-1-201410210942.pdf). Accessed: May 5, 2015.
- Jordan, M. 2000. Ecological Impacts of recreational use of trails: a literature review. The Nature Conservancy white paper. Available at: <http://www.parks.ca.gov/pages/795/files/ecologicalimpactsrecreationalusers.pdf>. Accessed June 2015
- Kingery, H. E., Editor. 1998. Colorado Breeding Bird Atlas. Colorado Bird Atlas Partnership.
- Knick, S.T., and J.T. Rotenberry. 1995. Landscape characteristics of fragmented shrubsteppe habitats and breeding passerine birds. *Conservation Biology* 9: 1059-1071.
- Knopf, F. L. 1994. Avian assemblages on altered grasslands. *Studies in Avian Biology* 15: 247-257.

- Kochert, M. N., K. Steenhof, C. L. McIntyre and E. H. Craig. 2002. Golden Eagle (*Aquila chrysaetos*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/684> doi:10.2173/bna.684
- Kotliar, N.B., B.W. Baker, A.D. Whicker, and G. Plumb. 1999. A critical review of assumptions about the prairie dog as a keystone species. *Environmental Management* 24: 177–192.
- Lusk, J.J., K. S. Wells, F. S. Guthery, and S.D. Fuhlendorf. 2003. Lark sparrow (*Chondestes grammacus*) nest-site selection and success in a mixed-grass prairie. *The Auk* 120:120-129.
- Martin, S.G., and T.A. Gavin. 1995. Bobolink (*Dolichonyx oryzivorous*). No. 176 in A. Poole and F. Gill, editors. The Birds of North America, The Academy of Natural Sciences, Philadelphia, and the American Ornithologists' Union, Washington, D.C.
- McIntyre, C. L. and L. G. Adams. 1999. Reproductive characteristics of migratory Golden Eagles in Denali National Park, Alaska. *Condor* 101: 115-123.
- Miller, B., C. Wemmer, D. Biggins, and R. Reading. 1990. A proposal to conserve black-footed ferrets and the prairie dog ecosystem. *Environmental Management* 14: 763-769.
- Miller, S. G., R. L. Knight, and C. K. Miller. 1998. Influence of recreational trails on breeding bird communities. *Ecological Applications* 8: 162-169.
- Miller, S. G., R. L. Knight, and C. K. Miller. 2001. Wildlife responses to pedestrians and dogs. *Wildlife Society Bulletin* 29: 124-132.
- Miller, J. R., J. A. Wiens, N. T. Hobbs, and D. M. Theobald. 2003. Effects of human settlement on bird communities in lowland riparian areas of Colorado. *Ecological Applications* 13: 1041-1059.
- OSMP. 1996. North Boulder Valley Inventory Report.
- Pineda, P. M. and A. R. Ellingson. 1998. A systematic inventory of rare and imperiled butterflies on the City of Boulder Open Space and Mountain Parks. Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO
- Pollard, E. 1977. A Method for Assessing Changes In Abundance of Butterflies. *Biological Conservation* 12: 115–133.
- Robinson N, S. Armstead S., and M. D. Bowers. 2012. Data from: Butterfly community ecology: the influences of habitat type, weather patterns, and dominant species in a temperate ecosystem. Dryad Digital Repository: <http://dx.doi.org/10.5061/dryad.57vh3>

- Roeder, B. 1998. The effects of suburbanization and haying on the reproductive success of grassland birds breeding in hayfields in Boulder, Colorado. Unpublished report to the City of Boulder Department of Open Space.
- Rosenstock, S. S., D. R. Anderson, K. M. Giesen, T. Leukering, and M. F. Carter. 2002. Landbird counting techniques: current practices and an alternative. *Auk* 119: 46-53.
- Royer, R. A., J. Austin, and W. Newton. 1998. Checklist and "Pollard Walk" Butterfly Survey Methods on Public Lands. *American Midland Naturalist*, 140: 358-371.
- Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2014. *The North American Breeding Bird Survey, Results and Analysis 1966 - 2013. Version 01.30.2015 USGS Patuxent Wildlife Research Center, Laurel, MD*
- Selby, G.. 2005. Ottoe Skipper (*Hesperia ottoe* W.H. Edwards): A Technical Conservation Assessment. USDA Forest Service, Rocky Mountain Region:
<http://www.fs.fed.us/r2/projects/scp/assessments/ottoeskipper.pdf> [1/19/2015].
- Shiple, B.K., D. Chiszar, K.T. Fitzgerald, & A.J. Saviola. 2013. Spatial ecology of prairie rattlesnakes (*Crotalus viridis*) associated with Black-tailed prairie dog (*Cynomys ludovicianus*) colonies in Colorado. *Herpetological Conservation and Biology*, 8, 240-250.
- Smith, KG., SR Wittenberg, RB Macwhirter and KL Bildstein. 2011. Northern Harrier (*Circus cyaneus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online:
<http://bna.birds.cornell.edu/bna/species/210> doi:10.2173/bna.210
- Sovell, J. R. 2013. Surveying Imperiled Butterflies and Assessing Butterfly Habitat Quality at North Boulder Grasslands, Boulder County. Final Report to OSMP. Colorado Natural Heritage Program, Colorado State University, Fort Collins, Colorado.
- Sovell, J. R. 2014. Butterfly Community Survey at North Boulder Grasslands, City of Boulder OSMP. Final Report to OSMP. Colorado Natural Heritage Program. Colorado State University, Fort Collins, Colorado.
- Swengel A. B. and S. R. Swengel. 2007. Benefit of Permanent Non-fire Refugia for Lepidoptera Conservation In Fire-Managed Sites. *Journal of Insect Conservation*, 11: 263-279.
- Swengel A. B. and S.R. Swengel. 2013. Decline of *Hesperia ottoe* in Northern Tallgrass Prairie Preserves. *Insects* 4: 663-682.
- Thompson, R., and J. Strauch. 1987. Habitat use by breeding birds on City of Boulder Open Space. Unpublished report prepared for City of Boulder Open Space and Real Estate Department. Boulder, Colorado.
- Vernalis, Inc. 2015. North Boulder Grasslands Snake Species Inventory: 2012-2014.

Vickery, P.D., M.L. Hunter, Jr. and S.M. Melvin. 1994. Effects of habitat area on the distribution of grassland birds in Maine. *Conservation Biology* 8(4): 1087-1097.

Vierling, K.T. 1997. Effects of suburbanization and haying on the reproductive success of grassland birds breeding in hayfields. Unpublished report prepared for the City of Boulder Open Space Department.

N-Appendix B: Native Vegetation



Rare and Sensitive Vegetation

One of the City of Boulder's OSMP Charter purposes is the preservation of rare and sensitive native plant species and their habitats. 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 (CNHP 2015). 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. Abundance, distribution, short- and long-term population trends, environmental specificity and range extent, and threats may be used to assign this ranking. OSMP Plant Ecologists use similar quantitative and qualitative factors to identify additional sensitive species that warrant local protection.



Previously documented rare plant species locations are inventoried on a regular basis across the OSMP system using a standardized methodology. Known subpopulations are resurveyed on a regular basis 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.



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 changes in 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

*Top: Bell's twinpod
(Physaria bellii)
Claudia Van Wie*

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

*Bottom: Dwarf leadplant
(Amorpha nana)
Bill May*

Rare plant communities are mapped on OSMP as part of the Vegetation Mapping project following a modified version of 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 either one tenth or one quarter of an acre at the 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 (CNHP 2015).

Map N7 displays the rare plant and vegetation types currently mapped in the TSA. For this report, specific rare plant locations have been generalized to protect the resources. More precise location data exists for each of the known occurrences and will be used for finer scale planning.

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

Table NB1. Rare Plant Species in the North TSA

Species	Scientific Name	Ranking	Populations	Subpopulations	Target
Narrow-leaved Milkweed	<i>Asclepias stenophylla</i>	S2/G4G5	1	2	MGPM
Blue Toadflax	<i>Linaria canadensis</i> var. <i>texana</i>	SNR/SU/G5	1	1	MGPM
Wavy-leaf stickleaf	<i>Nuttallia sinuata</i>	S3/G3	3	104	MGPM
Slim-pod Venus' looking-glass	<i>Triodanis leptocarpa</i>	S1/G5?	1	1	MGPM
Grassy slope sedge	<i>Carex oreocharis</i>	S2/G3	1	To be determined	XTP
Birds-foot violet	<i>Viola pedatifida</i>	S1/G5	1	116	MGPM/XTP
Dwarf leadplant	<i>Amorpha nana</i>	S1S2/G5	1	69	MGPM/XTP
Bell's Twinpod	<i>Physaria bellii</i>	S2S3/G2G3	7	526	MGPM/XTP/AG
Waterthread pondweed	<i>Potamogeton diversifolius</i>	S1/G5	1	19	Wetlands and Riparian Areas

Colorado Natural Heritage Program Ranking Descriptions

CNHP 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 (e.g., state))

1= critically imperiled

2 = imperiled

3 = vulnerable to extirpation or extinction

4 = apparently secure

5 = demonstrably widespread, abundant and secure

An S or G rank followed by a “?” denotes a questionable rank due to insufficient information; “U” denotes that the taxon or community cannot be ranked due to insufficient information; “NR” denotes a need for review by CNHP.

Table NB2. Rare Vegetation Associations in the North TSA

Common Name	Scientific Name	Rank	Acres in the TSA	Targets
Western Wheatgrass - Green Needlegrass Herbaceous Vegetation	<i>Pascopyrum smithii</i> - <i>Nassella viridula</i> Herbaceous Vegetation	S2/G3G4		Mixedgrass Prairie Mosaic

Common Name	Scientific Name	Rank	Acres in the TSA	Targets
Indian Ricegrass Shale Barren Herbaceous Vegetation	<i>Achnatherum hymenoides</i> Shale Barren Herbaceous Vegetation	S2/G2		Mixedgrass Prairie Mosaic
Needle-and-Thread Colorado Front Range Herbaceous Vegetation	<i>Hesperostipa comata</i> Colorado Front Range Herbaceous Vegetation	S1S2/G1G2		Mixedgrass Prairie Mosaic
New Mexico Needlegrass Herbaceous Vegetation	<i>Hesperostipa neomexicana</i> Herbaceous Vegetation	S3/G3		Mixedgrass Prairie Mosaic
			393	
Big Bluestem - Little Bluestem Western Great Plains Herbaceous Vegetation	<i>Andropogon gerardii</i> - <i>Schizachyrium scoparium</i> Western Great Plains Herbaceous Vegetation	S2/G2?		Xeric Tallgrass Prairie
Big Bluestem - Yellow Indiangrass Western Great Plains Herbaceous Vegetation	<i>Andropogon gerardii</i> - <i>Sorghastrum nutans</i> Western Great Plains Herbaceous Vegetation	S1S2/G2		Xeric Tallgrass Prairie
Big Bluestem - Prairie Dropseed Western Foothills Herbaceous Vegetation	<i>Andropogon gerardii</i> - <i>Sporobolus heterolepis</i> Western Foothills Herbaceous Vegetation	S1S2/G2		Xeric Tallgrass Prairie
Ponderosa Pine / Mountain-mahogany / Big Bluestem Tree Savannah Herbaceous Vegetation	<i>Pinus ponderosa</i> / <i>Cercocarpus montanus</i> / <i>Andropogon gerardii</i> Wooded Herbaceous Vegetation	S2?/G2		Xeric Tallgrass Prairie
			464	
Mountain-mahogany / Needle-and-Thread Shrubland	<i>Cercocarpus montanus</i> / <i>Hesperostipa comata</i> Shrubland	S2/G2		Upland Shrublands
Choke Cherry - (American Plum) Shrubland	<i>Prunus virginiana</i> - (<i>Prunus americana</i>) Shrubland	S3/G4Q		Upland Shrublands
Mountain-mahogany - Ill-scented Sumac / Big Bluestem Shrubland	<i>Cercocarpus montanus</i> - <i>Rhus trilobata</i> / <i>Andropogon gerardii</i> Shrubland	S2S3/G2G3		Upland Shrublands
			123	
Choke Cherry -	<i>Prunus virginiana</i> -	S3/G4Q		Wetlands and

Common Name	Scientific Name	Rank	Acres in the TSA	Targets
(American Plum) Shrubland	<i>(Prunus americana)</i> Shrubland			Riparian Areas
Western Snowberry Shrubland	<i>Symphoricarpos occidentalis</i> Shrubland	S3/G45		Wetlands and Riparian Areas
Big Bluestem - Yellow Indiangrass Western Great Plains Herbaceous Vegetation	<i>Andropogon gerardii</i> - <i>Sorghastrum nutans</i> Western Great Plains Herbaceous Vegetation	S1S2/G2		Wetlands and Riparian Areas
Threesquare Herbaceous Vegetation	<i>Schoenoplectus pungens</i> Herbaceous Vegetation	S3/G3G4		Wetlands and Riparian Areas
Saltgrass Herbaceous Vegetation	<i>Distichlis spicata</i> Herbaceous Vegetation	S3/G5		Wetlands and Riparian Areas
Nuttall Alkaligrass Herbaceous Vegetation	<i>Puccinellia nuttalliana</i> Herbaceous Vegetation	S3/G3?		Wetlands and Riparian Areas
Nebraska Sedge Herbaceous Vegetation	<i>Carex nebrascensis</i> Herbaceous Vegetation	S3/G4		Wetlands and Riparian Areas
Clustered Field Sedge Herbaceous Vegetation	<i>Carex praegracilis</i> Herbaceous Vegetation	S2/G3G4		Wetlands and Riparian Areas
American Mannagrass Herbaceous Vegetation	<i>Glyceria grandis</i> Herbaceous Vegetation	S2/G2?		Wetlands and Riparian Areas
Narrowleaf Cottonwood / Water Birch Woodland	<i>Populus angustifolia</i> / <i>Betula occidentalis</i> Woodland	S3/G3		Wetlands and Riparian Areas
Plains Cottonwood - (Peachleaf Willow) / (Coyote Willow, Sandbar Willow) Woodland	<i>Populus deltoides</i> - (<i>Salix amygdaloides</i>) / <i>Salix (exigua, interior)</i> Woodland	S3/G3G4		Wetlands and Riparian Areas
			138	

Colorado Natural Heritage Program Ranking Descriptions

CNHP 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 (e.g., state))

1= critically imperiled

2 = imperiled

3 = vulnerable to extirpation or extinction

4 = apparently secure

5 = demonstrably widespread, abundant and secure

An S or G rank followed by a “?” denotes a questionable rank due to insufficient information; “U” denotes that the taxon or community cannot be ranked due to insufficient information; “NR” denotes a need for review by CNHP.

Vegetation Monitoring: Grassland Ecosystem Management Plan

The success of Grassland Ecosystem Management Plan implementation is measured by monitoring the status of viability indicators across the Grassland Plan planning area. The Grassland Plan upland vegetation monitoring project was designed and initiated in 2009, and monitoring has been conducted annually since then. In 2009 and 2010, the complete set of 160 transects was monitored, and between 2011 and 2014 a quarter of these permanent transects were monitored each year. In 2015 and 2016, the full set of vegetation monitoring transects will be resampled. The monitoring project design, which used the GRITS methodology (Stevens and Olsen 2004), placed transects randomly across the Grassland Planning area, stratified by the three major upland grassland conservation targets: Mixedgrass Prairie Mosaic, Xeric Tallgrass Prairie, and Mesic Bluestem Prairie. A point-intercept method is used, and data is collected with a Cover Point Optical Device.



Preliminary analyses were conducted in 2009 and 2010 to assess the status of four major viability indicators for the attributes of vegetation composition and structure: absolute cover of bare soil, relative cover of native species, native species richness and conservative species richness. Preliminary system wide vegetation monitoring results for the Xeric Tallgrass Prairie and the Mixedgrass Prairie Mosaic, two of the largest North TSA conservation targets, indicated that the overall condition was fair. Grassland Plan vegetation monitoring data analyses for the North TSA area have produced similar results. Data analyses comparing the data collected in years when all transects are monitored (2009, 2010, 2015 and 2016) will contribute to a better understanding of the condition of these conservation targets. Lists of the most frequent native and non-native species documented by Grassland Plan monitoring in the Xeric Tallgrass and Mixedgrass Prairie Mosaic are included at the end of this appendix.

Grassland vegetation monitoring, North TSA – staff photo

Vegetation Mapping

Vegetation has been mapped across the OSMP land system using a standard methodology which employs the United States National Vegetation Classification (USNVC). Vegetation mapping data is the basis for conservation target and habitat delineation in the Grassland Plan, North TSA Inventory Report and other OSMP management plans. Mapping was updated in 2014 for a large portion of the North TSA, and the remaining areas will be updated in 2015.

Methods

The USNVC can be used to classify all types of vegetation, and provides a standardized approach for assessments of conservation status, trends, and management practices for ecological communities across local, regional and national landscapes. Existing vegetation is classified within a nested hierarchy, the finest level of which is called the *Association*. Upper levels of the hierarchical classification are based largely on vegetation structure and physiognomy and the lowest levels are defined by dominant and diagnostic species.

The USNVC has the following key attributes:

- It is based upon current vegetation;
- It uses a systematic approach to classify vegetation communities across environmental continuums;
- It emphasizes natural and existing vegetation;
- It uses a combined physiognomic-floristic hierarchy;
- It identifies vegetation units based on both qualitative and quantitative data; and
- It is appropriate for mapping at multiple scales.

OSMP vegetation communities are delineated using a combination of photo interpretation and field work that is organized and processed in a GIS. Additionally, wetland and riparian areas were mapped to the Association level within the USNVC hierarchy, using CNHP’s Field Guide to the Wetland and Riparian Plant Associations of Colorado (Carsey et al. 2003). Although published mapping methods that utilize the USNVC usually involve sample plots taken from a cross section of different vegetation types at the targeted level of mapping, OSMP has found it most effective to visit the majority of the system. Woodland and forest types with more than 25 percent tree cover are first outlined using aerial photos prior to field work and tree density is verified through site visits. Forest openings, grasslands, wetlands and riparian areas are comprehensively investigated in the field. This approach allows for data collection at scales consistent with OSMP’s level of management, and it eliminates errors introduced by aerial image interpretation. The method is practical due to the relatively small study area and ease of access to mapping sites, as compared to vegetation mapping conditions in large national parks and other large public land units.

The minimum mapping unit (MMU) is 0.1 ha (0.25 acre) for all types except wetlands, where the MMU is set at 0.04 ha (0.10 acre). The MMU both sets the standard lower size limit used to represent vegetation communities in the map, and defines the area of interest or scale at which vegetation community patterns are assessed in the field. Relatively small MMU’s have been selected because the local environment, the Great Plains-Southern Rocky Mountain ecotone, is characterized by patchy, small-scale differences in vegetation. Mapping at this finer scale increases the likelihood that these complex mosaics are detected and provides the data needed to analyze the ecological relationships among patch types. Finely resolved data also provide options for generalizing information, equipping OSMP with the data to inform both localized and system-wide management decisions.

Using aerial photographs as a guide in hard copy or electronic format, field investigators systematically visit sites and delineate boundaries between different community types. Published potential Alliance and Association descriptions have been compiled and used by ecologists to distinguish vegetation types (NatureServe 2015). The Alliance and appropriate Association is assigned to each mapped polygon. In cases where communities cannot be matched with existing published types or clearly differentiated, plot data are collected to assist with additional attribution work in the office. Plot data have not been a necessity for determining most Alliance and Association types, because existing OSMP types have been widely sampled, documented and described.

Mapping data is stored using the OSMP GIS, and can be linked to attributes such as the Grassland Plan conservation targets.

Plant Species Lists from Grassland Plan Upland Vegetation Monitoring

Table NB3. Native species found in the Mixed Grass Prairie Mosaic conservation target within the North TSA in 2010 (N=37 transects), ranked from most frequently occurring (based on percent of transects species were found in) to least frequently occurring species. Monitoring was conducted as part of the system-wide upland grassland monitoring. *OSMP scientific names are based on Weber and Wittmann, 2001.

Scientific name*	Common name	% of MGPM transects
<i>Pascopyrum smithii</i>	Western wheatgrass	86
<i>Psoralidium tenuiflorum</i>	slimflower scurfpea	78
<i>Gutierrezia sarothrae</i>	broom snakeweed	73

Scientific name*	Common name	% of MGPM transects
<i>Gaura coccinea</i>	scarlet gaura	70
<i>Sphaeralcea coccinea</i>	coppermallow	68
<i>Virgulus falcatus</i>	white prairie aster	68
<i>Aristida purpurea</i>	purple three-awn	65
<i>Artemisia frigida</i>	silver sage	65
<i>Liatris punctata</i>	dotted gayfeather	59
<i>Heterotheca villosa</i>	hairy goldenaster	54
<i>Yucca glauca</i>	yucca	54
<i>Chondrosium gracile</i>	blue grama	51
<i>Oligosporus dracunculus ssp. glaucus</i>	wild tarragon	51
<i>Artemisia ludoviciana</i>	prairie sage	49
<i>Adenolinum lewisii</i>	blue flax	46
<i>Buchloe dactyloides</i>	buffalograss	46
<i>Opuntia macrorhiza</i>	twistspine prickly-pear cactus	46
<i>Astragalus shortianus</i>	Short's milk vetch	43
<i>Bouteloua curtipendula</i>	sideoats grama	41
<i>Evolvulus nuttallianus</i>	shaggy dwarf morning-glory	38
<i>Helianthus pumilus</i>	rough sunflower	38
<i>Astragalus drummondii</i>	Drummond's milk vetch	35
<i>Grindelia squarrosa</i>	curly-cup gumweed	32
<i>Erigeron colo-mexicanus</i>	running fleabane	30
<i>Hesperostipa comata</i>	needle-and-thread grass	30
<i>Nassella viridula</i>	green needlegrass	30
<i>Dalea candida var. oligophylla</i>	white prairie colver	27
<i>Rosa sayi</i>	wild rose	27
<i>Schedonnardus paniculatus</i>	tumblegrass	27
<i>Agaloma marginata</i>	snow-on-the-mountain	24
<i>Ambrosia psilostachya var. coronopifolia</i>	Western ragweed	24
<i>Brickellia eupatorioides</i>	false boneset	24
<i>Chrysothamnus nauseosus ssp. nauseosus</i>	dwarf rabbitbrush	24
<i>Machaeranthera pinnatifida</i>	lacy tansyaster	24
<i>Oxybaphus linearis</i>	narrow-leaved umbrellawort	24
<i>Penstemon secundiflorus</i>	sidebells penstemon	24
<i>Viola nuttallii</i>	Nuttall's violet	24

Scientific name*	Common name	% of MGPM transects
<i>Allium cernuum</i>	nodding onion	22
<i>Astragalus bisulcatus</i>	two grooved milk vetch	22
<i>Ratibida columnifera</i>	prairie coneflower	22
<i>Andropogon gerardii</i>	big bluestem	19
<i>Chamaesyce glyptosperma</i>	ribseed sandmat	19
<i>Elymus elymoides</i>	squirreltail	19
<i>Oenothera howardii</i>	Howard's evening primrose	19
<i>Opuntia polyacantha</i>	plains prickly-pear	19
<i>Oxytropis sericea</i>	silver locoweed	19
<i>Rhus aromatica ssp. trilobata</i>	three-leaf sumac	19
<i>Tragia ramosa</i>	stinging spurge	19
<i>Astragalus flexuosus</i>	wiry milk vetch	16
<i>Cirsium ochrocentrum</i>	Wavyleaf thistle	16
<i>Comandra umbellata ssp. pallida</i>	bastard toadflax	16
<i>Eriogonum brevicaulis</i>	yellow buckwheat	16
<i>Helianthus annuus</i>	common sunflower	16
<i>Hybanthus verticillatus</i>	green violet	16
<i>Koeleria macrantha</i>	prairie Junegrass	16
<i>Mertensia lanceolata</i>	prairie bluebells	16
<i>Musineon divaricatum</i>	leafy wildparsley	16
<i>Quincula lobata</i>	Chinese lantern	16
<i>Adenolinum pratense</i>	meadow flax	14
<i>Argemone hispida</i>	rough prickly poppy	14
<i>Astragalus agrestis</i>	purple milk vetch	14
<i>Dalea purpurea</i>	purple prairie clover	14
<i>Iva axillaris</i>	povertyweed	14
<i>Lomatium orientale</i>	salt-and-pepper	14
<i>Plantago patagonica</i>	woolly plantain	14
<i>Polygonum douglasii</i>	devil's shoestring	14
<i>Sporobolus cryptandrus</i>	sand dropseed	14
<i>Thelesperma megapotamicum</i>	Hopi tea	14
<i>Aphyllon fasciculatum</i>	clustered broomrape	11
<i>Argemone polyanthemus</i>	crested prickly poppy	11
<i>Dyssodia papposa</i>	fetid marigold	11
<i>Glandularia bipinnatifida</i>	showy vervain	11

Scientific name*	Common name	% of MGPM transects
<i>Hesperostipa neomexicana</i>	New Mexico feathergrass	11
<i>Hymenopappus filifolius</i> var. <i>cinereus</i>	fineleaf hymenopappus	11
<i>Lesquerella montana</i>	mountain bladderpod	11
<i>Opuntia phaeacantha</i>	New Mexico prickly-pear cactus	11
<i>Paronychia jamesii</i>	James' nailwort	11
<i>Tithymalus brachyceras</i>	Rocky Mountain spurge	11
<i>Allium textile</i>	textile onion	8
<i>Asclepias viridiflora</i>	green-flowered milkweed	8
<i>Aster porteri</i>	Porter aster	8
<i>Chenopodium incanum</i>	mealy goosefoot	8
<i>Chondrosium hirsutum</i>	hairy grama	8
<i>Coryphantha missouriensis</i>	nipple cactus	8
<i>Hedysarum boreale</i>	chainpod	8
<i>Heterotheca foliosa</i>	hairy goldenaster	8
<i>Ipomopsis spicata</i>	spike gilia	8
<i>Leucocrinum montanum</i>	sand lily	8
<i>Pterogonum alatum</i>	singed buckwheat	8
<i>Senecio spartioides</i>	broom groundsel	8
<i>Achnatherum hymenoides</i>	Indian ricegrass	5
<i>Asclepias pumila</i>	dwarf milkweed	5
<i>Astragalus laxmannii</i>	prairie milk vetch	5
<i>Calochortus gunnisonii</i>	mariposa lily	5
<i>Carex pensylvanica</i> ssp. <i>heliophila</i>	sun sedge	5
<i>Chenopodium pratericola</i>	desert goosefoot	5
<i>Delphinium carolinianum</i> ssp. <i>virescens</i>	plains larkspur	5
<i>Descurainia pinnata</i>	Western tansymustard	5
<i>Drymocallis fissa</i>	bigflower cinquefoil	5
<i>Lithospermum incisum</i>	narrow-leaved puccoon	5
<i>Monarda pectinata</i>	beebalm	5
<i>Onosmodium molle</i> ssp. <i>occidentale</i>	Western marbleseed	5
<i>Orophaca tridactylca</i>	three-fingered milk vetch	5
<i>Oxytropis lambertii</i>	Colorado locoweed	5
<i>Packera pseud aurea</i>	falsegold groundsel	5
<i>Phyla cuneifolia</i>	fogfruit	5

Scientific name*	Common name	% of MGPM transects
<i>Physalis hederifolia</i> var. <i>comata</i>	ivy leaf ground cherry	5
<i>Physalis heterophylla</i>	clammy ground cherry	5
<i>Poa agassizensis</i>	Rocky Mountain bluegrass	5
<i>Rosa woodsii</i>	Woods' rose	5
<i>Sporobolus asper</i>	dropseed	5
<i>Toxicoscordion venenosum</i>	meadow death camas	5
<i>Vicia americana</i>	American vetch	5
<i>Vicia linearis</i>	mat vetch	5
<i>Virgulus ericoides</i>	white heath aster	5
<i>Achillea lanulosa</i>	Western yarrow	3
<i>Asclepias stenophylla</i>	narrow-leaved milkweed	3
<i>Astragalus parryi</i>	Parry's milk vetch	3
<i>Atriplex canescens</i>	four-winged saltbush	3
<i>Brickellia rosmarinifolia</i> ssp. <i>chlorolepis</i>	false boneset	3
<i>Brickellia</i> spp.	unknown brickellbush	3
<i>Campanula rotundifolia</i>	common harebell	3
<i>Carex</i> spp. 1	unknown sedge 1	3
<i>Castilleja sessiliflora</i>	plains paintbrush	3
<i>Cerastium strictum</i>	mouse-eared chickweed	3
<i>Chenopodium berlandieri</i>	pitseed goosefoot	3
<i>Chrysothamnus parryi</i> ssp. <i>parryi</i>	Parry's rabbitbrush	3
<i>Critesion jubatum</i>	foxtail barley	3
<i>Delphinium geyeri</i>	Geyer's larkspur	3
<i>Distichlis stricta</i>	inland saltgrass	3
<i>Echinocereus viridiflorus</i>	green-flowered hedgehog cactus	3
<i>Elymus lanceolatus</i>	thickspike wheatgrass	3
<i>Erigeron divergens</i>	spreading fleabane	3
<i>Erigeron flagellaris</i>	whiplash fleabane	3
<i>Erigeron pumilus</i>	low daisy	3
<i>Eriogonum umbellatum</i>	wild buckwheat	3
<i>Erysimum capitatum</i>	Western wallflower	3
<i>Gaura mollis</i>	velvetweed	3
<i>Hedeoma hispida</i>	rough false pennyroyal	3
<i>Juncus arcticus</i> ssp. <i>ater</i>	arctic rush	3

Scientific name*	Common name	% of MGPM transects
<i>Lappula redowskii</i>	beggar's tick	3
<i>Lathyrus leucanthus</i>	white peavine	3
<i>Monarda fistulosa</i> var. <i>menthifolia</i>	horsemint	3
<i>Nothocalais cuspidata</i>	prairie false dandelion	3
<i>Nuttallia sinuata</i>	leechleaf blazingstar	3
<i>Opuntia fragilis</i>	brittle cactus	3
<i>Oxalis dillenii</i>	slender yellow woodsorrel	3
<i>Oxybaphus hirsutus</i>	hairy umbrellawort	3
<i>Oxytropis</i> spp.	unknown locoweed	3
<i>Packera plattensis</i>	prairie groundsel	3
<i>Padus virginiana</i> ssp. <i>melanocarpa</i>	chokecherry	3
<i>Phlox multiflora</i>	flowery phlox	3
<i>Physalis virginiana</i>	Virginia ground cherry	3
<i>Physaria bellii</i>	Bell's twinpod	3
<i>Physocarpus monogynus</i>	mountain ninebark	3
<i>Populus deltoides</i> ssp. <i>monilifera</i>	plains cottonwood	3
<i>Ribes aureum</i>	golden currant	3
<i>Ribes cereum</i>	wax currant	3
<i>Schizachyrium scoparium</i>	little bluestem	3
<i>Scutellaria brittonii</i>	Britton's skullcap	3
<i>Sporobolus airoides</i>	alkali sacaton	3
<i>Stanleya pinnata</i>	prince's plume	3
<i>Thermopsis divaricarpa</i>	spreadfruit goldenbanner	3
<i>Townsendia hookeri</i>	Easter daisy	3
<i>Tradescantia occidentalis</i>	spiderwort	3

Table NB4. Nonnative species found in the Mixed Grass Prairie Mosaic conservation target within the North TSA in 2010 (N=37 transects), ranked from most frequently occurring (based on percent of transects species were found in) to least frequently occurring species. Monitoring was conducted as part of the system-wide upland grassland monitoring.*OSMP scientific names are based on Weber and Wittmann, 2001.

Scientific name*	Common name	% of MGPM transects
<i>Alyssum parviflorum</i>	alyssum	100
<i>Tragopogon dubius</i> ssp. <i>major</i>	yellow salsify	89
<i>Bromus japonicus</i>	Japanese brome	86

Scientific name*	Common name	% of MGPM transects
<i>Convolvulus arvensis</i>	bindweed	86
<i>Lactuca serriola</i>	prickly lettuce	76
<i>Erodium cicutarium</i>	redstem filaree	57
<i>Anisantha tectorum</i>	cheatgrass	49
<i>Podospermum laciniatum</i>	false salsify	49
<i>Carduus nutans ssp. macrolepis</i>	musk thistle	46
<i>Sisymbrium altissimum</i>	Jim Hill mustard	43
<i>Bromopsis inermis</i>	smooth brome	38
<i>Camelina microcarpa</i>	littlepod false flax	38
<i>Acosta diffusa</i>	diffuse knapweed	35
<i>Melilotus officinale</i>	yellow sweet clover	30
<i>Neolepia campestris</i>	fieldcress	30
<i>Salsola australis</i>	prickly Russian-thistle	30
<i>Lepidium densiflorum</i>	peppergrass	24
<i>Polygonum arenastrum</i>	devil's shoestrings	24
<i>Medicago lupulina</i>	black medic	22
<i>Taraxacum officinale</i>	common dandelion	19
<i>Agropyron desertorum</i>	crested wheatgrass	16
<i>Silene antirrhina</i>	sleepy catchfly	16
<i>Verbascum thapsus</i>	common mullein	16
<i>Breea arvensis</i>	Canada thistle	11
<i>Chenopodium album</i>	goosefoot	11
<i>Fallopia convolvulus</i>	black bindweed	11
<i>Linaria genistifolia ssp. dalmatica</i>	Dalmation toadflax	11
<i>Melilotus albus</i>	white sweet clover	11
<i>Poa pratensis</i>	Kentucky bluegrass	11
<i>Descurainia sophia</i>	herb sophia	8
<i>Melilotus spp.</i>	unknown sweetclover	8
<i>Plantago lanceolata</i>	English plantain	8
<i>Poa compressa</i>	Canada bluegrass	8
<i>Rumex crispus</i>	curly dock	8
<i>Salvia aethiopsis</i>	Mediterranean sage	8
<i>Tridens muticus var. elongatus</i>	slim tridens	8
<i>Verbena bracteata</i>	bigbract verbena	8
<i>Ambrosia artemisiifolia var. elatior</i>	annual ragweed	5

Scientific name*	Common name	% of MGPM transects
<i>Bromus briziformis</i>	rattlesnakegrass	5
<i>Dipsacus fullonum</i>	common teasel	5
<i>Elytrigia repens</i>	quackgrass	5
<i>Glaucium corniculatum</i>	blackspot horned poppy	5
<i>Hypericum perforatum</i>	St. Johnswort	5
<i>Marrubium vulgare</i>	horehound	5
<i>Medicago sativa</i>	alfalfa	5
<i>Solanum rostratum</i>	buffalobur nightshade	5
<i>Thinopyrum intermedium</i>	intermediate wheatgrass	5
<i>Thlaspi arvense</i>	pennycress	5
<i>Arctium minus</i>	lesser burdock	3
<i>Atriplex heterosperma</i>	twoscale saltbush	3
<i>Bassia sieversiana</i>	kochia	3
<i>Chamaesyce serpyllifolia</i>	thymeleaf sandmat	3
<i>Cichorium intybus</i>	chicory	3
<i>Conyza canadensis</i>	horseweed	3
<i>Cuscuta epithimum ssp. approximata</i>	dodder	3
<i>Cylindropyrum cylindricum</i>	jointed goatgrass	3
<i>Dactylis glomerata</i>	orchardgrass	3
<i>Festuca arundinacea</i>	tall fescue	3
<i>Galium spurium</i>	cleavers	3
<i>Hordeum vulgare</i>	barley	3
<i>Nepeta cataria</i>	catnip	3
<i>Pseudognaphalium canescens</i>	Wright's cudweed	3
<i>Salsola spp.</i>	unknown Russian thistle	3
<i>Saponaria officinalis</i>	soapwort	3
<i>Securigera varia</i>	crownvetch	3
<i>Spergularia media</i>	sand spurry	3
<i>Stenactis strigosa</i>	daisy fleabane	3
<i>Thinopyrum ponticum</i>	tall wheatgrass	3
<i>Trifolium pratense</i>	red clover	3
<i>Trifolium repens</i>	white dutch clover	3
<i>Ulmus pumila</i>	Chinese elm	3
<i>Veronica peregrina ssp. xalapensis</i>	purslane speedwell	3

Table NB5. Native species found in the Xeric Tallgrass Prairie conservation target within the North TSA in 2010 (N= 5 transects), ranked from most frequently occurring (based on percent of transects species were found in) to least frequently occurring species. Monitoring was conducted as part of the system-wide upland grassland monitoring. *OSMP scientific names are based on Weber and Wittmann, 2001.

Scientific name	Common name	% of XTG transects
<i>Ambrosia psilostachya</i> var. <i>coronopifolia</i>	Western ragweed	100
<i>Andropogon gerardii</i>	big bluestem	100
<i>Artemisia frigida</i>	silver sage	100
<i>Artemisia ludoviciana</i>	prairie sage	100
<i>Carex pensylvanica</i> ssp. <i>heliophila</i>	sun sedge	100
<i>Erigeron colo-mexicanus</i>	running fleabane	100
<i>Hesperostipa comata</i>	needle-and-thread grass	100
<i>Koeleria macrantha</i>	prairie Junegrass	100
<i>Opuntia macrorhiza</i>	twistspine prickly-pear cactus	100
<i>Poa agassizensis</i>	Rocky Mountain bluegrass	100
<i>Yucca glauca</i>	yucca	100
<i>Bouteloua curtipendula</i>	sideoats grama	80
<i>Cerastium strictum</i>	mouse-eard chickweed	80
<i>Chenopodium pratericola</i>	desert goosefoot	80
<i>Elymus lanceolatus</i>	thickspike wheatgrass	80
<i>Helianthus pumilus</i>	rough sunflower	80
<i>Heterotheca villosa</i>	hairy goldenaster	80
<i>Phacelia heterophylla</i>	scorpionweed	80
<i>Psoralidium tenuiflorum</i>	slimflower scurfpea	80
<i>Allium cernuum</i>	nodding onion	60
<i>Campanula rotundifolia</i>	common harebell	60
<i>Cirsium ochrocentrum</i>	yellowspine thistle Wavyleaf thistle	60
<i>Dalea purpurea</i>	purple prairie clover	60
<i>Elymus elymoides</i>	squirreltail	60
<i>Eriogonum umbellatum</i>	wild buckwheat	60
<i>Erysimum capitatum</i>	Western wallflower	60
<i>Gaillardia aristata</i>	blanketflower	60
<i>Gaura coccinea</i>	scarlet gaura	60
<i>Grindelia squarrosa</i>	curly-cup gumweed	60
<i>Oxybaphus hirsutus</i>	hairy umbrellawort	60
<i>Padus virginiana</i> ssp. <i>melanocarpa</i>	chokecherry	60

Scientific name	Common name	% of XTG transects
<i>Penstemon virens</i>	blue mist penstemon	60
<i>Physalis virginiana</i>	Virginia ground cherry	60
<i>Rosa sayi</i>	wild rose	60
<i>Schizachyrium scoparium</i>	little bluestem	60
<i>Sporobolus cryptandrus</i>	sand dropseed	60
<i>Tradescantia occidentalis</i>	spiderwort	60
<i>Tragia ramosa</i>	stinging spurge	60
<i>Virgulus falcatus</i>	white prairie aster	60
<i>Allium textile</i>	textile onion	40
<i>Aristida purpurea</i>	purple three-awn	40
<i>Asclepias viridiflora</i>	green-flowered milkweed	40
<i>Aster porteri</i>	Porter aster	40
<i>Astragalus flexuosus</i>	wiry milk vetch	40
<i>Chondrosium gracile</i>	blue grama	40
<i>Comandra umbellata ssp. pallida</i>	bastard toadflax	40
<i>Drymocallis fissa</i>	bigflower cinquefoil	40
<i>Geranium caespitosum ssp. caespitosum</i>	Western purple crane's bill	40
<i>Heuchera parvifolia</i>	littleleaf alumroot	40
<i>Lathyrus leucanthus</i>	white peavine	40
<i>Lesquerella montana</i>	mountain bladderpod	40
<i>Liatris punctata</i>	dotted gayfeather	40
<i>Onosmodium molle ssp. occidentale</i>	Western marbleseed	40
<i>Opuntia polyacantha</i>	plains prickly-pear	40
<i>Oxalis dillenii</i>	slender yellow woodsorrel	40
<i>Oxybaphus linearis</i>	narrow-leaved umbrellawort	40
<i>Pascopyrum smithii</i>	Western wheatgrass	40
<i>Ratibida columnifera</i>	prairie coneflower	40
<i>Rhus aromatica ssp. trilobata</i>	three-leaf sumac	40
<i>Ribes cereum</i>	wax currant	40
<i>Senecio spartioides</i>	broom groundsel	40
<i>Asclepias spp.</i>	unknown milkweed	20
<i>Astragalus agrestis</i>	purple milk vetch	20
<i>Astragalus laxmannii</i>	prairie milk vetch	20
<i>Astragalus shortianus</i>	Short's milk vetch	20
<i>Boechera drummondii</i>	Drummond's rockcress	20
<i>Brickellia californica</i>	California brickellbush	20

Scientific name	Common name	% of XTG transects
<i>Bromopsis lanatipes</i>	woolly brome	20
<i>Cercocarpus montanus</i>	mountain mahogany	20
<i>Chamaesyce glyptosperma</i>	ribseed sandmat	20
<i>Cystopteris fragilis</i>	brITTLEfern	20
<i>Descurainia pinnata</i>	Western tansymustard	20
<i>Dichanthelium oligosanthes</i> var. <i>scribnerianum</i>	Scribner's rosette grass	20
<i>Echinocereus viridiflorus</i>	green-flowered hedgehog cactus	20
<i>Erigeron pumilus</i>	low daisy	20
<i>Evolvulus nuttallianus</i>	shaggy dwarf morning-glory	20
<i>Gutierrezia sarothrae</i>	broom snakeweed	20
<i>Harbouria trachypleura</i>	whiskbroom parsley	20
<i>Helianthus annuus</i>	common sunflower	20
<i>Hesperostipa spartea</i>	porcupine grass	20
<i>Lathyrus eucosmus</i>	peavine	20
<i>Leucopoa kingii</i>	kingspike fescue	20
<i>Monarda fistulosa</i> var. <i>menthifolia</i>	horsemint	20
<i>Muhlenbergia montana</i>	mountain muhly	20
<i>Muhlenbergia wrightii</i>	spike muhly	20
<i>Nassella viridula</i>	green needlegrass	20
<i>Nuttallia sinuata</i>	leechleaf blazingstar	20
<i>Oenothera villosa</i> ssp. <i>strigosa</i>	common evening-primrose	20
<i>Oligosporus dracunculus</i> ssp. <i>glaucus</i>	wild tarragon	20
<i>Oreobatus deliciosus</i>	Boulder raspberry	20
<i>Oryzopsis asperifolia</i>	rough-leaved ricegrass	20
<i>Oxytropis sericea</i>	silver locoweed	20
<i>Pediocactus simpsonii</i> var. <i>minor</i>	ball cactus	20
<i>Penstemon secundiflorus</i>	sidebells penstemon	20
<i>Physalis hederifolia</i> var. <i>comata</i>	ivy leaf ground cherry	20
<i>Poa nemoralis</i> ssp. <i>interior</i>	inland bluegrass	20
<i>Prunus americana</i>	American plum	20
<i>Rhus glabra</i>	smooth sumac	20
<i>Scutellaria brittonii</i>	Britton's skullcap	20
<i>Sorghastrum avenaceum</i>	yellow Indiangrass	20
<i>Sporobolus asper</i>	dropseed	20
<i>Sporobolus heterolepis</i>	prairie dropseed	20

Scientific name	Common name	% of XTG transects
<i>Tithymalus brachyceras</i>	Rocky Mountain spurge	20
<i>Toxicodendron rydbergii</i>	poison-ivy	20

Table NB6. Nonnative species found in the Xeric Tallgrass Prairie conservation target within the North TSA in 2010 (N= 5 transects), ranked from most frequently occurring (based on percent of transects species were found in) to least frequently occurring species. Monitoring was conducted as part of the system-wide upland grassland monitoring. *OSMP scientific names are based on Weber and Wittmann, 2001.

Scientific name	Common name	% of XTG transects
<i>Alyssum parviflorum</i>	alyssum	100
<i>Bromus japonicus</i>	Japanese brome	100
<i>Lactuca serriola</i>	prickly lettuce	100
<i>Poa compressa</i>	Canada bluegrass	100
<i>Tragopogon dubius ssp. major</i>	yellow salsify	100
<i>Anisantha tectorum</i>	cheatgrass	80
<i>Sisymbrium altissimum</i>	Jim Hill mustard	80
<i>Verbascum thapsus</i>	common mullein	80
<i>Silene antirrhina</i>	sleepy catchfly	60
<i>Breea arvensis</i>	Canada thistle	40
<i>Camelina microcarpa</i>	littlepod false flax	40
<i>Carduus nutans ssp. macrolepis</i>	musk thistle	40
<i>Chenopodium album</i>	goosefoot	40
<i>Erodium cicutarium</i>	redstem filaree	40
<i>Galium spurium</i>	cleavers	40
<i>Lepidium densiflorum</i>	peppergrass	40
<i>Linaria genistifolia ssp. dalmatica</i>	Dalmation toadflax	40
<i>Ambrosia artemisiifolia var. elatior</i>	annual ragweed	20
<i>Bromopsis inermis</i>	smooth brome	20
<i>Convolvulus arvensis</i>	bindweed	20
<i>Conyza canadensis</i>	horseweed	20
<i>Marrubium vulgare</i>	horehound	20
<i>Neolepia campestris</i>	fieldcress	20
<i>Panicum capillare</i>	witchgrass	20
<i>Pseudognaphalium canescens</i>	Wright's cudweed	20
<i>Secale cereale</i>	cereal rye	20
<i>Taraxacum officinale</i>	common dandelion	20

Scientific name	Common name	% of XTG transects
<i>Ulmus pumila</i>	Chinese elm	20

Table NB7. Average cover of substrate and total vegetation (± 1 standard error of the mean) found in the Mixed Grass Prairie Mosaic (MGPM) and Xeric Tallgrass Prairie (XTP) conservation targets within the North TSA in 2010

	MGPM	XTP
Number of transects	37	5
Bare soil/ground cover	13.1 \pm 2.0	1.6 \pm 0.7
Litter cover	29.5 \pm 2.1	18.4 \pm 2.0
Rock cover	3.9 \pm 0.8	18.0 \pm 4.1
Total vegetation cover	53.4 \pm 2.1	62.0 \pm 2.6

N-Appendix B: Literature Cited

Carsey, K., G. Kittel, K. Decker, D.J. Cooper, and D. Culver. 2003. Field Guide to Wetland and Riparian Plant Associations of Colorado. Colorado Natural Heritage Program, Fort Collins, Colorado.

Colorado Natural Heritage Program (CNHP). 2015. Rare species and communities tracking lists. Available from <http://www.cnhp.colostate.edu/download/list.asp> (accessed June 2015).

Grossman, D. H., D. Faber-Langendoen, A. S. Weakley, M. Anderson, P. Bourgeron, R. Crawford, K. Goodin, S. Landaal, K. Metzler, K. D. Patterson, M. Pyne, M. Reid, and L. Sneddon. 1998. International classification of ecological communities: terrestrial vegetation of the United States. Volume I. The National Vegetation Classification System: development, status, and applications. The Nature Conservancy, Arlington, Virginia, USA.

NatureServe. 2004. A habitat based strategy for delimiting plant element occurrences: guidance from the 2004 working group. Arlington, Virginia: NatureServe.

NatureServe. 2015. Plant community classification information. NatureServe Explorer: An online encyclopedia of life [web application]. NatureServe, Arlington, Virginia. Available from <http://www.natureserve.org/explorer> (accessed June 2015).

Stevens, D. L., Jr. and A. R. Olsen. 2004. Spatially-balanced sampling of natural resources. *Journal of American Statistical Association* 99(465): 262-278.

Weber, W.A. and R.C. Whittmann. 2001. Colorado Flora: Eastern Slope. 3rd Edition. University Press of Colorado, Boulder, Colorado.

N-Appendix C: Invasive Plant Species



Top: Common teasel (*Dipsacus fullonum*) dominated wetland
OSMP staff

Bottom: Jointed goatgrass (*Cylindropyrum cylindricum*) swath along trail
OSMP staff

Invasive plant species have the ability to thrive and spread aggressively outside their native range and can change ecological processes (Mummey and Rilling 2006 and Stinson et al. 2006), can promote more frequent fires (Coffman et al. 2010 and Balch et al. 2013), and reduce biomass and diversity of native flora and fauna (Gould and Gorchov 2000, Burghardt et al. 2009, Spyreas et al. 2010, Tallamy et al. 2010, and Hanula and Horn 2011). An "invasive species" is defined as a species that is 1) non-native (or alien) to the ecosystem under consideration, and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health (U.S. Department of Agriculture 2012). Most invasive plant species tracked and managed by OSMP are also noxious weeds that are alien (not native to the state) where the plant and parts of the plant have been designated by rule as being noxious as defined by the Colorado Noxious Weed Act, §§ 35-5.5-101 through 119, C.R.S. (2003). The Colorado Noxious Weed Act (35-5.5 CRS) established a noxious weed list with prioritized management goals for the weeds on the A, B, C, and Watch lists. Each noxious weed is required to be eradicated, contained or controlled (A and B lists only). Elimination means the removal or destruction of all emerged, growing plants of a population of List A or List B species designated for elimination by the Commissioner. Plants mandated for elimination must not be allowed to spread. Containment means maintaining an intensively managed buffer zone that separates infested regions, where suppression activities prevail, from largely infested regions where elimination activities prevail. Suppression means reducing the vigor of noxious weed populations within an infested region, decreasing the propensity of noxious weed species to spread to surrounding lands and mitigating the negative effects of noxious weed populations on infested lands. **Maps N5 and N6** show the known locations of List A and List B species, respectively mandated for elimination within the North TSA planning area. Even though OSMP actively treats invasive plant species through various integrated methods, including noxious weeds as described in the Colorado Noxious Weed Act, preventing the spread of invasive plant species is the first and most efficient management method (Wittenberg & Cock 2001, Leung et al. 2002). Reducing the spread of invasive plant species, especially in areas with low presence (**Map N4**) is accomplished by containing known infestations through multiple active integrated methods and minimizing or eliminating human associated disturbance, limiting soil disturbances, establishing or maintaining competitive native plant communities, and preventing movement of propagules along disturbance routes and on users and equipment. Propagules are often moved along roadways on vehicles and

machinery, as well as, recreationists (Potito 1995, Pyle 1995, Sheley et al. 1996).

OSMP monitors the distribution and/or abundance of 116 invasive or alien plants species (**Table NC1**) and actively treats approximately 65 species on OSMP-managed lands each year. The management of invasive plant species on OSMP lands is a key focus of the department and integrated pest management considerations factor into most management decisions. A key to effective weed management is having accurate and consistent mapping of weed occurrences across the system. **Map N4** “Density of Priority Invasive Plant Species” is a visual representation of invasive plant densities in mapped areas of the North TSA.

In 2006 staff began mapping invasive plant species across the OSMP system using methods developed by Utah State University and referred to as Rapid Assessment Mapping (RAM). The primary objective of this project is to document the distribution and abundance of targeted invasive plant species across the range of native habitats and areas of management within Boulder OSMP lands. The information from this inventory is useful in the city’s ongoing efforts to improve strategic planning, to increase the effectiveness of field operations associated with invasive plant management and conservation efforts and to assist with recreation driven planning and construction projects.

Invasive plant mapping in 2006, 2007 and 2014 focused on large portions of the North TSA (**Map N4**). RAM inventories are conducted between June and August. Staffing and timing restrictions limit the amount of mapping possible in any given year so mapping is focused on more contiguous portions of the OSMP system and new properties. Additional portions of the North TSA will be mapped as resources become available.

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. 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 invasive plant patch the mapper recorded the species name, size of the infestation and percent cover in five categories ranging from a trace (less than one percent) to a majority (51-100 percent). Scattered patches separated by less than 50 meters were considered one distinct patch.

Map N4 displays a weighted density of the RAM invasive plant inventory data currently completed within the North TSA. 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

Table NC1. List of invasive plant species tracked and/or treated by the OSMP IPM program and species with known populations in the North TSA.

Common Name	Scientific Name	STATE DESIGNATION	PRESENT IN NORTH TSA
Absinth wormwood	<i>Artemisia absinthium</i>	B+	Yes
Bermudagrass	<i>Cynodon dactylon</i>		
Black locust	<i>Robinia pseudoacacia</i>		Yes
Bladder senna	<i>Colutea arborescens</i>		Yes
Bohemian knotweed	<i>Polygonum bohemicum</i>	A	Yes
Bouncingbet	<i>Saponaria officinalis</i>	B+	Yes
Bull thistle	<i>Cirsium vulgare</i>	B+	Yes
Canada thistle	<i>Cirsium arvense</i>	B	Yes
Cattail	<i>T. angustifolia & x glauca</i>		Yes
Cheatgrass	<i>Bromus tectorum</i>	C	Yes
Chicory	<i>Cichorium intybus</i>	C	Yes
Common buckthorn	<i>Rhamnus cathartica</i>		
Common Bugloss	<i>Anchusa officinalis</i>	Watch	
Common burdock	<i>Arctium minus</i>	C	Yes
Common mullein	<i>Verbascum thapsus</i>	C	Yes
Common reed	<i>Phragmites australis var australis</i>		
Common tansy	<i>Tanacetum vulgare</i>	B+	Yes
Common teasel	<i>Dipsacus fullonum</i>	B +	Yes
Corn chamomile	<i>Anthemis arvensis</i>	B	
Cotoneaster	<i>Cotoneaster sp.</i>		Yes

Common Name	Scientific Name	STATE DESIGNATION	PRESENT IN NORTH TSA
Crack Willow	<i>Salix Fragilis</i>		Yes
Creeping buttercup	<i>Ranunculus repens</i>		Yes
Crown vetch	<i>Securigera [Coronilla] varia</i>		Yes
Cutleaf teasel	<i>Dipsacus laciniatus</i>	B+	Yes
Cypress spurge	<i>Euphorbia cyparissias</i>	A	
Dalmatian toadflax	<i>Linaria genistifolia subsp. dalmatica</i>	B +	Yes
Dame's rocket	<i>Hesperis matronalis</i>	B +	Yes
Diffuse knapweed	<i>Centaurea diffusa</i>	B+	Yes
Dyer's woad	<i>Isatis tinctoria</i>	A	
Eurasian watermilfoil	<i>Myriophyllum spicatum</i>	B	
European barberry	<i>Berberis vulgaris</i>		
European privet	<i>Ligustrum vulgare</i>		Yes
Field bindweed	<i>Convolvulus arvensis</i>	C	Yes
Garden loosestrife	<i>Lysimachia vulgaris</i>		Yes
Garlic mustard	<i>Alliaria petiolata</i>	Watch	Yes
Giant knotweed	<i>Polygonum sachalinense</i>	A	
Green Ash	<i>Frazinus pennsylvanica var. lanceolata</i>		Yes
Hairy willow-herb	<i>Epilobium hirsutum</i>	A	Yes
Himalayan blackberry	<i>Rubus armeniacus</i>	Watch	
Hoary cress	<i>Cardaria draba</i>	B+	Yes

Common Name	Scientific Name	STATE DESIGNATION	PRESENT IN NORTH TSA
Honeysuckle	<i>lonicera morrowii</i> and <i>l. tatarica</i>		Yes
Houndstongue	<i>Cynoglossum officinale</i>	B+	Yes
Japanese barberry	<i>Berberis vulgaris</i>		
Japanese brome	<i>Bromus japonicus</i>		Yes
Japanese knotweed	<i>Polygonum cuspidatum</i>	A	
Jointed goatgrass	<i>Aegilops cylindrical</i>	B+	Yes
Honeylocust	<i>Gleditsia triacanthos</i>		Yes
Kochia	<i>Kochia scoparia</i>		Yes
Leafy spurge	<i>Euphorbia esula</i>	B +	Yes
Mayweed chamomile	<i>Anthemis cotula</i>	B	
Mediterranean sage	<i>Salvia aethiopsis</i>	A	Yes
Moth mullein	<i>Verbascum blattaria</i>	B +	Yes
Musk thistle	<i>Carduus nutans</i>	B	Yes
Myrtle spurge	<i>Euphorbia myrsinites</i>	A	Yes
Orange hawkweed	<i>Hieracium aurantiacum</i>	A	Yes
Oxeye daisy	<i>Chrysanthemum leucanthemum</i>	B +	Yes
Perennial pepperweed	<i>Lepidium latifolium</i>	B+	Yes
Perennial sowthistle	<i>Sonchus arvensis</i>	C	Yes
Perennial sweetpea	<i>Lathyrus latifolius</i>		Yes
Plumeless thistle	<i>Carduus acanthoides</i>	B+	
Poison hemlock	<i>Conium maculatum</i>	C	Yes

Common Name	Scientific Name	STATE DESIGNATION	PRESENT IN NORTH TSA
Puncturevine	<i>Tribulus terrestris</i>	C	Yes
Purple loosestrife	<i>Lythrum salicaria</i>	A	Yes
Quackgrass	<i>Elytrigia repens</i>	B	Yes
Queen of the Meadow	<i>Filipendula ulmaria</i>		
Red horned poppy	<i>Glaucium corniculatum</i>		Yes
Redstem filaree	<i>Erodium cicutarium</i>		Yes
Reed canarygrass	<i>Phalaris arundinacea</i>		Yes
Rush skeletonweed	<i>Chondrilla juncea</i>	A	
Russian knapweed	<i>Acroptilon repens</i>	B+	Yes
Russian-olive	<i>Elaeagnus angustifolia</i>	B	Yes
Salt cedar	<i>Tamarix chinensis</i> , <i>T. parviflora</i> and <i>T. ramosissima</i>	B+	Yes
Scentless chamomile	<i>Matricaria perforata</i>	B +	
Scotch thistle	<i>Onopordum acanthium</i> , <i>O. tauricum</i>	B	Yes
Siberian elm	<i>Ulmus pumila</i>		Yes
Spotted knapweed	<i>Centaurea maculosa</i>	B+	Yes
Squarrose knapweed	<i>Centaurea virgata</i>	A	
Sulfur cinquefoil	<i>Potentilla recta</i>	B+	Yes
Sweetbriar rose	<i>Rosa rubiginosa</i>		Yes
Tall oatgrass	<i>Arrhenatherum elatius</i>		Yes
Tansy ragwort	<i>Senecia jacobaea</i>	A	
Tree of Heaven	<i>Ailanthus altissima</i>		Yes

Common Name	Scientific Name	STATE DESIGNATION	PRESENT IN NORTH TSA
Wayfaring Tree	<i>Viburnum lantana</i>		Yes
White campion	<i>Silene alba</i>		Yes
White Horehound	<i>Marrubium vulgare</i>		Yes
Wild caraway	<i>Carum carvi</i>	B	
Wild four o'clock	<i>Mirabilis nyctaginea</i>		
Yellow iris	<i>Iris pseudacorus</i>		Yes
Yellow starthistle	<i>Centaurea solstitialis</i>	A	
Yellow toadflax	<i>Linaria vulgaris</i>	B +	Yes

Bold used in Invasive Plant Density Map

(Map N4)

B+ species mandated for elimination in Boulder County or a portion of Boulder County (*does not include species where elimination is only mandated along public parking areas, roads and within 15 feet of the mean high water mark of perennial and intermittent streams*).

N-Appendix C: Literature Cited

- Balch, J.K., B.A. Bradley, C.M. D'Antonio, and J. Gómez-Dans. 2013. Introduced annual grass increases regional fire activity across the arid western USA (1980-2009). *Global Change Biology*, 19:173-183. doi: 10.1111/gcb.12046
- Burghardt, K.T., D.W. Tallamy, and G.W. Shriver. 2009. Impact of Native Plants on Bird and Butterfly Biodiversity in Suburban Landscapes. *Conservation Biology* 23: 219-224. doi: 10.1111/j.1523-1739.2008.01076.x
- Coffman, G.C., R.F. Ambrose, and P.W. Rundel. 2010. Wildfire promotes dominance of invasive giant reed (*Arundo donax*) in riparian ecosystems. *Biological Invasions* 12: 2723-2734.
- Gould, A. and D.L. Gorchov. 2000. Effects of exotic invasive shrub *Lonicera maackii* on the survival and fecundity of three species of native annuals. *The American Midland Naturalist* 144: 36-50.
- Haunla, J.L. and S. Horn. 2011. Removing an invasive shrub (Chinese privet) increases native bee diversity and abundance in riparian forests of the southeastern United States. *Insect Conservation and Diversity* 4: 275-283. doi: 10.1111/j.1752-4598.2011.00131.x
- Leung, B., D.M. Lodge, D. Finnoff, J.F. Shogren, M.A. Lewis, and G. Lamberti. 2002. An ounce of prevention or a pound of cure: bioeconomic risk analysis of invasive species. *Proceedings of the Royal Society of London* 169: 2407-2413.
- Mummey D.L., and M.C. Rilling. 2006. The invasive plants species *Centaurea maculosa* alters arbuscular mycorrhizal fungal communities in the field. *Plant and Soil* 288: 81-90.
- Potito, A. 1995. Impacts of recreation trails on exotic and invasive species distribution in grassland areas along the Colorado Front Range (MA Thesis). University of Colorado, Boulder.
- Pyle, L. 1995. Effects of disturbance on herbaceous exotic plant species on the floodplain of the Potomac River. *American Midland naturalist* 134: 244-253.
- Sheley, R., M. Manoukian, and G. Marks. 1996. Preventing noxious weed invasion. *Rangelands* 18: 100-101.
- Spyreas, G., B.W. Wilm, A.E. Plocher, D.M. Ketzner, J.W. Matthews, J.L. Ellis, and E.J. Heske. 2010. Biological consequences of invasion by reed canary grass (*Phalaris arundinacea*). *Biological Invasions* 12: 1253-1267.
- Stinson K.A., S.A. Campbell, J.R. Powell, B.E. Wolfe, R.M. Callaway, G.C. Thelen, S.G. Hallet, D. Prati, and J.N. Klironomos. 2006. Invasive Plant Suppresses the Growth of Native Tree

Seedlings by Disrupting Belowground Mutualisms. PLoS Biol 4(5): e140
doi:10.1371/journal.pbio.0040140.

Tallamy, D.W., M. Ballard, V. D'Amico. 2010. Can alien plants support generalist insect herbivores? *Biological Invasions* 12: 2285-2292.

Wittenberg, R. and M.J.W. Cock (eds.). 2001. Invasive alien species: a toolkit of best prevention and management practices. CAB International, Wallingford, Oxon, UK.

U.S. Department of Agriculture, National Invasive Species Information Center. 2012. What is an Invasive Species? Available from <http://www.invasivespeciesinfo.gov/whatis.shtml> (accessed May 2015).

N-Literature Cited

Andrews, R. and R. Righter. 1992. Colorado Birds Denver Museum of Natural History, Denver, CO.

Baker, W.L., and S.M. Galatowitsch. 1985. The Boulder tallgrass prairies. Boulder County Nature Association, Boulder, Colorado.

Beidleman, C. A. 2000. Partners in Flight Land Bird Conservation Plan, Colorado, Version 1. Colorado Partners in Flight

Benedict, A.D. 1991. A Sierra Club Naturalist's Guide: The Southern Rockies. Sierra Club Books, San Francisco.

Benninger-Truax, M., J. L. Vankat and R. L. Schaefer. 1992. Trail corridors as habitat and conduits for movement of plant species in Rocky Mountain National Park, Colorado. *Landscape Ecology* 6(4): 269-278.

Blakesley, J. A., D. C. Pavlacky, Jr., and D. J. Hanni. 2010. Monitoring the birds of the Southern Rockies/Colorado Plateau Bird Conservation Region (BCR 16), 2009 field season report. Tech Rep. SC-RMR-USFS09-01. Rocky Mountain Bird Observatory, Brighton, CO, 40 pp.

Bock, J.H., and C.E. Bock. 1998. Tallgrass prairie: remnants and relicts. *Great Plains Research* 8:213-230.

Bock, C.E., J.H. Bock, and B.C. Bennett. 1999. Songbird abundance in grasslands at a suburban interface on the Colorado high plains. *Studies in Avian Biology* 19: 131-136.

Boone, T. 1990. Beech open space management plan. Unpublished report. Boulder County Parks and Open Space, Resource Management Division.

Boulder County. 2013. Boulder County Comprehensive Plan, List of Wildlife Species of Special Concern. Boulder County Land Use Department, Boulder, Colorado. Available from <http://www.bouldercounty.org/doc/landuse/bccp-wssc.pdf> (accessed May 2015).

Braddock, W.A. Undated. Geology of Beech Open Space. Unpublished report. Boulder County Parks and Open Space Department.

Branson, F.A., R.F. Miller, and I.S. McQueen. 1965. Plant communities and soil moisture relationships near Denver, Colorado. *Ecology*: 46(3): 311-319.

Bridge, Raymond. 2008. Geology of the Denver Area. Lone Eagle Publications, Boulder, Colorado.

- Buckner, D.L. 1994. Report of Findings: Nature and distribution of warm season grassland, Section 16, R70W, T2S, Jefferson County, Colorado. Unpublished report prepared for Western Aggregates Inc.
- City of Boulder. 1996. North Boulder Valley Inventory Report. City of Boulder Open Space and Mountain Parks, Boulder, Colorado.
- City of Boulder. 2005. Boulder Valley Comprehensive Plan. City of Boulder Development and Planning Services, Boulder, Colorado. Available from <http://www.ci.boulder.co.us/files/PDS/BVCP/bvcp.pdf> (accessed January 2008).
- City of Boulder. 2010. Grassland Ecosystem Management Plan. City of Boulder Open Space and Mountain Parks, Boulder, Colorado. Available from <https://www-static.bouldercolorado.gov/docs/final-grassland-plan-1-201305101529.pdf> (accessed May 2015).
- Colorado Natural Heritage Program (CNHP). 2015. Rare species and communities tracking lists. Available from <http://www.cnhp.colostate.edu/download/list.asp> (accessed June 2015).
- Cole, D. N. 1978. Estimating the susceptibility of wildland vegetation to trailside alteration. *Journal of Applied Ecology* 15: 281-286.
- Colorado Natural Heritage Program. 2007. Western Great Plains Cliff, Outcrop and Shale Barren Ecological System: Ecological Integrity Assessment. Colorado Natural Heritage Program and Colorado State University.
- Colorado Natural Heritage Program. 2008. Survey of Critical Biological Resources in Boulder County, Colorado. Colorado Natural Heritage Program and Colorado State University.
- Colorado Division of Wildlife. 2006. Colorado's Comprehensive Wildlife Conservation Strategy (CWCS) and Wildlife Action Plans.
- Colorado Parks and Wildlife. 2014. State Wildlife Action Plan: Species of Greatest Conservation Need. Available at: <http://cpw.state.co.us/aboutus/Pages/StateWildlifeActionPlan.aspx>. (accessed June 2015).
- Cushman, R.C., S.R. Jones, and J. Knopf. Boulder County Nature Almanac. Pruett Publishing Co., Boulder, Colorado.
- Evanoff, Emmett. 2001. Sedimentary Rocks of the Boulder Valley. University of Northern Colorado affiliation. Graphic available at: <https://www-static.bouldercolorado.gov/docs/boulder-sediments-1-201305101122.pdf>. (accessed June 2015).
- Greene, E., V. R. Muehter, and W. Davison. 2014. Lazuli Bunting (*Passerina amoena*), The Birds of North America Online (A. Poole, Ed.) Ithaca: Cornell Lab of Ornithology.

Haire, S.L., C.E. Bock, B.S. Cade, and B.C. Bennett. 2000. The role of landscape and habitat characteristics in limiting abundance of grassland nesting songbirds in an urban open space. *Landscape and Urban Planning* 48: 65-82.

Hamilton, W.J., III. 1962. Bobolink migratory patterns and their experimental analysis under night skies. *Auk* 79: 208-233.

Hammit WE and DN Cole. 1987. Wildland recreation: ecology and management. John Wiley and Sons, New York.

Hanson, H.C., and E. Dahl. 1957. Some grassland communities in the mountain-front zone in northern Colorado. *Vegetation* 7: 249-270.

Harlan, Casey and Associates, Inc. 1993. Remedial investigation Beech Aircraft, Boulder Colorado facility. Remedial investigation report and remedial measures plan. Volume I: Text. Beech Aircraft Corporation, Wichita, Kansas.

Henderson, J. 1907. The annotated notebooks of Denis Gale. Unpublished manuscript. Rare Books Room, Norlin Library, University of Colorado, Boulder

Hoekstra, J.M., T.M. Boucher, T.H. Ricketts, and Carter Roberts. 2005. Confronting a biome crisis: global disparities of habitat loss and protection. *Ecology Letters* 8: 23-29.

Hoogland, J.L., editor. 2006. Conservation of the Black-tailed Prairie Dog. Island Press, Washington, D.C.

Jollie, M.T. 1943. The Golden eagle: its life history, behavior and ecology. Ph. D. Thesis, University of Colorado, Boulder.

Jones, S.L. 1998. Rock Wren, *Salpinctes obsoletus*. In The Colorado Breeding Bird Atlas. H. Kingery, Ed. Colorado Atlas Partnership.

Jordan, M. 2000. Ecological impacts of recreational use of trails: a literature review. The Nature Conservancy. Available: <http://www.parks.ca.gov/pages/795/files/ecologicalimpactsrecreationalusers.pdf> (accessed June 2015).

Kelso, S., N.W. Bower, K.E. Heckmann, P.M. Beardsley, and D.G. Greve. 2003. Geobotany of the Niobrara chalk barrens in Colorado: a study of edaphic endemism. *Western North American Naturalist* 63(3): 299-313.

Kingery, H.E., Editor. 1998. Colorado Breeding Bird Atlas. Colorado Bird Atlas Partnership.

Knopf, F.L. 1985. Significance of riparian vegetation to breeding birds across an altitudinal cline. Pages 105-111 in R.R. Johnson, C.D. Zeibell, D.R. Patten, P.F. Folliot, and R.H. Hamre, Technical Coordinators. Riparian ecosystems and their management: reconciling conflicting

uses. General Technical Report RM-120. U.S. Department of Agriculture Forest Service Rocky Mountain Research Station, Fort Collins, Colorado.

Knopf, F.L. 1996. Prairie conservation: preserving North America's most endangered ecosystem. Samson, F. B. and F. L. Knopf, Eds. Island Press, Covelo, CA.

Kothera, L. 2006. Population genetics and incidence of hybridization in the rare Colorado endemic plant *Physaria bellii*. Ph.D. dissertation, Colorado State University, Fort Collins, Colorado.

Kotliar, N.B., B.W. Baker, A.D. Whicker, and G. Plumb. 1999. A critical review of assumptions about the prairie dog as a keystone species. *Environmental Management* 24: 177–192.

Kretzer, J.E., and J.F. Cully Jr. 2001. Effects of black-tailed prairie dogs on reptiles and amphibians in Kansas shortgrass prairie. *The Southwestern Naturalist* 46: 171–177.

Leidolf, A., T. Nuttle, M. L. Wolfe. 2007. Spatially scaled response of a Lazuli Bunting population to fire. *Western North American Naturalist* 67: 1-7.

Livingston, R.B. 1952. Relict true prairie communities in Colorado. *Ecology* 33(1): 72-86.

Mieras, Barbara. 2002. Hand-drawn stratigraphic cross section, "Major Units in Boulder Stratigraphy". Unpublished; used for OSMP educational programs.

Moir, W.H. 1969. Steppe communities in the foothills of the Colorado Front Range and their relative productivities. *American Midland Naturalist* 81: 331-340.

Mutel, C.F. and J.C. Emerick. 1992. From Grassland to Glacier: The Natural History of Colorado and the Surrounding Region. Johnson Books, Boulder, Colorado.

Pasbrig, C. A., K. D. Koupal, S. Schainost, and W. W. Hogback. 2012. Changes in range-wide distribution of plains topminnow *Fundulus sciadicus*. *Endangered Species Research* 16: 235-247.

Pineda, P.M., and A.R. Ellingson. 1998. A Systematic Inventory of Rare and Imperiled Butterflies on the City of Boulder Open Space and Mountain Parks. Colorado National Heritage Program, Fort Collins, Colorado.

Pitlick J., E.H. Houle, J.H. McCutchan, W. Lewis. 2014. Quantifying the effects of the 2013 flood on ecosystem components of front range streams. Unpublished report submitted to OSMP.

Prichard, D., H. Barrett, J. Cagney, R. Clark, J. Fogg, K. Gebhart, P.L. Hansen, B. Mitchell, and D. Tippy. 1993. Riparian Area Management: Process for Assessing Proper Functioning Condition. TR 1737-9 (Revised 1998). BLM/SC/ST-93/003+1737+REV95+REV98. U.S. Department of Interior Bureau of Land Management, Service Center, Denver, Colorado.

Prichard, D., C. Bridges, R. Krapf, S. Leonard, and W. Hagenbuck. 1994. Riparian Area Management: Process for Assessing Proper Functioning Condition for Lentic Riparian-Wetland Areas. TR 1737-11. BLM/SC/ST-94/008+1737. U.S. Department of Interior Bureau of Land Management, Service Center, Denver, Colorado.

Renwald, J.D. 1977. Effect of fire on Lark Sparrow nesting densities. *Journal of Range Management* 30: 283-285.

Runnells, D.D. 1976. Boulder: a sight to behold: guidebook. Estey Printing Company, Boulder, Colorado.

Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2014. *The North American Breeding Bird Survey, Results and Analysis 1966 - 2013. Version 01.30.2015* [USGS Patuxent Wildlife Research Center](http://www.fws.gov/patuxent/wildlife-research-center), Laurel, MD

Sherriff, R.L., and T.T. Veblen. 2007. Spatially-explicit reconstruction of historical fire occurrence in the ponderosa pine zone of the Colorado Front Range. *Ecosystems* 10: 311-323.

Shiple, B.K., and R.P. Reading. 2006. A comparison of herpetofauna and small mammal diversity on Blacktailed Prairie Dog (*Cynomys ludovicianus*) colonies and non-colonized grasslands in Colorado. *Journal of Arid Environments* 66: 27-41.

Shiple, B.K., D. Chiszar, K.T. Fitzgerald, & A.J. Saviola. 2013. Spatial ecology of prairie rattlesnakes (*Crotalus viridis*) associated with Black-tailed prairie dog (*Cynomys ludovicianus*) colonies in Colorado. *Herpetological Conservation and Biology*, 8, 240-250.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. 2015. Web Soil Survey. Available from <http://websoilsurvey.nrcs.usda.gov/>. (accessed June 2015).

Sovell, J. 2013. Surveying imperiled butterflies and assessing butterfly habitat quality at North Boulder Grasslands. Colorado Natural Heritage Program final report to City of Boulder Open Space and Mountain Parks.

Sovell, J. 2014. Butterfly Community Survey at North Boulder Grasslands, City of Boulder Boulder Open Space and Mountain Parks. Colorado Natural Heritage Program final report to City of Boulder Open Space and Mountain Parks.

Swengel S.R., D. Schlicht, F. Olsen, and A.B. Swengel. 2010. Declines of prairie butterflies in the midwestern USA. *Journal of Insect Conservation*, 15(1-2), 327-339.

Swengel A. B. and S.R. Swengel. 2013. Decline of *Hesperia ottoe* in Northern Tallgrass Prairie Preserves. *Insects* 4: 663-682.

Thompson, R., and J. Strauch. 1986. Habitat use by breeding birds on City of Boulder Open Space. Unpublished report prepared for City of Boulder Open Space and Real Estate Department. Boulder, Colorado.

U.S. Department of Agriculture, National Invasive Species Information Center. 2012. What is an Invasive Species? Available from <http://www.invasivespeciesinfo.gov/whatis.shtml> (accessed May 2015).

Vestal, A.G. 1914. Prairie vegetation of a mountain-front area in Colorado. *Botanical Gazette* 167: 1574-1582.

Warning , N. 2013. Rock wren nest attributes. Unpublished data- Lois Webster Fund Grant Report.

Wohl, E.E. 2001. *Virtual rivers: lessons from the mountain rivers of the Colorado Front Range*. Yale University Press, New Haven, Connecticut.

Wrucke, C.I. and R.S. Wilson. 1967. Geologic map of the Boulder quadrangle, Boulder County, Colorado. U.S. Geological Survey Open File Report 67-281.

Cultural Resources Appendices

C-Appendix A - Cultural Resources Section Glossary

Archaeology: 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 human-made object which is a form of 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 due to lack of maintenance.

Disturbance: something that negatively affects an archaeological site (e.g. destruction of historic integrity 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 history property is judged).

Formations: a formal mappable rock unit (it can be displayed on a map and in a cross-section). It is generally of one rock type such as sandstone or limestone or a sequence of rock types that are differentiated from those above, below and laterally. It is named by the geologists who originally mapped and described the rock unit (i.e. the Morrison Fm for the town of Morrison). Thickness is not a characteristic – it may be a few feet thick to thousands of feet thick.

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: associated with lives of persons or events that are significant in our past.
- Distinction in the Development of the Community of Boulder:

this is most applicable to an institution (religious, educational, civic, etc.) or business structure, though in 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.

Member: a smaller rock unit that is part of a formation and possesses characters that distinguish it from adjacent parts of the formation. It is useful to designate members when there are different rock types present within a formation (sandstone, shale, limestone, etc.) For example, the Dakota is sometimes considered a formation with different rock members or some geologists raise the level of the different rock types to formations and call it the Dakota Group.

National Register of Historic Places: 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 represents the work of a master, or that possesses high artistic merit;
- 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 portions or 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 particular 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 regardless 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 characteristics:

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

C-Appendix B: Colorado Management Data Form

COLORADO CULTURAL RESOURCE SURVEY

OAHP1400

Management Data Form

Rev. 11/10

A *Management Data Form* should be completed for each cultural resource recorded during an archaeological survey. Isolated finds and revisits are the exception and they do not require a *Management Data Form*. Please attach the appropriate component forms and use continuation pages if necessary. Fields can be expanded or compressed as necessary.

1. Resource Number:

2. Temporary Resource Number:

3. Attachments (check as many as apply)

- Prehistoric Archaeological Component
- Historic Archaeological Component
- Linear Component
- Sketch/Instrument Map (required)
- U.S.G.S. Map Photocopy (required)
- Photograph(s) (required)
- Other, specify:

4. Official determination (OAHP use only)

- Determined Eligible NR\SR _____
- Determined Not Eligible NR\SR _____
- Nominated _____
- Need Data NR\SR _____
- Contributing to NR Dist.\SR Dist. _____
- Not Contributing to NR Dist.\SR Dist. _____
- Supports overall linear eligibility NR\SR _____
- Does not support overall linear eligibility NR\SR _____

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

National Register District name:

Historic: archaeology site building(s) structure(s) object(s) In existing National Register District

National Register District name:

9. Owner(s) Name and Address:

10. Boundary Description and Justification:

11. Site/Property Dimensions Length: m Width: m Area: m² Acres (m²/4047):

Area was calculated as: Length x Width (rectangle/square) Length x Width x 0.785 (Ellipse) GIS

II. LOCATION

12. Legal Location

PM ___ Township ___ Range ___ Section ___ ___ ¼ ___ ¼

PM ___ Township ___ Range ___ Section ___ ___ ¼ ___ ¼

PM ___ Township ___ Range ___ Section ___ ___ ¼ ___ ¼

PM ___ Township ___ Range ___ Section ___ ___ ¼ ___ ¼

If section is irregular, explain alignment method:

13. **USGS Quad:**

14. **County:**

15. **UTM Coordinates:** Datum used NAD 27 NAD 83 WGS 84 Other:

A. Zone ___; _____ mE _____ mN

B. Zone ___; _____ mE _____ mN

C. Zone ___; _____ mE _____ mN

D. Zone ___; _____ mE _____ mN

16. **UTM Source:** Corrected GPS/rectified survey (<5m error) Uncorrected GPS Map template

Other (explain):

17. **Site elevation** (feet):

18. **Address:** Lot: Block: Addition:

19. **Location/Access:**

III. NATURAL ENVIRONMENT/SITE CONDITION

20. **General Description** (should include both on site as well as geographical setting with aspect, landforms, vegetation, soils, depositional environment, water, ground visibility):

21. **Soil depth (cm) and description:**

22. **Condition**

a. Architectural/Structural

- Excellent
- Good
- Fair
- Deteriorated
- Ruin

b. Archaeological/Paleontological

- Undisturbed
- Light disturbance
- Moderate disturbance
- Heavy disturbance
- Total disturbance

23. **Describe condition:**

24. **Vandalism:** Yes No

Describe:

IV. NATIONAL/STATE REGISTER ELIGIBILITY ASSESSMENT

25. **Context or Theme:**

26. **Applicable National Register Criteria:**

- A. Associated with events that have made a significant contribution to the broad pattern of our history
- B. Associated with the lives of persons significant in our past
- 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
- D. Has yielded, or may be likely to yield, information important in history or prehistory
- Does not meet any of the National Register criteria
- Qualifies under exceptions A through G. List exception(s):

27. **Applicable State Register Criteria:**

- A. Property is associated with events that have made a significant contribution to history
- B. Property is connected with persons significant in history
- C. Property has distinctive characteristics of a type, period, method of construction or artisan
- D. Property is of geographic importance
- E. Property contains the possibility of important discoveries related to prehistory or history
- Does not meet any of the State Register criteria

28. **Area(s) of significance:**

29. **Period(s) of significance:**

30. **Level of significance:** National State Local

31. **Statement of significance:**

32. **Statement of historic integrity related to significance:**

33. **National Register Eligibility Field Assessment:**

Linear Segment Evaluation (if applicable):

Eligible

Supporting

Not eligible

Non Supporting

Need data

34. **Status in an Existing National Register District:**

Contributing

Non-contributing

35. **State Register Eligibility Field Assessment:**

Eligible

Not eligible

Need data

36. **Status in an Existing State Register District:**

Contributing

Non-contributing

37. **National/State Register District Potential:** Yes No Describe:

38. **Cultural Landscape Potential:** Yes No Describe:

39. **If Yes to either 37 or 38, is this site:** Contributing Non-contributing Explain:

V. MANAGEMENT AND ADMINISTRATIVE DATA

40. **Threats to Resource:** Water erosion Wind erosion Grazing Neglect Vandalism
 Recreation Construction Other (explain):

41. **Existing protection** None Marked Fenced Patrolled Access controlled
Other (specify):

Comments:

42. **Local landmark designation:**

43. **Easement:**

44. **Recorder's Management Recommendations:**

VI. DOCUMENTATION

45. **Previous actions accomplished at the site:** Tested Partial excavation Complete excavation

Date(s):

a. Excavations:

b. Stabilization:

Date(s):

c. HABS/HAER documentation [date(s) and numbers]:

d. Other:

46. **Known collections/reports/interviews and other references (list):**

47. **Primary location of additional data:**

48. **State or Federal Permit number:**

49. **Collection:** Artifact collection authorized: Yes No Were artifacts collected: Yes No
Artifact repository:

Collection method: Diagnostics Grab Sample Random Sample

Other (specify):

50. Photograph Numbers:

Files or negatives stored at:

51. Report title:

52. Recorder(s):

Date:

53. Recorder affiliation:

Phone number/Email:

NOTE: Please attach a site map, a photocopy of the USGS 1:24000 map indicating resource location, and photographs.

History Colorado - Office of Archaeology & Historic Preservation
1200 Broadway, Denver, CO 80203
303-866-3395

C- References

Boulder County. 1988. Boulder county comprehensive plan, goals, policies, and maps. Boulder Colorado: Boulder County Land Use Department (Section 17 – Historic Preservation Program, other cultural resource references throughout regarding open space purposes/land use designation, etc.)

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 Open Space Board of Trustees in 2000.*

City of Boulder. 1996. North Boulder Valley Inventory Report, City of Boulder Open Space Department.

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

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.*

City of Boulder. 2014. Class III Cultural Resources Survey of the Joder II, Lappin and Papini Open Space in Boulder County, Colorado. David Killam, for RMC Consultants, Inc.

City of Boulder. 1996. Cultural Resources of City of Boulder Open Space: North Boulder Valley, Boulder County, Colorado. Gleichman, Peter J. and Phillips, Scott C. for Native Cultural Resources.

City of Boulder. 1992. A Cultural Resource Inventory of City of Boulder Open Space Wonderland Lake to Lee Hill Road, Boulder County, Colorado. Gleichman, Peter J. for Native Cultural Resources

Holleran, Michael. 2005. Historic Context for Irrigation and Water Supply: Ditches and Canals in Colorado. Colorado Center for Preservation Research, University of Colorado at Denver and Health Sciences Center.

Joder, Dan. "Ranch History," *Joder Ranch website*, www.joderranch.com; July 30, 2013.

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

Cultural resource management (CRM) laws and agreements:

Boulder City – e.g. all the CRM guidelines in the BRC

Boulder County

State of Colorado

Federal – including US and Tribal Sovereignty law

Agricultural Resources

Appendices

A-Appendix A: Agricultural Inventory Irrigation and Fencing Details

Lease Area	Irrigation	Condition of Irrigation Infrastructure	Fencing	Condition of Fencing
Axelson-Johnson-Cowles-Dawson (AJCD)	Johnson Ditch and the Star Ditch	The irrigation infrastructure is relatively minimal. There are a few concrete junction and diversion boxes that are anywhere from 50-100 years old. These structures continue to function in a decent fashion but should be replaced within the next 2-5 years for the most efficient irrigation use. There are some drainage issues along 55 th Street from irrigation tailwater on the West Axelson property. This issue has been reoccurring for the past 10-15 years and is compromising the road edge of 55 th Street. The installation of additional field laterals on the interior side of the perimeter fence would help to prevent any further erosion issues along the 55 th Street.	10 strand high tensile fence	The fence design consists of all wooden line posts spaced at 60 foot intervals with 10 strands of a 12.5 gauge high tensile wire with a 200 ksi rating that is set at a pattern that encourages cattle to stay within its fenced boundary. Most of this fence was installed in the mid-1980s and is starting to deteriorate quickly. The typical lifespan of this style of fence is around 20-30 years, so this fence is in need of replacement in the near future.
Boulder Valley Ranch Complex	Farmers Ditch	All 292 currently irrigated acres are irrigated with Farmers Ditch water. Current infrastructure shortcomings only allow for 292 acres to be irrigated. There are multiple concrete diversions off of Farmers Ditch that service the area. These headgate structures vary from good to poor in condition and functionality. Water that is diverted from the ditch is conveyed in earthen laterals throughout the BVR complex. Tailwater drainage has been an occurring problem on the Lore/Ellison property near the Eagle trailhead. This drainage issue has also compromised the road edge of 55 th Street and occasionally floods the Eagle trailhead parking lot. Additional field laterals may be a solution to lessen the effects of excess tailwater.	10 strand high tensile fencing on the eastern properties and four strand barbwire fencing on most of the western properties	Much of the barbwire fencing to the west is 40 plus years old and is in various stages of disrepair. As this fence is due for replacement it is either being replaced with a 10 strand high tensile fence or a wildlife friendly four strand smooth wire/barbwire fence design.
Gallagher-Nu-West-Harrington	Farmers Ditch	Farmers ditch is piped through an underground lateral system that feeds the properties through multiple valves. The valves feed water through gated pipe on both Gallagher and Nu-West. The Gallagher hayfield is 39 acres and 100 percent irrigated. The middle third of the property is a natural drainage. It also drains the tailwater from the hayfield. The northern third of the property is occupied by prairie dogs and has not been irrigated for more than 10 years. There are 56 acres of the Nu-West/Harrington property that are irrigated pasture land. These acres are irrigated through the same piped system as the Gallagher hayfield. The	10 strand high tensile fencing on the north, east and west property boundaries and four strand barbwire fence on the shared property line to the west.	The high tensile fencing is in good to fair condition while the barbwire fence is in fair to poor shape. The barbwire fence at best estimate is 50-60 years old and is due for replacement. The Nu-West-Harrington fence is 10 strand high tensile fence on the north and west boundaries and four strand barbwire fence on the southeast boundary. The barbwire fence on the southeast boundary is owned/maintained by the Colorado Department of Transportation (CDOT) since it is the boundary to Highway 119. All fencing on the Nu-West-Harrington property is in good to fair condition.

Lease Area	Irrigation	Condition of Irrigation Infrastructure	Fencing	Condition of Fencing
		<p>pipings system runs underneath 51st Street to service the property. A section of the Nu-West property is irrigated through gated piping as well (approx. 25 acres) while the remaining 31 acres are irrigated through earthen laterals. The southern 20 acres of Nu-West are occupied by prairie dogs and are not currently irrigated.</p>		
Bennett-Steele	Table Mountain Ditch	<p>Both Bennett and Steele have irrigated hayfields which are irrigated with Table Mountain Ditch water. Irrigation infrastructure on the Steele property consists of earthen laterals that service the 20 acres of hay. Earthen laterals are also the main form of water delivery on the Bennett property. A small portion (eight acres) is fitted with gated pipe that is diverted through a newly installed concrete diversion. The Table Mountain Ditch runs through the middle of both properties. The Bennett hayfield is 35 acres and the Steele hayfield is 20 acres. Prairie dog occupation limits large portions of pasture on both properties.</p>	10 strand high tensile fence	<p>Fencing on the Bennett property is in fair to poor condition. Fencing on the Steele property is in good to fair condition.</p>
Campbell-Hester	Left Hand Ditch Company	<p>On Hester, 25 of the 39 acres are actively irrigated while 29 of the total 56 acres on the Campbell property are irrigated. An additional 17 acres have the ability to be irrigated on the Campbell property. During the flood of 2013, significant damage occurred on the eastern side of the Campbell property that has not allowed for irrigation to continue at this time. The main issue was two pipes that conveyed water over the top of the Left Hand Valley Inlet Ditch were washed out. Heavy sedimentation on the hayfield along with severe washing of the field laterals also contributed to the problem. Reconstruction efforts are in place to return irrigation water to the east side of Campbell by as early as the 2016 irrigation season.</p>	<p>Campbell property has mostly five strand barbwire fence. The northern boundary fence is a 10 strand high tensile fence. The fencing on the Hester property is a mix of four to five strand barbwire and 10 strand high tensile fence.</p>	<p>The high tensile fence on the Campbell property was recently replaced (2012) and is in good working condition. The barbwire fencing throughout the rest of the Campbell property is in fair to poor shape and will need to be completely replaced within the next five years. The western and northern boundary fence as well as the interior fence on the Hester property were replaced in 2012 and are in good working condition. The eastern and southern boundaries have been properly maintained and are in good condition.</p>
Deluca-Stratton	Left Hand Ditch Company	<p>All of the Deluca property is irrigated for hay production. Nearly 22 acres on the north end of the Stratton property is irrigated. These same 22 acres in the north are also serviced by a year round seep that keeps a constant amount of water in the field laterals. This seep is also directed into the northern most pond which connects to the other ponds through the fenced off 20 acre wet meadow. Due to the constant wet condition in the northern end of the Stratton</p>	<p>Four strand barbwire on the north, south and west boundaries and 10 strand high tensile fencing on the east side of the Deluca property. Interior fencing is field fencing that is 36 inch wire mesh fence with strands of barbwire on the top of it. The perimeter of the Stratton property has five strand barb-wire fencing and the interior fence around the wet meadow if strand wildlife friendly</p>	<p>Fencing on the Deluca property is in fair condition and will need to be replaced in the next five to 10 years. Perimeter fencing on the Stratton property is in fair to poor condition and will need to be replaced with the next two to four years. Stratton's interior wildlife friendly fencing was installed in 2012 and is in good condition.</p>

Lease Area	Irrigation	Condition of Irrigation Infrastructure	Fencing	Condition of Fencing
		<p>property it is only suitable for cattle production. The southern end of Stratton has historically been irrigated, but due to inconsistent use and lack of maintenance to the irrigation infrastructure, it is not currently able to be serviced. OSMP does have preliminary plans to improve irrigation infrastructure on the south end of the property to once again irrigate as much of the property as possible. Both Deluca and Stratton are serviced by Left Hand Ditch Company irrigation water.</p>	<p>fencing.</p>	
Bruning	<p>Left Hand Ditch Company and the Table Mountain Ditch Company</p>	<p>All 22 acres are irrigated and irrigation water sources are Left Hand Ditch Company and the Table Mountain Ditch Company.</p>	<p>10 strand high tensile fence</p>	<p>Fence is in fair condition and may need to be replaced in the next 10 to 15 years, but due to lack of grazing on the property, the fence only serves as a property boundary and will be low on any fence replacement priority list.</p>
Seigle	<p>Boulder and Whiterocks Ditch Company and Farmers Ditch Company</p>	<p>Hayfields are irrigated with Boulder and Whiterocks Ditch Company and Farmers Ditch Company irrigation water during the irrigation season (April–October). During the fall and winter months a small trickle is allowed down the Boulder and Whiterocks ditch that allows for cattle stock water. Water is run down a concrete lateral that parallels Highway 119 and is then diverted into earthen laterals within the fields.</p>	<p>10 strand high tensile fence for all interior fencing as well as the west, north and northeastern boundaries. The southeastern fence line is owned by CDOT and is a four strand barbwire fence.</p>	<p>These fences are in good to poor condition. The majority of this fence was replaced/repared in 2012 and will not be in need of replacement for 20+ years. Certain interior sections are in poor condition and will be repaired in 2015. All maintenance of the southeastern fence line is the responsibility of CDOT.</p>
Lousberg	<p>Farmers Ditch Company</p>	<p>Currently 22 acres are irrigated through field laterals that are diverted off of Farmers Ditch. Historically, an additional 15 acres were irrigated in the northwest pasture but due to a lack of use over time irrigation infrastructure in that area is no longer adequate. OSMP is currently exploring options to make that 15 acres irrigable in the next two years. This would increase the grass production available to the sheep and increase the overall production of the property. The five acres of organic vegetables are irrigated through a drip tape system. An irrigation pond was constructed in the southwest corner of the property in 2014 to accommodate the vegetable production. The drip tape is a slow release tubing installed 12 to 18 inches underground to irrigate the crops from the ground up. The drip tape is fed from the irrigation pond through a solar pumping system that allows the vegetable crops to be irrigated whenever they need to be during the irrigation</p>	<p>10 strand high tensile fence</p>	<p>This fence was newly installed or refurbished in early 2013 and is in good condition. This fence should not need replacement in the next 20 years. In order to keep the sheep where they need to be and to protect them from neighboring predators, the agricultural tenants use pliable wire mess fencing that can easily be installed and uninstalled quickly. In order not to overgraze a certain area the sheep must be moved frequently which requires constantly changing the fencing alignment within the lease area.</p>

Lease Area	Irrigation	Condition of Irrigation Infrastructure	Fencing	Condition of Fencing
		season (April–September) for the Farmers Ditch. There are also multiple sources of tailwater that run through the property. The tailwater and the pond in the center of the property serve as fall/winter water sources for the sheep on the property.		
Dagle	Left Hand Ditch Company	The two main conveyances of irrigation water are through a concrete lateral and through 10 inch gated pipe.	Four strand barbwire fencing and four strand smooth wire fencing.	Both fencing types are in good to fair condition and will not be in need of replacement for the next 15+ years.
Bison	Sweede Ditch Company and irrigation shares in the Colorado Big Thompson Irrigation Company	Nearly all (62 acres) of the Bison lease area is irrigated. The property is irrigated through a series of earthen field laterals in conjunction with a small run of a concrete lateral in the middle of the property.	Half of the perimeter fence on the Bison property is 10 strand high tensile fence while the other half is four strand barbwire fencing. The permanent interior fencing is also 10 strand high tensile fence. While cattle are present on the property, single strand electrical fence is temporarily installed to contain cattle in certain areas.	Not assessed
Ryan	No irrigation currently	The only water source for cattle is the drainage that runs along the south side of the lease area. That drainage typically goes dry by mid to late summer making it the main factor in determining the grazing season on the Ryan property. The Ryan property was historically irrigated, but that practice has not happened for 30+ years. OSMP is working with the private landowner to the west of the property as well as Boulder County Parks and Open Space to devise a way to return irrigation water to the property.	Four strand wildlife-friendly fencing	The fence was newly installed or refurbished in 2013, is in good condition and will not need replacement for the next 20+ years.
Oasis	Sweede Ditch Company		10 strand high tensile fence	The fencing is in good to fair condition
Berman Brothers	Lefthand		Four strand barbwire fence around the property except for the northern boundary which is not fenced and will be completed by the end of 2015.	The fencing is in good to fair condition

A- Literature Cited

Bent, A.C. 1958. Life histories of North American blackbirds, orioles, tanagers, and their allies. *United States National Museum Bulletin 211*: 28-52.

Hamilton, W.J., III. 1962. Bobolink migratory patterns and their experimental analysis under night skies. *Auk* 79: 208-233.

Martin, S.G., and T.A. Gavin. 1995. Bobolink (*Dolichonyx oryzivorous*). No. 176 in A. Poole and F. Gill, editors. *The Birds of North America*, The Academy of Natural Sciences, Philadelphia, and the American Ornithologists' Union, Washington, D.C.

Roeder, B. 1998. The effects of suburbanization and haying on the reproductive success of grassland birds breeding in hayfields in Boulder, Colorado. Unpublished report to the City of Boulder Department of Open Space.

Thompson, R., and J. Strauch. 1986. Habitat use by breeding birds on City of Boulder Open Space. Unpublished report prepared for City of Boulder Open Space and Real Estate Department. Boulder, Colorado.

Property Acquisition Appendices

P-Appendix A: Pre-2008 Acquisitions Currently Closed to Public Access Year-round

Up-to-date descriptions of the following 10 properties, acquired before 2008 and in the North TSA, are listed below in order to facilitate any potential changes in management or public access as part of the North TSA planning process. Recent planning and data collection for these properties has been incorporated into this summary, such as the Grassland Plan, vegetation and wildlife monitoring and agricultural operations.

Property	ABBOTT
Acres	51
Management Area Designation	Natural Area
Resource Values	<ul style="list-style-type: none"> • Agricultural land of statewide importance • Nesting and foraging habitat for raptors • Tiger salamander habitat • Rare plant communities • Active prairie dog habitat (transition area)
Management Issues	<ul style="list-style-type: none"> • Priority invasive species • Fencing and pasture in poor condition • Potential livestock trespass



Abbott Property

OSMP staff

Property	ANDREA
Acres	48
Management Area Designation	Natural Area
Resource Values	<ul style="list-style-type: none"> • Component of larger open space complex • Large wetland complex • Successful Northern harrier nesting sites in wetlands • Consistent elk migration route • Bell's twinpod population • Visual integrity of Potato Hill • Active prairie dog habitat (multiple objective area) • Agricultural land of statewide importance
Management Issues	<ul style="list-style-type: none"> • Priority invasive species • Adjacent land uses and multiple jurisdictions • Potential livestock trespass • Double fence line along western border with Ryan property creates wildlife barrier



Andrea Property

OSMP staff

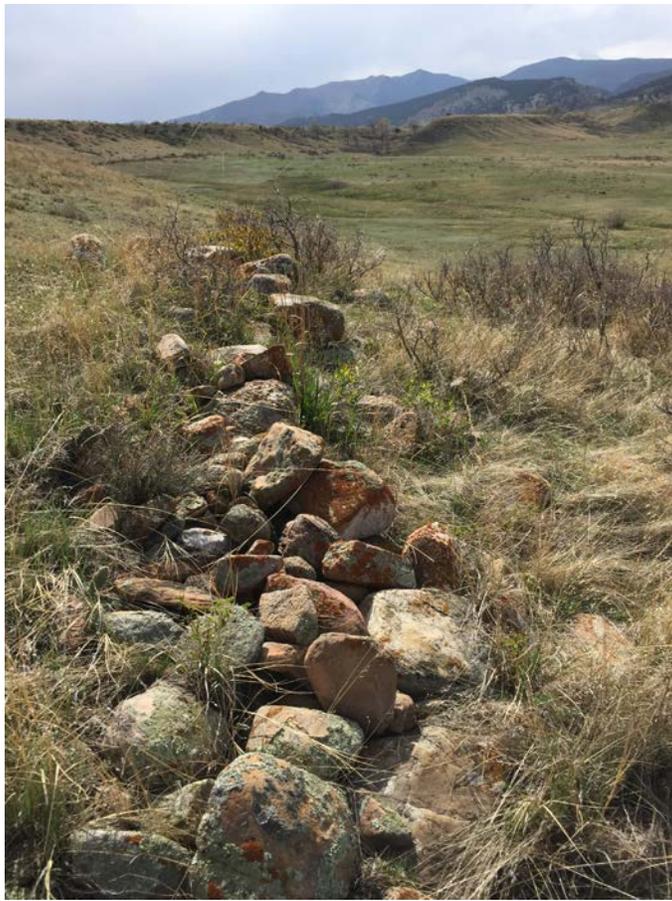
Property	JACOB
Acres	25
Management Area Designation	Natural Area
Resource Values	<ul style="list-style-type: none"> • Component of larger open space complex • Consistent elk migration route and wintering grounds • Bell's twinpod population • Diverse topography • Active prairie dog habitat (multiple objective area) • Agricultural land of statewide importance
Management Issues	<ul style="list-style-type: none"> • Priority invasive species • Scattered debris and safety hazards surrounding former home site



Jacob Property

OSMP staff

Property	RYAN
Acres	70
Management Area Designation	Natural Area
Resource Values	<ul style="list-style-type: none"> • Component of larger open space complex • Large wetland complex • Grassland bird habitat • Northern harrier nesting sites in wetlands • Consistent elk migration route and wintering grounds • Bell's twinpod population • Diverse topography • Active prairie dog habitat (multiple objective area) • Agricultural land of statewide importance • Northwestern portion is suitable agricultural land (active lease)
Management Issues	<ul style="list-style-type: none"> • Priority invasive species • Double fence line on eastern border with Andrea property creates wildlife barrier • Lack of clear emergency/administrative access



Ryan Property OSMP staff

Property	BENNETT
Acres	122
Management Area Designation	Agricultural Area
Resource Values	<ul style="list-style-type: none"> • Riparian and wildlife habitat • Raptor foraging and nesting habitat • This is the only property in North TSA with Northern leopard frogs • High restoration potential in pond • Rare plant communities • Active prairie dog habitat (transition area) • Agricultural land of statewide and local importance • Suitable agricultural land (active lease)
Management Issues	<ul style="list-style-type: none"> • Priority invasive species • Degraded grassland • Degraded pond habitat • Lack of clear access

Property	STEELE
Acres	95
Management Area Designation	Natural Area
Resource Values	<ul style="list-style-type: none"> • Visual integrity of Table Mountain slopes • Diverse topography • Bell's twinpod population • Agricultural values • Active prairie dog habitat (transition area) • Agricultural land of local importance • Suitable agricultural land (active lease)
Management Issues	<ul style="list-style-type: none"> • Priority invasive species • Erosive vertical ditch channel • Scattered debris

Property	BISON
Acres	64
Management Area Designation	Agricultural Area
Resource Values	<ul style="list-style-type: none"> • Agricultural land of statewide importance • Suitable agricultural land (active lease) • Open space buffer to St. Vrain corridor • Ground-nesting bird habitat, including bobolink
Management Issues	<ul style="list-style-type: none"> • Potential for priority invasive species • Lack of clear emergency/ administrative access



Bison Property

OSMP staff

Property	DODD
Acres	63
Management Area Designation	Natural Area
Resource Values	<ul style="list-style-type: none"> • Visual integrity of Table Mountain slopes • Diverse topography • Potential Bell's twinpod habitat • Foraging habitat for raptors • Active prairie dog habitat (multiple objective area) • Agricultural land of local importance
Management Issues	<ul style="list-style-type: none"> • Priority invasive species • Degraded grassland • Fencing in poor condition • Unauthorized access • Lack of clear emergency/administrative access

Property	OASIS
Acres	71
Management Area Designation	Agricultural Area
Resource Values	<ul style="list-style-type: none"> • Riparian habitat along ditch • Foraging habitat for raptors • Agricultural land of statewide importance • Potential for agricultural use • Active prairie dog habitat (removal area)
Management Issues	<ul style="list-style-type: none"> • Dominated by non-native species • Major infestations of priority invasive species



Oasis Property

OSMP staff

Property	WALDORF
Acres	74
Management Area Designation	Natural Area
Resource Values	<ul style="list-style-type: none"> • Preble's habitat along ditch • Rare plant communities • Foraging habitat for raptors • Potential cultural resource area • Part of elk migration route • Agricultural land of statewide importance • Potential for agricultural use
Management Issues	<ul style="list-style-type: none"> • Priority invasive species • Degraded grassland condition



Waldorf Property

OSMP staff

P-Appendix B: Properties in the North TSA without Management Area Designations

To facilitate decision-making about management area designations and public access for the following 10 properties, current conditions are summarized below. More detailed information about recreational, natural, cultural or agricultural resources on these properties is integrated into other sections of this inventory report to support an ecosystem-wide analysis.

BERMAN BROTHERS	
Acres	42
Surrounding Management Area Designation(s)	Natural Area; Agricultural Area
Public Access	Closed (Reason: New Property)
Resource Values	<ul style="list-style-type: none"> • Mixedgrass prairie mosaic • Wetland plant community • Agricultural land of statewide significance (suitable for hay or grazing) • Irrigation ditches • Ground-nesting bird habitat • Raptor foraging habitat
Management Issues	<ul style="list-style-type: none"> • Priority invasive species • Soils not suitable for vegetable farming • Boundary fencing and signing • Potential for illegal dumping off of Niwot Road • Public safety concerns from scattered debris, abandoned oil and gas well and cistern



Berman Brothers Property

ERO Resources Corp

LAPPIN	
Acres	42
Surrounding Management Area Designation(s)	Passive Recreation Area
Public Access	Closed (Reason: New Property)
Resource Values	<ul style="list-style-type: none"> • Open space buffer along urban edge of Boulder • Nesting habitat for raptors • Pond provides breeding area for state-threatened topminnow; pond holds potential for additional habitat restoration • Potential for agricultural use (small-scale animal operation) • Active prairie dog habitat (grassland preserve) • Limited cultural relevance and fossil record
Management Issues	<ul style="list-style-type: none"> • Safety concerns with adjacent rifle range • Scattered debris • Structures in poor condition • Priority invasive species • Fencing in poor condition • Illegal dumping • Poor soils • No irrigable water



Lappin Property

OSMP staff

STRATTON	
Acres	70
Surrounding Management Area Designation(s)	Natural Area
Public Access	Closed (Reason: New Property)
Resource Values	<ul style="list-style-type: none"> • Contiguous wetlands and sensitive riparian network • Nesting and perch sites for raptors • High restoration potential in ponds • Native amphibians present in southern pond • Agricultural lands of statewide significance • Roughly 30 acres of suitable agricultural land (active grazing lease) • Active prairie dog habitat (removal area)
Management Issues	<ul style="list-style-type: none"> • Trespass and enforcement issues • Potential illegal dumping • Multiple land uses and sensitive resources • Signing and parking for public access • Priority invasive species • Fencing and signing, especially along eastern boundary • Safety concerns with scattered debris, including barbeque pit and wood pile



Stratton Property

ERO Resources Corp

DAGLE II	
Acres	14
Surrounding Management Area Designation(s)	Natural Area, Habitat Conservation Area
Public Access	Closed (Reason: New Property)
Resource Values	<ul style="list-style-type: none"> • Mixedgrass prairie mosaic • Suitable agricultural land (active lease) • Homesite and barn
Management Issues	<ul style="list-style-type: none"> • Fencing west of ditch prevents additional agricultural use • Potential for priority invasive species

JODER COMPLEX	
Acres (Joder II)	331
Acres (Cox)	3
Surrounding Management Area Designation(s)	Habitat Conservation Area*/Natural Area
Public Access	Closed** (Reason: New Property)
Resource Values	<ul style="list-style-type: none"> • Abundance of globally-imperiled grassland butterflies • Western draw supports a diverse community of songbirds • Habitat for bobcats and rarely-detected species like grey fox and ringtail • Raptor habitat • Abundant rattlesnakes • Active prairie dog habitat (multiple objective area) • High value foothills grassland, savanna, shrubland communities • Rare plant communities • Agricultural potential to serve as grassbank for future grazing needs
Management Issues	<ul style="list-style-type: none"> • Priority invasive species • Home site inconsistent with landscape

* OSBT and Boulder City Council approved the Habitat Conservation Area designation for the Joder property during acquisition approval. OSBT approved motion to review the Habitat Conservation Area designation during the North TSA Plan.

**Interim trail and trailhead will be constructed during North TSA Plan development providing public access and a connecting trail between Highway 36 and Olde Stage Road. The long-term decisions for the trail are to be determined by North TSA Plan.



Joder Property

OSMP staff

DAKOTA RIDGE VILLAGE	
Acres	14
Surrounding Management Area Designation(s)	Passive Recreation Area; Habitat Conservation Area
Public Access	Open
Resource Values	<ul style="list-style-type: none"> • Serves as important buffer for shale community and associated rare plants • Bell's twinpod population
Management Issues	<ul style="list-style-type: none"> • Priority invasive species • Encroachment from adjacent properties, such as social trailing and illegal dumping • Missing segments of boundary fencing

HART-JONES EXCHANGE	
Acres	2
Surrounding Management Area Designation(s)	Natural Area
Public Access	Open
Resource Values	<ul style="list-style-type: none"> • Plains/foothills transitional riparian vegetation (conservation target) • History of high-quality habitat for rare plants
Management Issues	<ul style="list-style-type: none"> • Management integration with larger Hart-Jones property to the east

IBM Open Space Easement (IBM ownership)	
Acres	69
Surrounding Management Area Designation(s)	Natural Area
Public Access	Open
Resource Values	<ul style="list-style-type: none"> • Riparian tree and shrub habitat along Dry Creek and irrigation ditches • Wetlands (conservation target) • Mixedgrass prairie mosaic (conservation target) • Rare plant community • Winter foraging habitat for bald eagles • Habitat for other raptors and migratory birds • Active prairie dog habitat (multiple objective area), including burrowing owls • Potential agricultural uses
Management Issues	<ul style="list-style-type: none"> • Priority invasive species • Fencing and signing • Coordinated management of forthcoming trail • No irrigable water • Illegal dumping • Encroachment from adjacent land uses • Management/coordination with IBM ownership

PALO PARK TRAIL	
Acres	12
Surrounding Management Area Designation(s)	Natural Area
Public Access	Open
Resource Values	<ul style="list-style-type: none"> • High restoration potential
Management Issues	<ul style="list-style-type: none"> • Multiple jurisdictions and management responsibilities • Priority invasive species • Flood damage

P-Appendix C: North TSA Property Easement and Access Summary

OSMP PROPERTY NAME	OWNERSHIP TYPE	EASEMENTS, RIGHTS OF WAY, LEGAL ACCESS
Abbott	Fee	
Andrea (Potato Hill)	Fee	No access inside one acre Conservation Easement (CE) around the pond
Axelson	Fee	
Axelson, West - Development Rights	Development Rights	No public access in the development rights area
B.L.I.P. I and B.L.I.P. II	Fee	Colorado Parks and Wildlife have 50 foot wide access easement to Mesa Reservoir
Beech - East Sec 30 & 31	Fee	20 foot waterline easement with access; Foothills Water
Beech - West Sec 25 & 36	Fee and three CE's	County has CE's but OSMP manages, 20 foot access easement, one acre storage tank easement, access and waterline easement to tank
BELGROVE	Fee	
Bennett	Fee	Boulder Feeder canal goes through the property
Berman Brothers	Fee	North property line is not the fence
Bison	Fee	Seller retained five acres in the middle and access road
Bonsall	Fee	
Boulder Valley Ranch - Lore	Fee	
Boulder Warehouse (Schneider)	Fee	Nutting has a non-exclusive access easement
Brewbaker	Fee	Boulder County Parks and Open Space is managing agricultural lease on the property
Bruning	Fee	Easement for a leach field
Buckingham Park	Fee	
Campbell	Fee	County CE on a portion of Campbell (Lot 5) for "open space preservation and agricultural uses"
Cowles	Fee	

OSMP PROPERTY NAME	OWNERSHIP TYPE	EASEMENTS, RIGHTS OF WAY, LEGAL ACCESS
Cox	Fee	
Dagle	Fee	
Dakota Ridge Village	Fee	Dedicated by plat
Dawson - Open Space	Fee	No public access in five acre CE
Degge II	Fee	
Deluca	Fee	Utility and access easements exist, Hester Lane is a shared access easement
Ditzel	Fee	
Dodd	Fee	County has CE, east boundary fence is off
Dunn, Anna	Fee	
Eisenberg	Fee	Residence used to house seasonal volunteer crews
Ellison	Fee	County CE on Lot 5 around house, does not prevent trails
ERNI	Fee	The north 58 acres was the first City of Boulder Open Space property purchase
Foothills Business Park	Fee	County owns one-half of the fee interest, OSMP manages the property
Gallagher	Fee	
Gilbert	Fee	
Harrington	Fee	
Hart-Jones	Fee	
Hart-Jones - Exchange	Fee	
Henriksen	Fee	Includes access easement from 47th Street
Hester	Fee	60 foot wide private access easement along the south property line; Hester Lane is a shared access easement
Jacob	Fee	
Joder I	Fee	

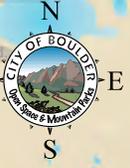
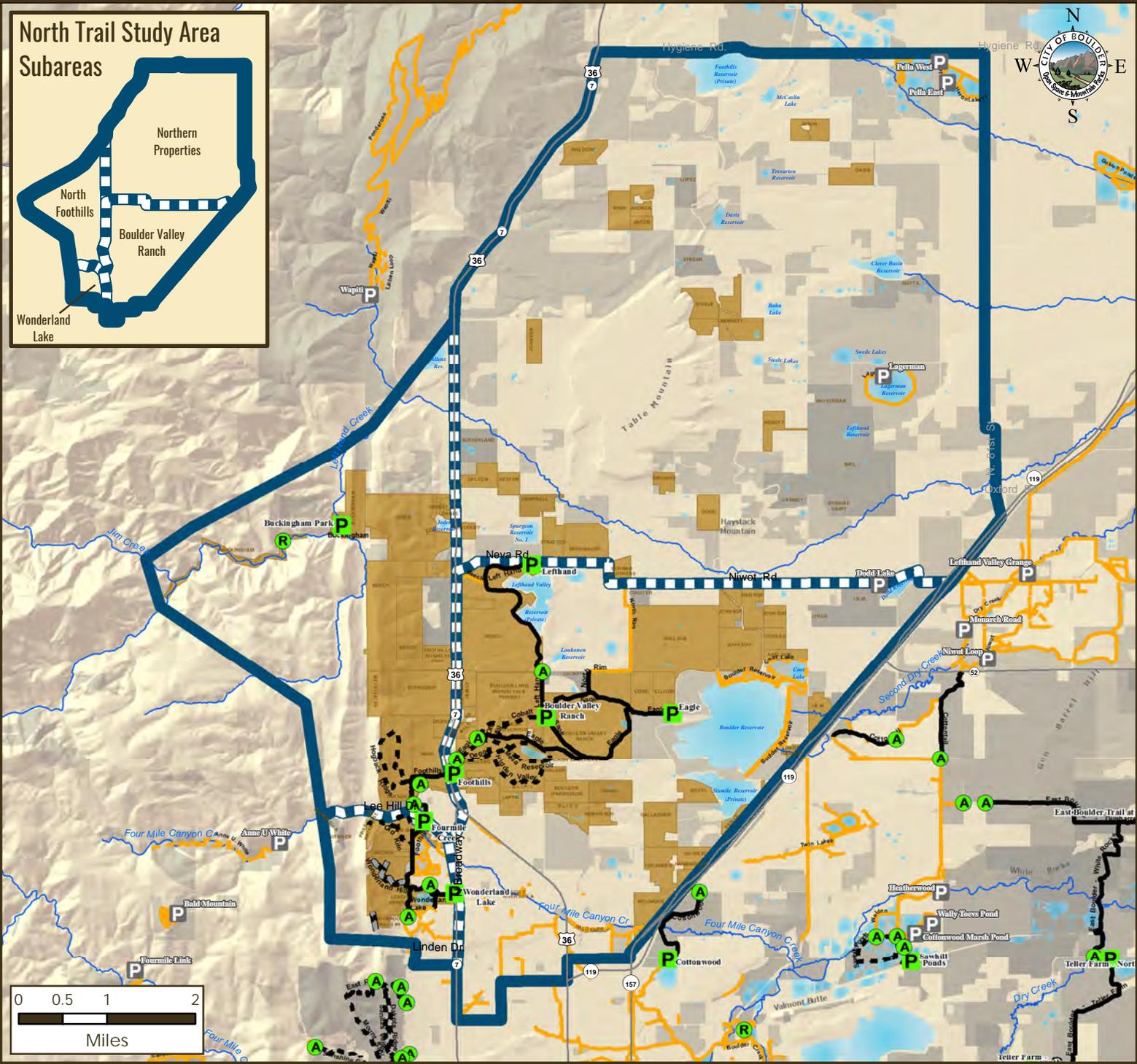
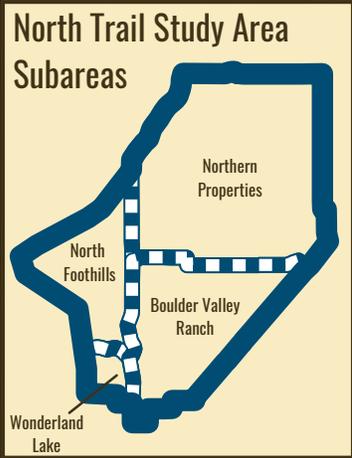
OSMP PROPERTY NAME	OWNERSHIP TYPE	EASEMENTS, RIGHTS OF WAY, LEGAL ACCESS
Joder II	Fee	
Johnson	Fee	
Johnson - East	Fee	Private access easement along west boundary
Johnson	Fee	Boulder Feeder canal located on the property
Lappin	Fee	Includes access easement over existing road
Loukonen Brothers	Fee	Water storage rights in Mesa Reservoir
Lousberg	Fee	Boundary fences are not correct
Mann	Fee	
Mesa Reservoir	CE	Colorado Parks and Wildlife is owner; CE identifies OSMP as managing entity
Moore, Mary	Fee	
Nejezchleb	Fee	Well and well access easements
Nu-West	Fee	Ditch easements
Oasis Direct Seven	Fee	
Palo Park Trail	Fee	Dedicated by plat
Papini	Fee	
Parsons	Fee	No access on the 33 acre development rights parcel
Pinebrook Hills #6	Fee	
Pinebrook Water District	Fee	Easement for water tank
Proper	Fee	
Riverside Grove Outlot A (Bednark)	Easement	Open space, scenic and trail easement and dedication
Riverside Grove Outlot B (Bednark)	Easement	Drainage, open space and scenic easement and dedication
Ryan	Fee	Access, utility and farm access easements

OSMP PROPERTY NAME	OWNERSHIP TYPE	EASEMENTS, RIGHTS OF WAY, LEGAL ACCESS
Schneider	Fee	
Schooley	Fee	
Seigle	Fee	
STEELE	Fee	County CE
Stratton	Fee	Five acres around the house is private
Waldorf	Fee	
Walker	Fee	
Wonderland Hill	Fee	
Wright	Fee	County CE

General Maps

North Trail Study Area Plan

Date: 6/12/2015



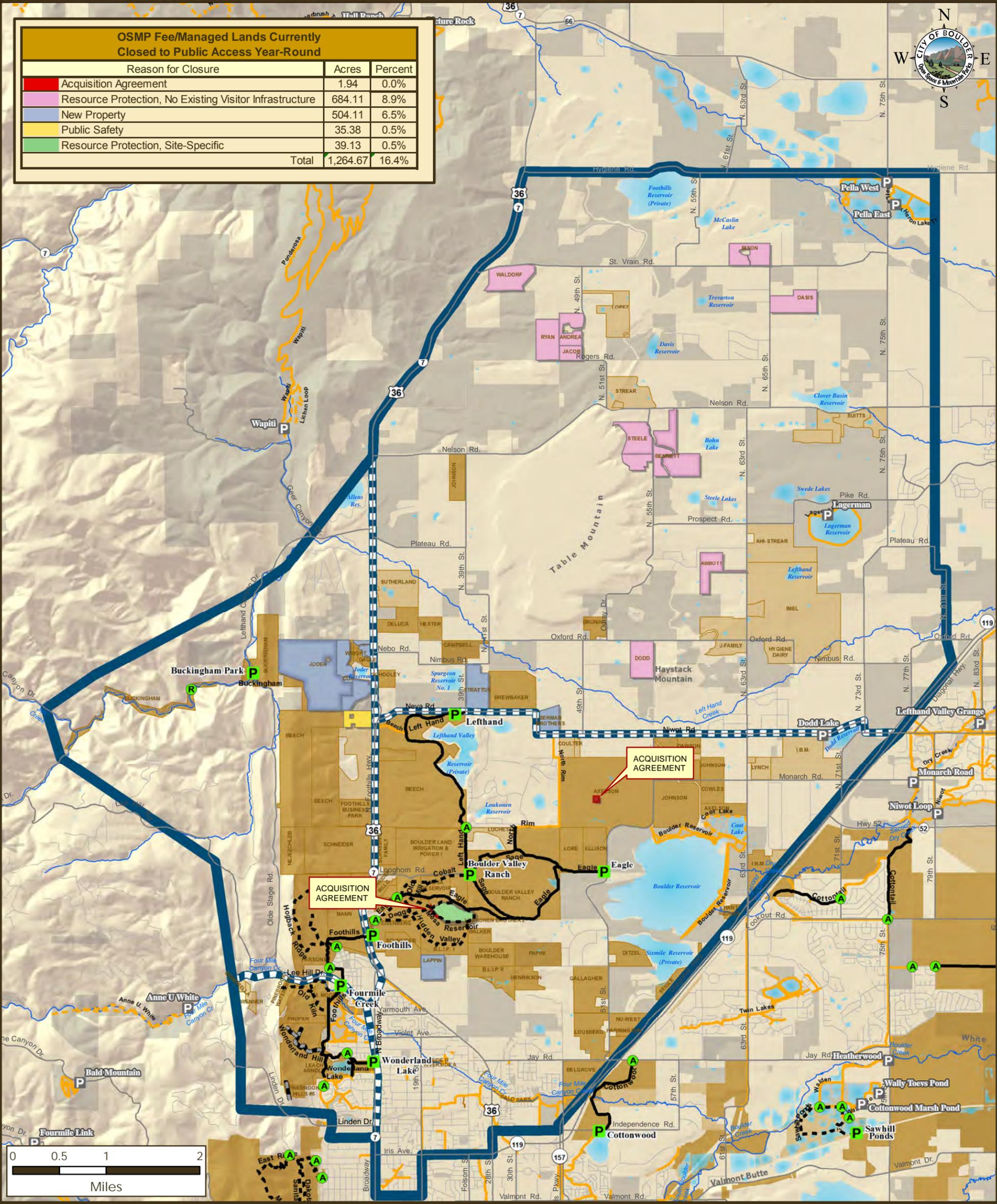
MAP G1: PROPERTY MAP

- | | | |
|----------------------------------|----------------------------------|-----------------------------------------------------|
| OSMP Trailhead | OSMP Hiking/Equestrian Trail | North TSA Boundary |
| OSMP Access Point | OSMP Multi-Use Trail | North TSA Subarea |
| OSMP Recreational Feature Access | OSMP Gliding Access | OSMP Fee and Managed Property |
| Boulder County Trailhead | Non-OSMP Managed Hiking Trail | OSMP Easement or Jointly Owned, County-Managed Land |
| | Non-OSMP Managed Multi-Use Trail | Other Government Land |

North Trail Study Area Plan

Date: 6/12/2015

OSMP Fee/Managed Lands Currently Closed to Public Access Year-Round		
Reason for Closure	Acres	Percent
Acquisition Agreement	1.94	0.0%
Resource Protection, No Existing Visitor Infrastructure	684.11	8.9%
New Property	504.11	6.5%
Public Safety	35.38	0.5%
Resource Protection, Site-Specific	39.13	0.5%
Total	1,264.67	16.4%



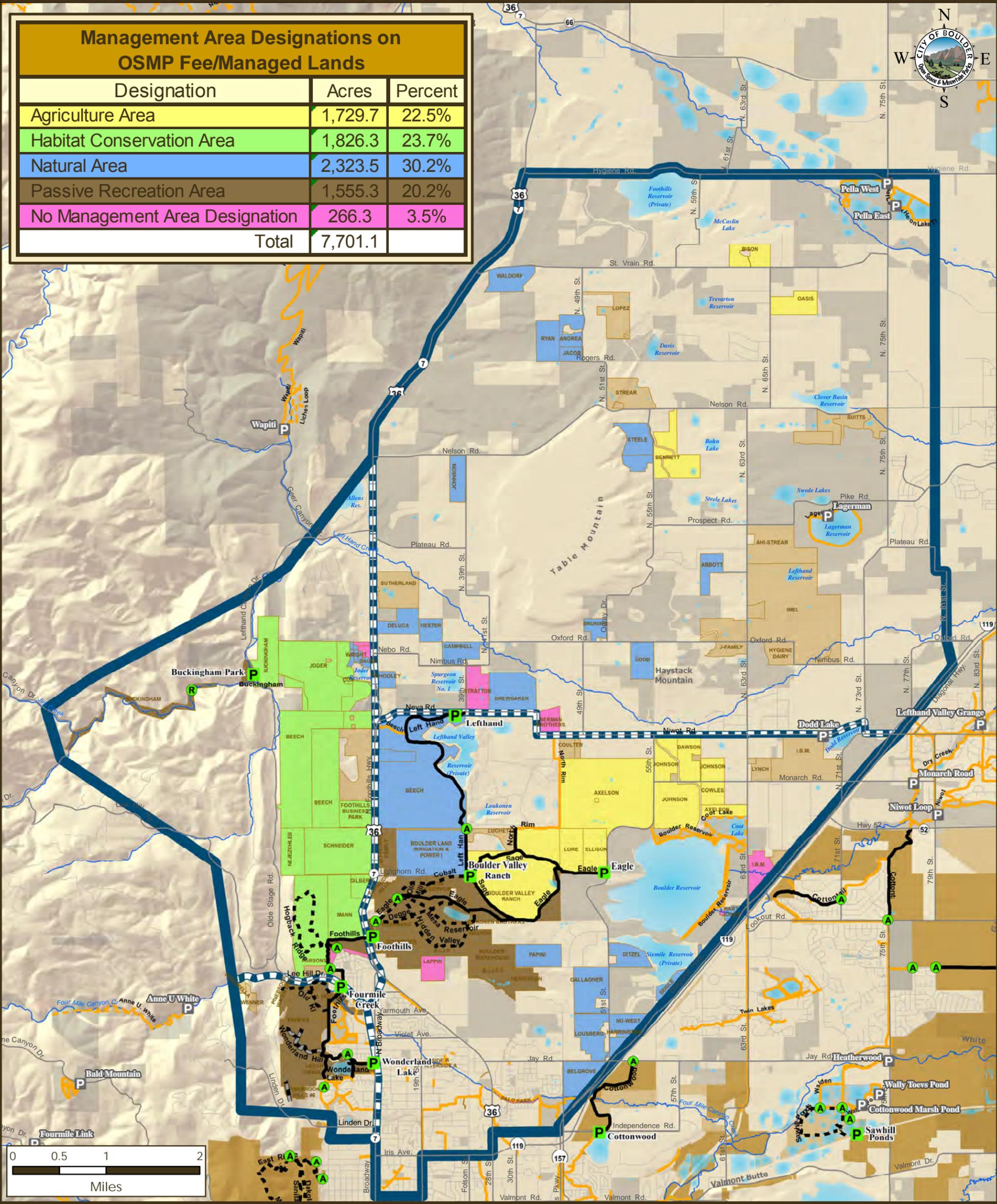
MAP G2: AREAS CLOSED TO PUBLIC ACCESS YEAR ROUND

- OSMP Trailhead
- OSMP Hiking/Equestrian Trail
- North TSA Boundary
- OSMP Access Point
- OSMP Multi-Use Trail
- North TSA Subarea
- OSMP Recreational Feature Access
- OSMP Gliding Access
- OSMP Fee and Managed Property
- Non-OSMP Managed Hiking Trail
- OSMP Easement or Jointly Owned, County-Managed Land
- Boulder County Trailhead
- Non-OSMP Managed Multi-Use Trail
- Other Government Land

Recreation Maps

North Trail Study Area Plan

Management Area Designations on OSMP Fee/Managed Lands		
Designation	Acres	Percent
Agriculture Area	1,729.7	22.5%
Habitat Conservation Area	1,826.3	23.7%
Natural Area	2,323.5	30.2%
Passive Recreation Area	1,555.3	20.2%
No Management Area Designation	266.3	3.5%
Total	7,701.1	

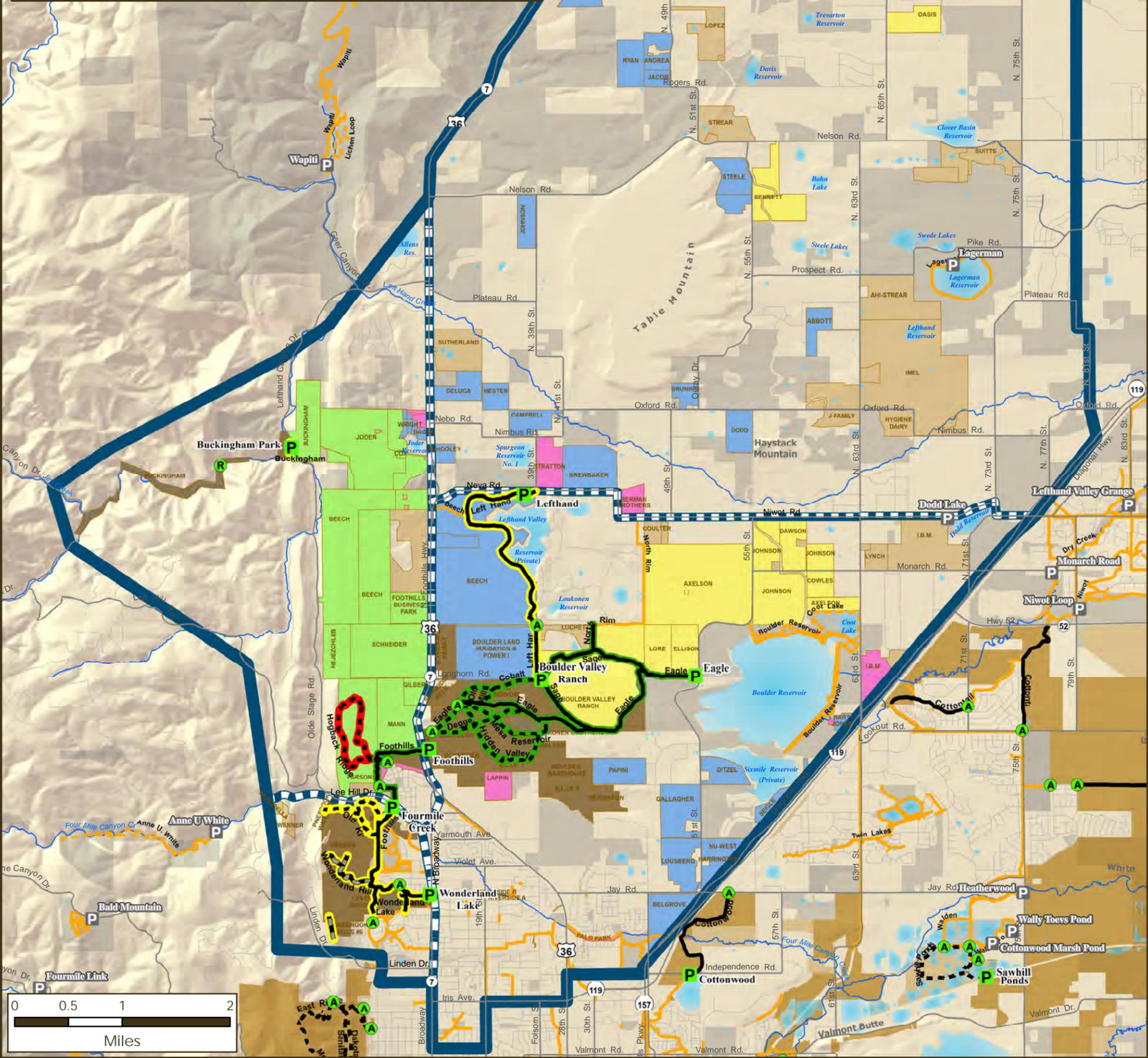


MAP R1: MANAGEMENT AREA DESIGNATIONS

- OSMP Trailhead
- OSMP Hiking/Equestrian Trail
- North TSA Boundary
- OSMP Access Point
- OSMP Multi-Use Trail
- North TSA Subarea
- OSMP Recreational Feature Access
- OSMP Gliding Access
- OSMP Fee and Managed Property
- OSMP Easement or Jointly Owned, County-Managed Land
- Boulder County Trailhead
- Non-OSMP Managed Hiking Trail
- Other Government Land
- Non-OSMP Managed Multi-Use Trail

North Trail Study Area Plan

Dog Regulations on Trails by Management Area on OSMP Fee/Managed Lands		
Regulation/Designation	Miles	Percent
Leash, Voice & Sight - Agriculture Area	1.4	7.2%
Leash, Voice & Sight - Passive Recreation Area	9.0	46.9%
Leash, Voice & Sight - No Designation	0.1	0.5%
Total	10.5	54.7%
Leash Required - Natural Area	2.9	15.2%
Leash Required - Passive Recreation Area	4.0	20.8%
Total	6.9	36.0%
No Dogs - Habitat Conservation Area	1.8	9.3%
Total	1.8	9.3%
Grand Total	19.2	

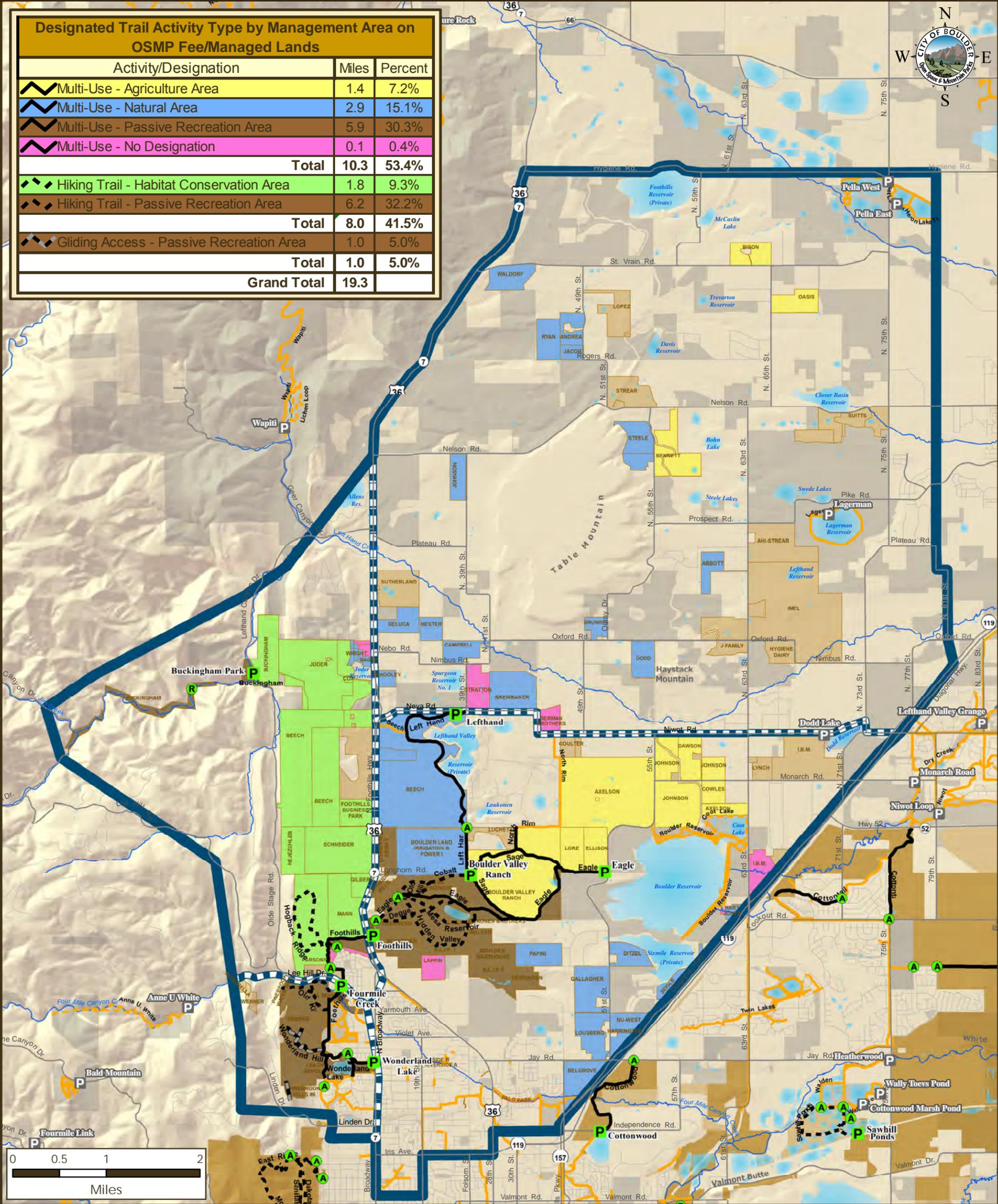


MAP R2: DOG REGULATIONS ON DESIGNATED TRAILS

- OSMP Trailhead
- OSMP Hiking/Equestrian Trail
- North TSA Boundary
- OSMP Access Point
- OSMP Multi-Use Trail
- North TSA Subarea
- OSMP Recreational Feature Access
- OSMP Gliding Access
- OSMP Fee and Managed Property
- OSMP Easement or Jointly Owned, County-Managed Land
- Boulder County Trailhead
- Non-OSMP Managed Hiking Trail
- Other Government Land
- Non-OSMP Managed Multi-Use Trail

North Trail Study Area Plan

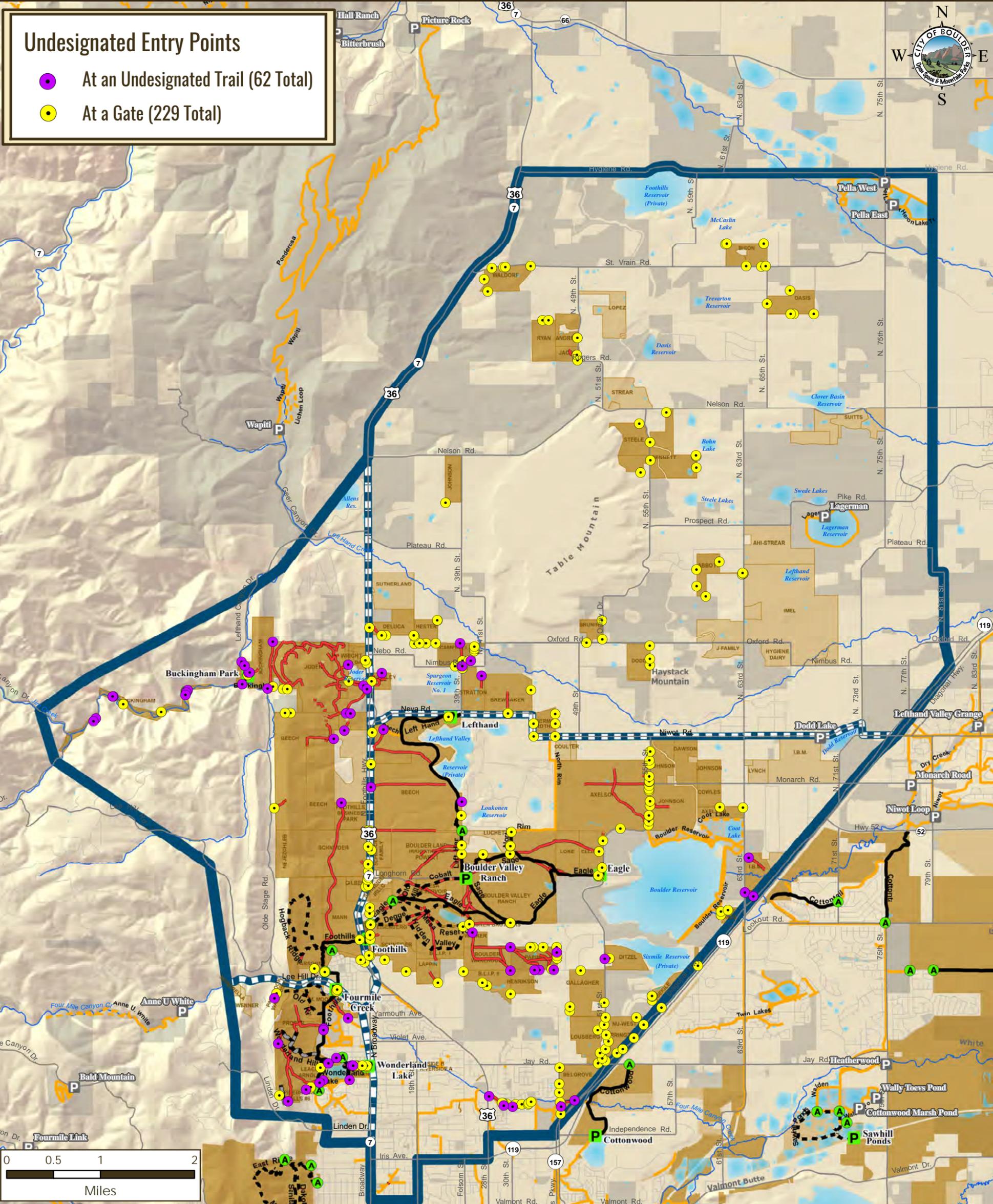
Designated Trail Activity Type by Management Area on OSMP Fee/Managed Lands		
Activity/Designation	Miles	Percent
Multi-Use - Agriculture Area	1.4	7.2%
Multi-Use - Natural Area	2.9	15.1%
Multi-Use - Passive Recreation Area	5.9	30.3%
Multi-Use - No Designation	0.1	0.4%
Total	10.3	53.4%
Hiking Trail - Habitat Conservation Area	1.8	9.3%
Hiking Trail - Passive Recreation Area	6.2	32.2%
Total	8.0	41.5%
Gliding Access - Passive Recreation Area	1.0	5.0%
Total	1.0	5.0%
Grand Total	19.3	



MAP R3: DESIGNATED TRAILS BY ACTIVITY TYPE

- OSMP Trailhead
- OSMP Hiking/Equestrian Trail
- North TSA Boundary
- OSMP Multi-Use Trail
- North TSA Subarea
- OSMP Gliding Access
- OSMP Fee and Managed Property
- OSMP Access Point
- OSMP Easement or Jointly Owned, County-Managed Land
- OSMP Recreational Feature Access
- Non-OSMP Managed Hiking Trail
- Other Government Land
- Boulder County Trailhead
- Non-OSMP Managed Multi-Use Trail

North Trail Study Area Plan



MAP R4: UNDESIGNATED ENTRY POINTS

- | | | |
|----------------------------------|----------------------------------|-----------------------------------------------------|
| Undesignated Trail | OSMP Hiking/Equestrian Trail | North TSA Boundary |
| OSMP Trailhead | OSMP Multi-Use Trail | North TSA Subarea |
| OSMP Access Point | OSMP Gliding Access | OSMP Fee and Managed Property |
| OSMP Recreational Feature Access | Non-OSMP Managed Hiking Trail | OSMP Easement or Jointly Owned, County-Managed Land |
| Boulder County Trailhead | Non-OSMP Managed Multi-Use Trail | Other Government Land |

North Trail Study Area Plan

TRAIL CONCEPTS BY PLAN/EFFORT

Boulder Valley Comprehensive Plan (BVCP)
 - BVCP Underpasses
 ☆ Proposed ☆ Underway

- BVCP Trail Concepts

■ Line
 ⊕ Conceptual Alignment
 ■ Project Underway

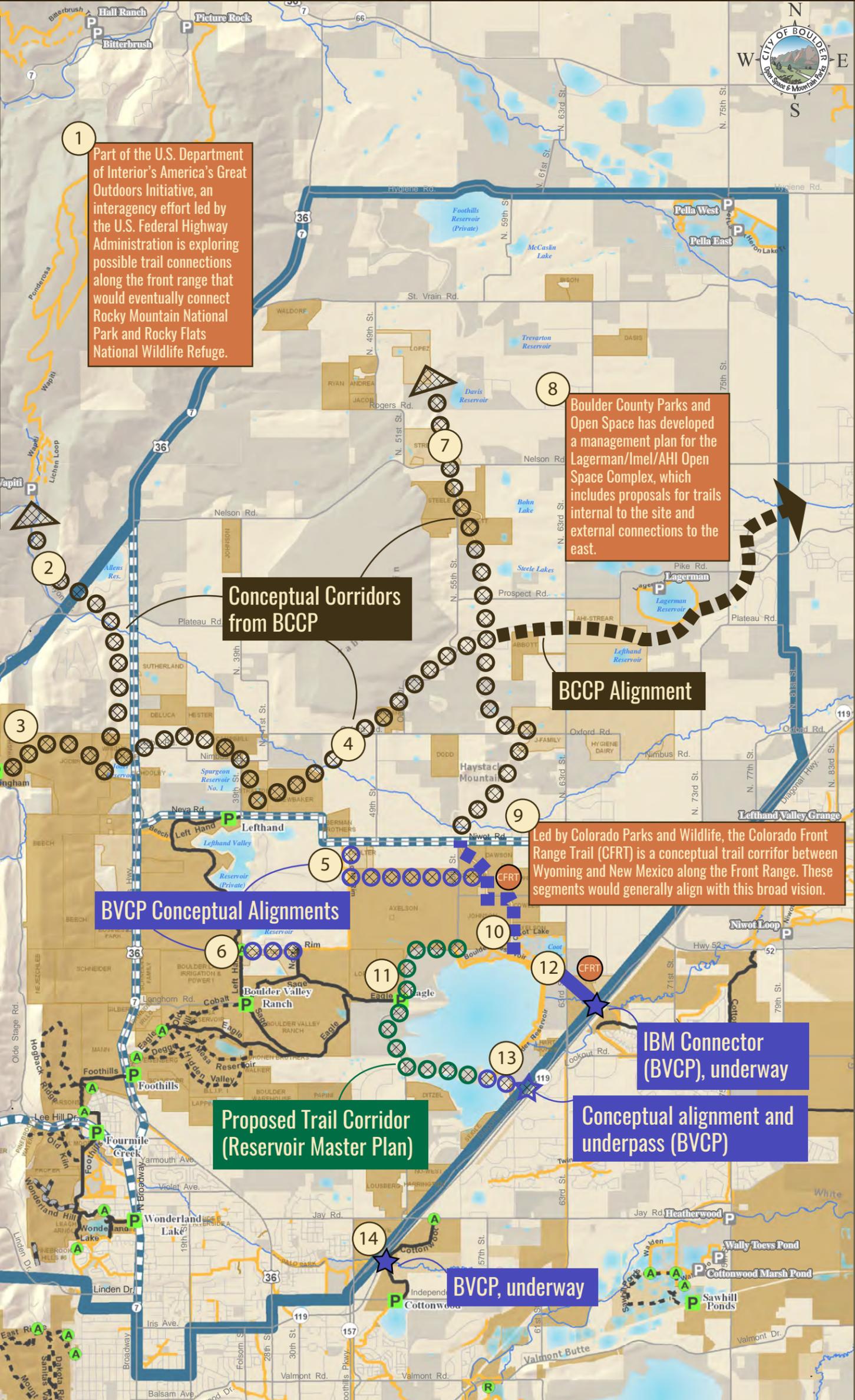
Boulder Reservoir Master Plan
 ⊕ Proposed Trail Corridor

Boulder County Comp Plan (BCCP)

■ Alignment
 ⊕ Corridor

Other Regional Concepts

⊕ Conceptual Corridor
 # Reference to Text Explanation



Part of the U.S. Department of Interior's America's Great Outdoors Initiative, an interagency effort led by the U.S. Federal Highway Administration is exploring possible trail connections along the front range that would eventually connect Rocky Mountain National Park and Rocky Flats National Wildlife Refuge.

Boulder County Parks and Open Space has developed a management plan for the Lagerman/Imel/AHI Open Space Complex, which includes proposals for trails internal to the site and external connections to the east.

Led by Colorado Parks and Wildlife, the Colorado Front Range Trail (CFRT) is a conceptual trail corridor between Wyoming and New Mexico along the Front Range. These segments would generally align with this broad vision.

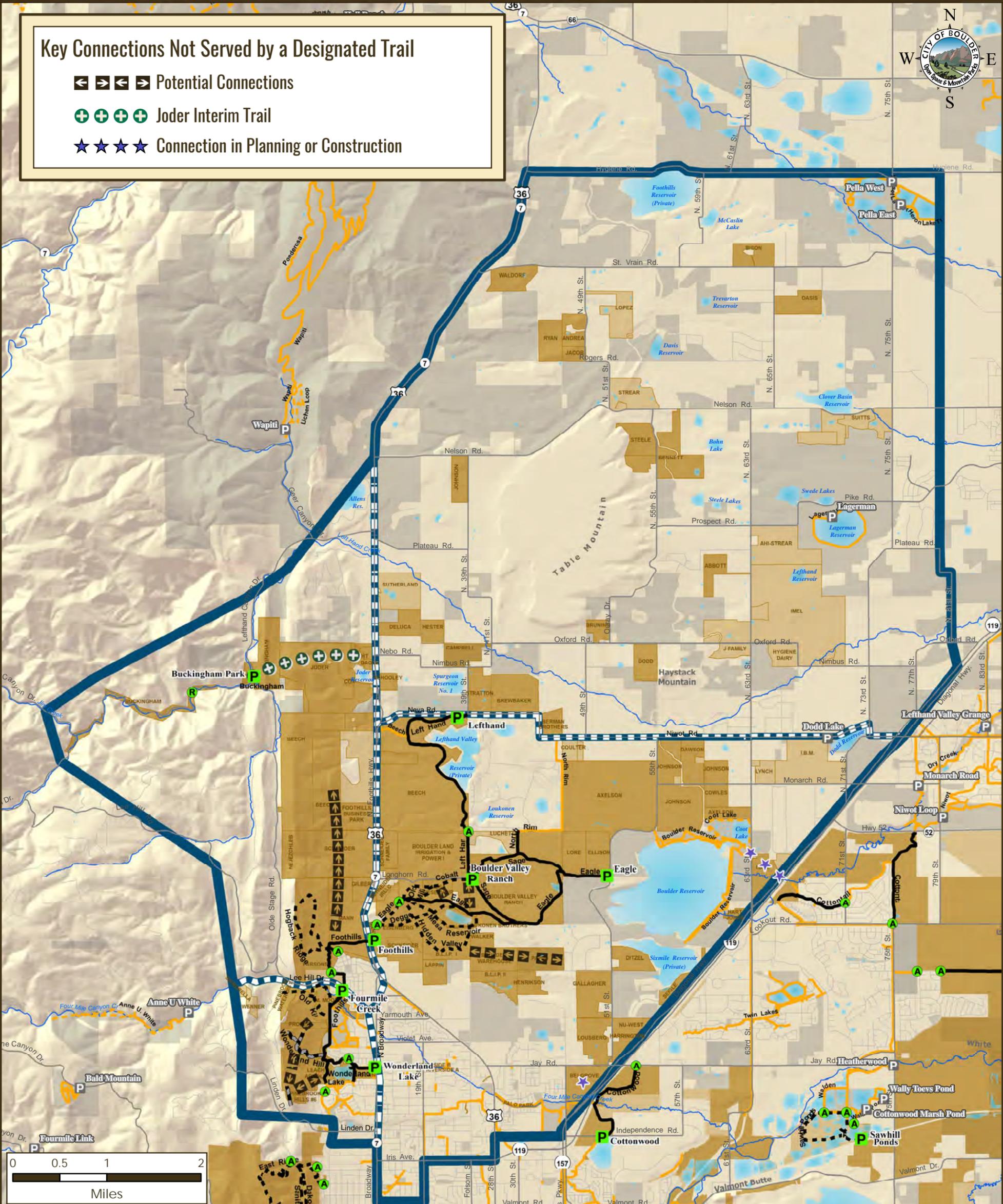
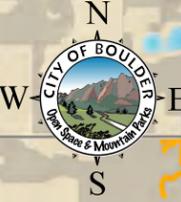
MAP R5: REGIONAL TRAIL CONCEPTS FROM PUBLIC AGENCY PLANS/EFFORTS

OSMP Trailhead	OSMP Hiking/Equestrian Trail	NTSA Boundary
OSMP Access Point	OSMP Multi-Use Trail	NTSA Subarea
OSMP Recreational Feature Access	OSMP Gliding Access	OSMP Fee and Managed Property
Boulder County Trailhead	Non-OSMP Managed Hiking Trail	OSMP Easement or Jointly Owned, County-Managed Land
	Non-OSMP Managed Multi-Use Trail	Other Government Land

North Trail Study Area Plan

Key Connections Not Served by a Designated Trail

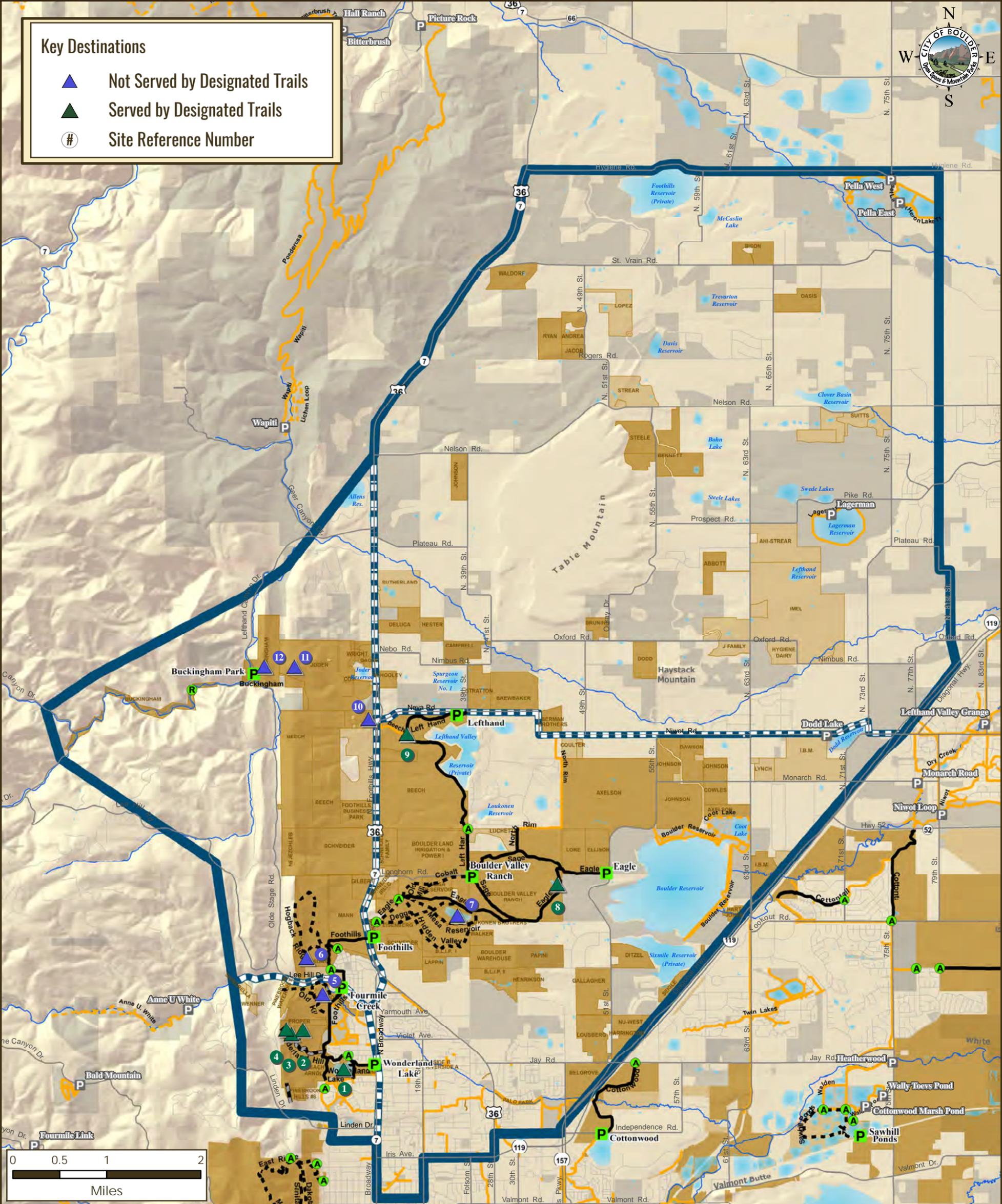
- ◄ ◄ ◄ ◄ Potential Connections
- ++++ Joder Interim Trail
- ★★★★ Connection in Planning or Construction



MAP R6: KEY CONNECTIONS NOT SERVED BY A DESIGNATED TRAIL

- | | | |
|----------------------------------|----------------------------------|-----------------------------------------------------|
| OSMP Trailhead | OSMP Hiking/Equestrian Trail | North TSA Boundary |
| OSMP Access Point | OSMP Multi-Use Trail | North TSA Subarea |
| OSMP Recreational Feature Access | OSMP Gliding Access | OSMP Fee and Managed Property |
| Boulder County Trailhead | Non-OSMP Managed Hiking Trail | OSMP Easement or Jointly Owned, County-Managed Land |
| | Non-OSMP Managed Multi-Use Trail | Other Government Land |

North Trail Study Area Plan

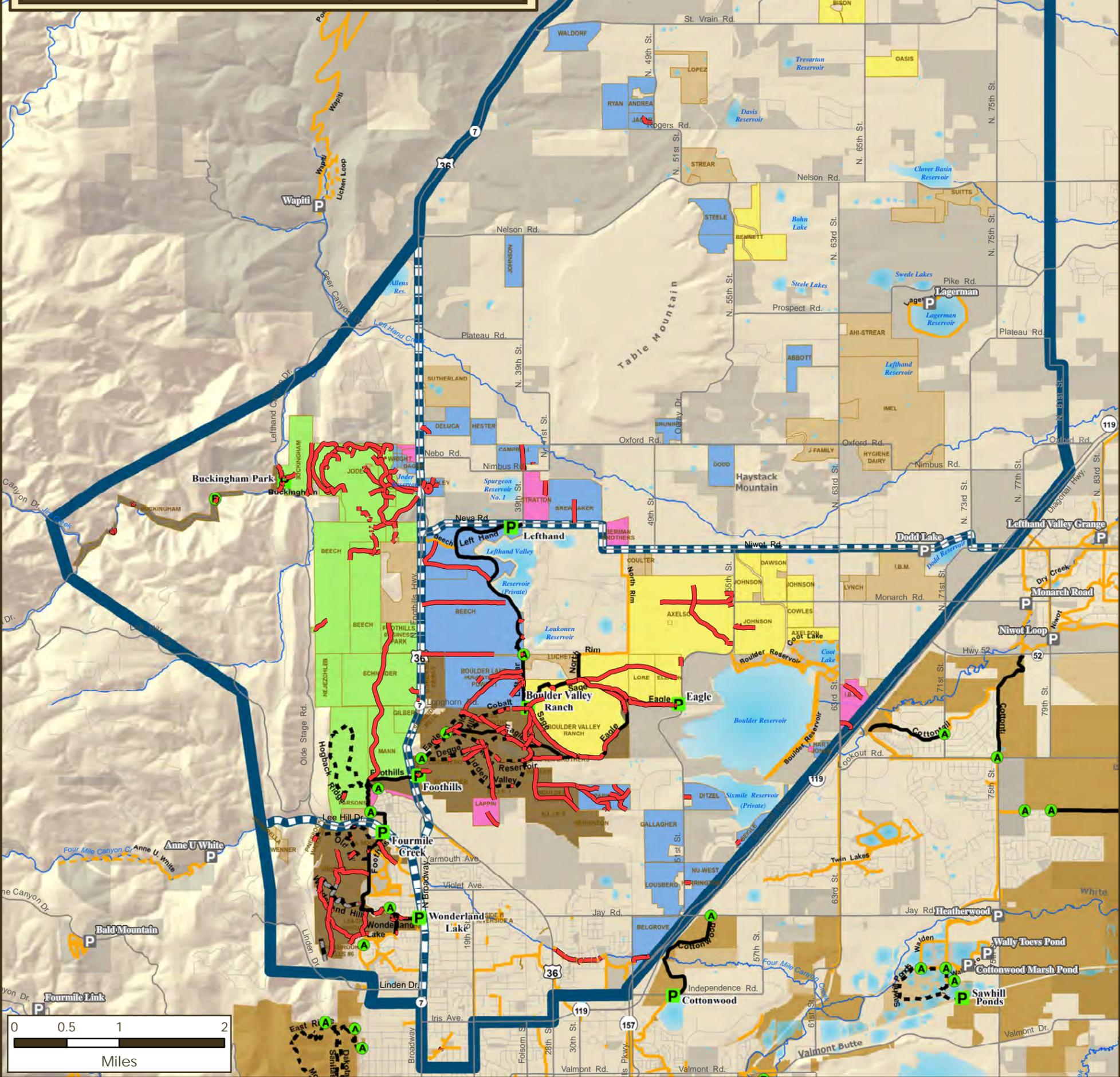


MAP R7: ACCESS TO KEY DESTINATIONS

- | | | |
|----------------------------------|----------------------------------|-----------------------------------------------------|
| OSMP Trailhead | OSMP Hiking/Equestrian Trail | North TSA Boundary |
| OSMP Access Point | OSMP Multi-Use Trail | North TSA Subarea |
| OSMP Recreational Feature Access | OSMP Gliding Access | OSMP Fee and Managed Property |
| Boulder County Trailhead | Non-OSMP Managed Hiking Trail | OSMP Easement or Jointly Owned, County-Managed Land |
| | Non-OSMP Managed Multi-Use Trail | Other Government Land |

North Trail Study Area Plan

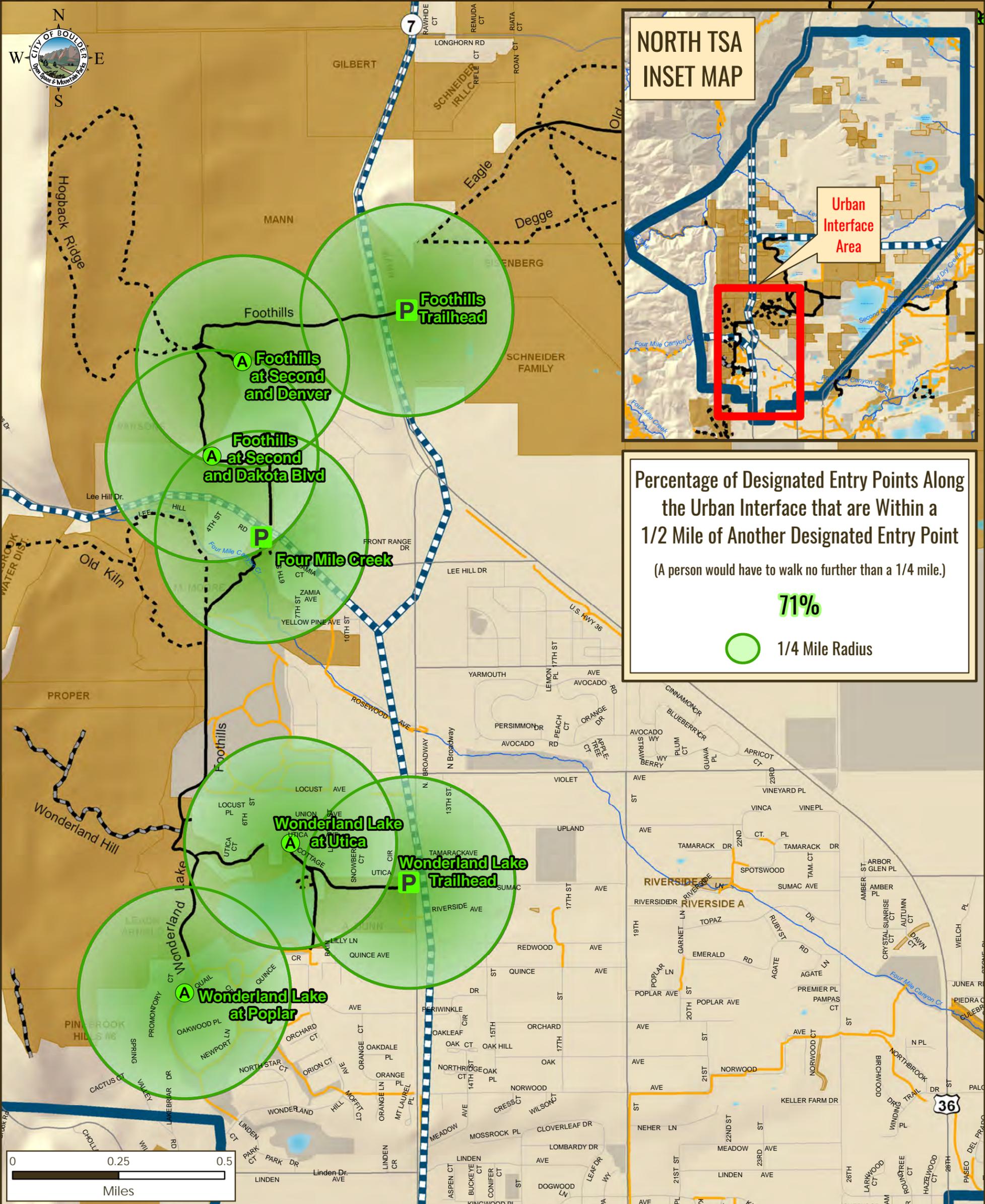
Undesignated Trail Mileage by Management Area on OSMP Fee/Managed Lands		
Designation	Miles	Percent
Agriculture Area	4.6	13.0%
Habitat Conservation Area	9.9	27.8%
Natural Area	7.4	20.8%
Passive Recreation Area	12.6	35.4%
No Management Area Designation	1.1	3.2%
Total	35.6	



MAP R8: UNDESIGNATED TRAILS

-  Undesignated Trail
-  OSMP Trailhead
-  OSMP Access Point
-  OSMP Recreational Feature Access
-  Boulder County Trailhead
-  OSMP Hiking/Equestrian Trail
-  OSMP Multi-Use Trail
-  OSMP Gliding Access
-  Non-OSMP Managed Hiking Trail
-  Non-OSMP Managed Multi-Use Trail
-  North TSA Boundary
-  North TSA Subarea
-  OSMP Fee and Managed Property
-  OSMP Easement or Jointly Owned, County-Managed Land
-  Other Government Land

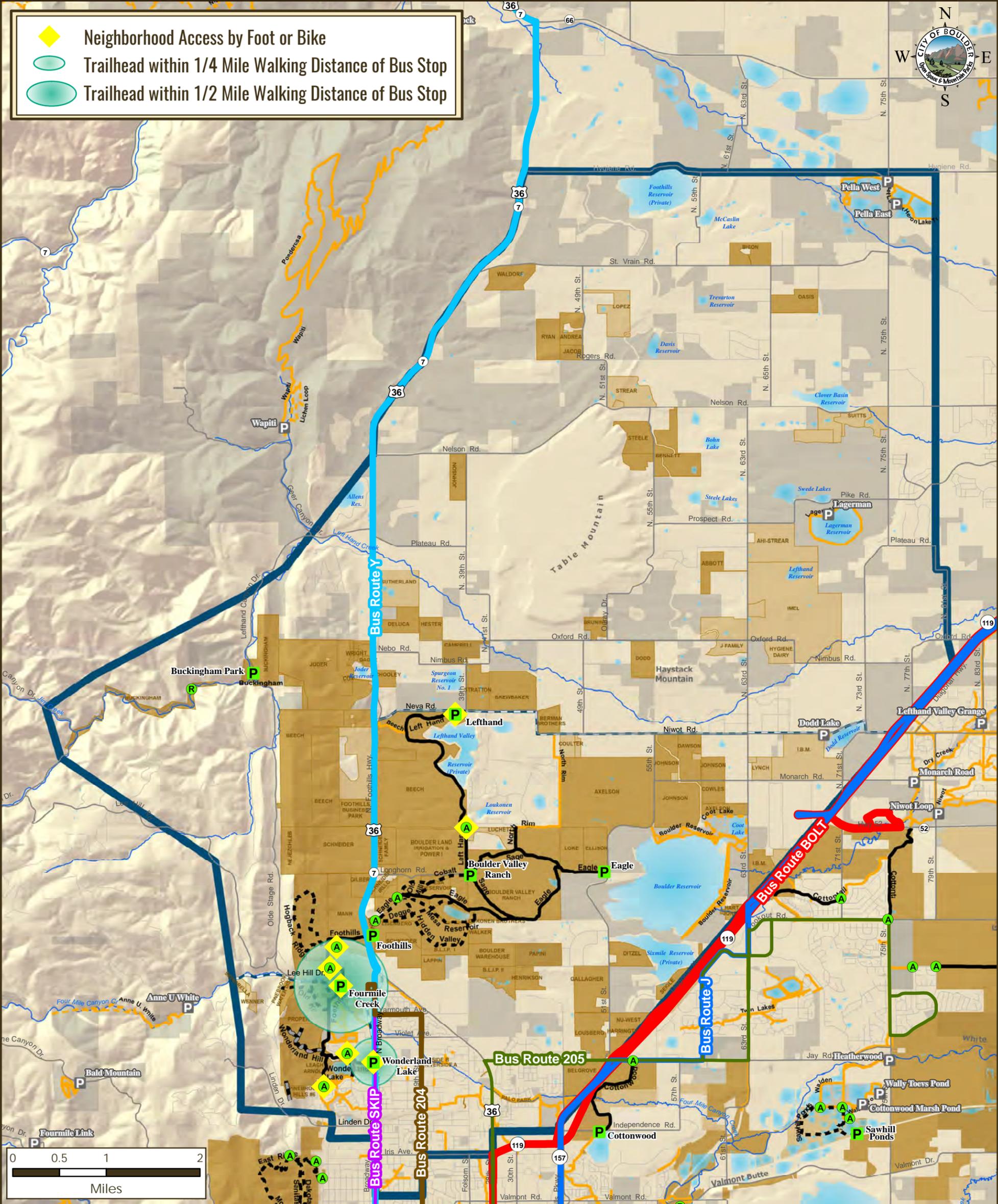
North Trail Study Area Plan



MAP R9: DESIGNATED ENTRY POINTS ALONG THE URBAN INTERFACE

- | | | |
|-------------------------------------------|----------------------------------|-----------------------------------------------------|
| P OSMP Trailhead | OSMP Hiking/Equestrian Trail | North TSA Boundary |
| A OSMP Access Point | OSMP Multi-Use Trail | North TSA Subarea |
| R OSMP Recreational Feature Access | OSMP Gliding Access | OSMP Fee and Managed Property |
| P Boulder County Trailhead | Non-OSMP Managed Hiking Trail | OSMP Easement or Jointly Owned, County-Managed Land |
| | Non-OSMP Managed Multi-Use Trail | Other Government Land |

North Trail Study Area Plan

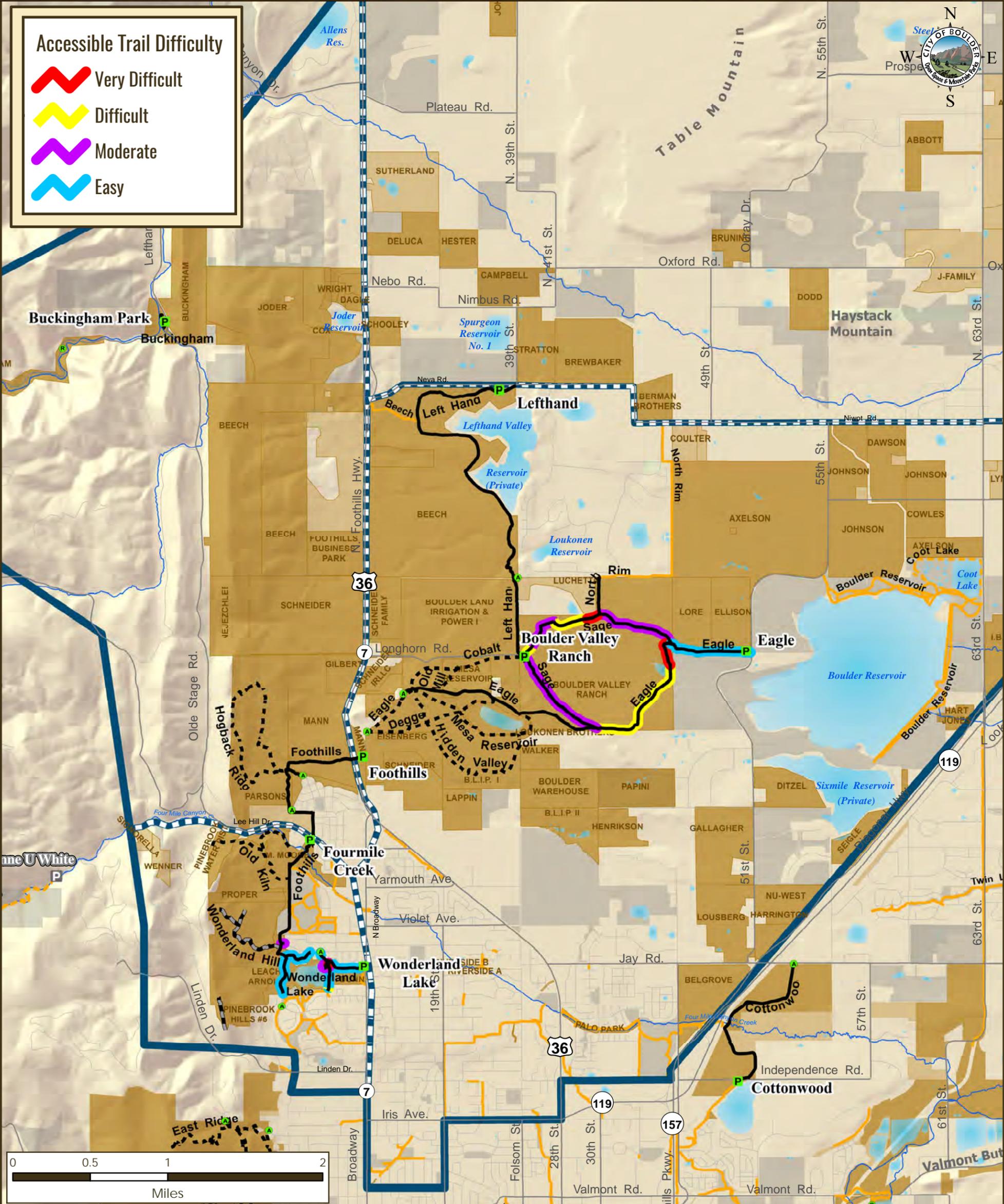


MAP R10: MULTIMODAL ACCESS TO OSMP ENTRY POINTS

- | | | |
|-----------------------------------------------------------------------|----------------------------------|-----------------------------------------------------|
| P OSMP Trailhead | OSMP Hiking/Equestrian Trail | North TSA Boundary |
| A OSMP Access Point | OSMP Multi-Use Trail | North TSA Subarea |
| R OSMP Recreational Feature Access | OSMP Gliding Access | OSMP Fee and Managed Property |
| P Boulder County Trailhead | Non-OSMP Managed Hiking Trail | OSMP Easement or Jointly Owned, County-Managed Land |
| | Non-OSMP Managed Multi-Use Trail | Other Government Land |

North Trail Study Area Plan

Date: 6/9/2015



MAP R11: ACCESSIBLE TRAILS FOR PEOPLE WITH DISABILITIES

- | | | |
|----------------------------------|----------------------------------|-----------------------------------------------------|
| OSMP Trailhead | OSMP Hiking/Equestrian Trail | North TSA Boundary |
| OSMP Access Point | OSMP Multi-Use Trail | North TSA Subarea |
| OSMP Recreational Feature Access | OSMP Gliding Access | OSMP Fee and Managed Property |
| Boulder County Trailhead | Non-OSMP Managed Hiking Trail | OSMP Easement or Jointly Owned, County-Managed Land |
| | Non-OSMP Managed Multi-Use Trail | Other Government Land |

North Trail Study Area Plan

Visitor Access Regulations

- P** Trailhead Leash Area
- Closed To Public Access
- Seasonal Raptor Closure

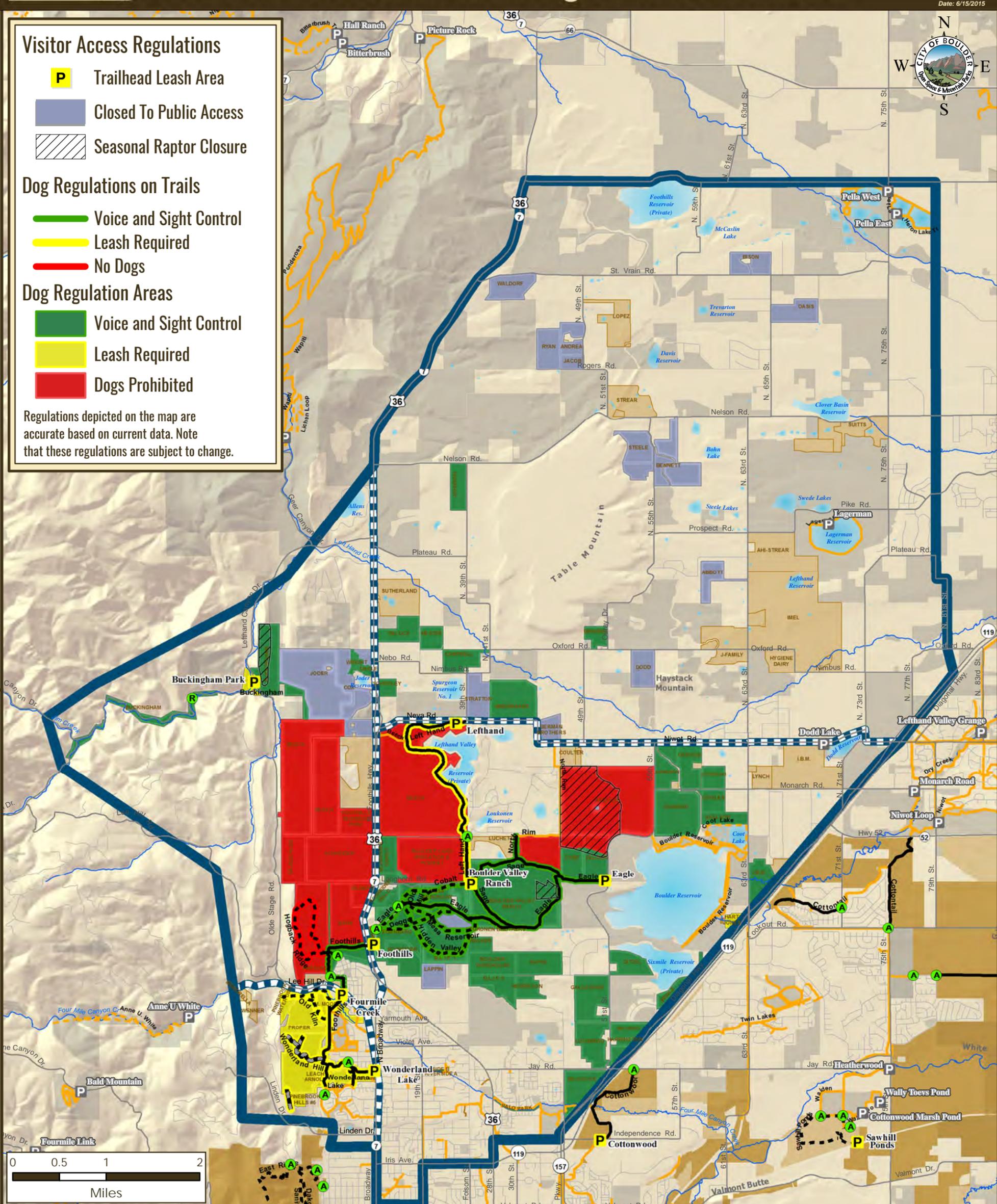
Dog Regulations on Trails

- Voice and Sight Control
- Leash Required
- No Dogs

Dog Regulation Areas

- Voice and Sight Control
- Leash Required
- Dogs Prohibited

Regulations depicted on the map are accurate based on current data. Note that these regulations are subject to change.



MAP R12: REGULATORY SETTINGS

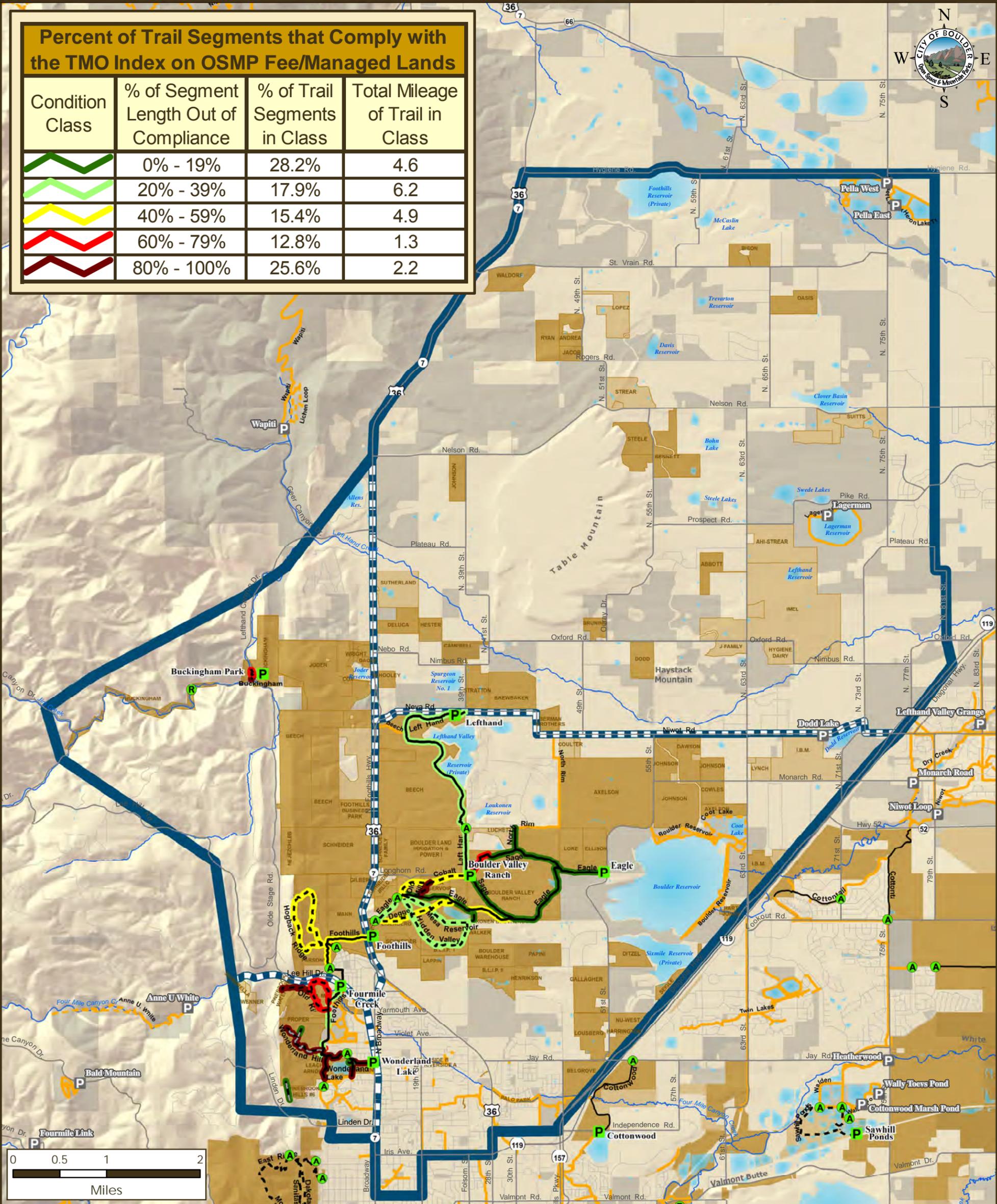
- OSMP Access Point
- OSMP Recreational Feature Access
- Boulder County Trailhead
- OSMP Hiking/Equestrian Trail
- OSMP Multi-Use Trail
- OSMP Gliding Access
- Non-OSMP Managed Hiking Trail
- Non-OSMP Managed Multi-Use Trail
- North TSA Boundary
- North TSA Subarea
- OSMP Fee and Managed Property
- OSMP Easement or Jointly Owned, County-Managed Land
- Other Government Land

OSMP parking lots in the North Trail Study Area are closed to vehicles between 11 p.m. - 5 a.m.

North Trail Study Area Plan

Percent of Trail Segments that Comply with the TMO Index on OSMP Fee/Managed Lands

Condition Class	% of Segment Length Out of Compliance	% of Trail Segments in Class	Total Mileage of Trail in Class
	0% - 19%	28.2%	4.6
	20% - 39%	17.9%	6.2
	40% - 59%	15.4%	4.9
	60% - 79%	12.8%	1.3
	80% - 100%	25.6%	2.2

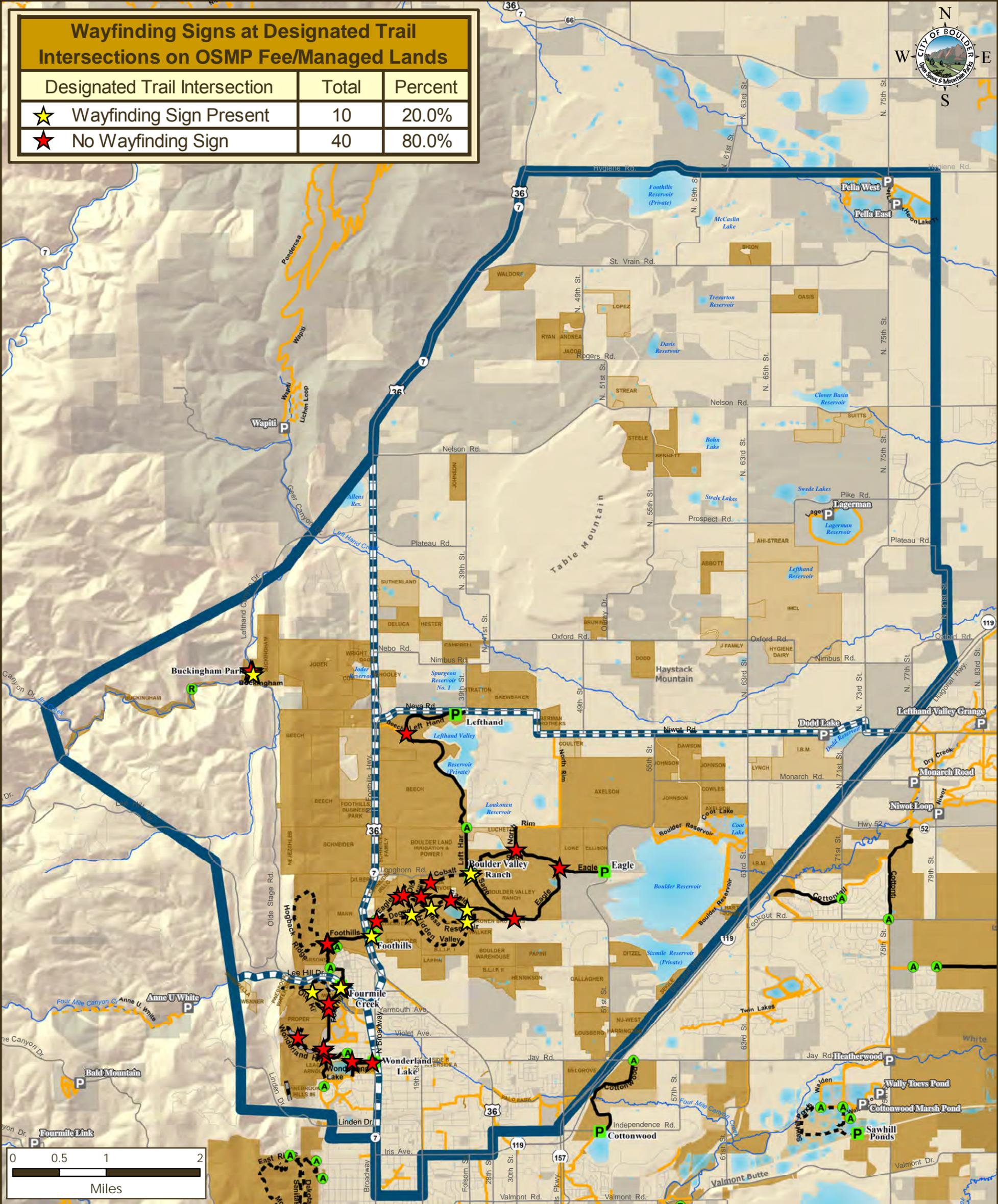


MAP R13: TRAIL MANAGEMENT OBJECTIVE (TMO) COMPLIANCE

- OSMP Trailhead
- OSMP Hiking/Equestrian Trail
- North TSA Boundary
- OSMP Access Point
- OSMP Multi-Use Trail
- North TSA Subarea
- OSMP Recreational Feature Access
- OSMP Gliding Access
- OSMP Fee and Managed Property
- Non-OSMP Managed Hiking Trail
- OSMP Easement or Jointly Owned, County-Managed Land
- Boulder County Trailhead
- Non-OSMP Managed Multi-Use Trail
- Other Government Land

North Trail Study Area Plan

Wayfinding Signs at Designated Trail Intersections on OSMP Fee/Managed Lands		
Designated Trail Intersection	Total	Percent
★ Wayfinding Sign Present	10	20.0%
★ No Wayfinding Sign	40	80.0%



MAP R14: WAYFINDING SIGNS AT DESIGNATED TRAIL INTERSECTIONS

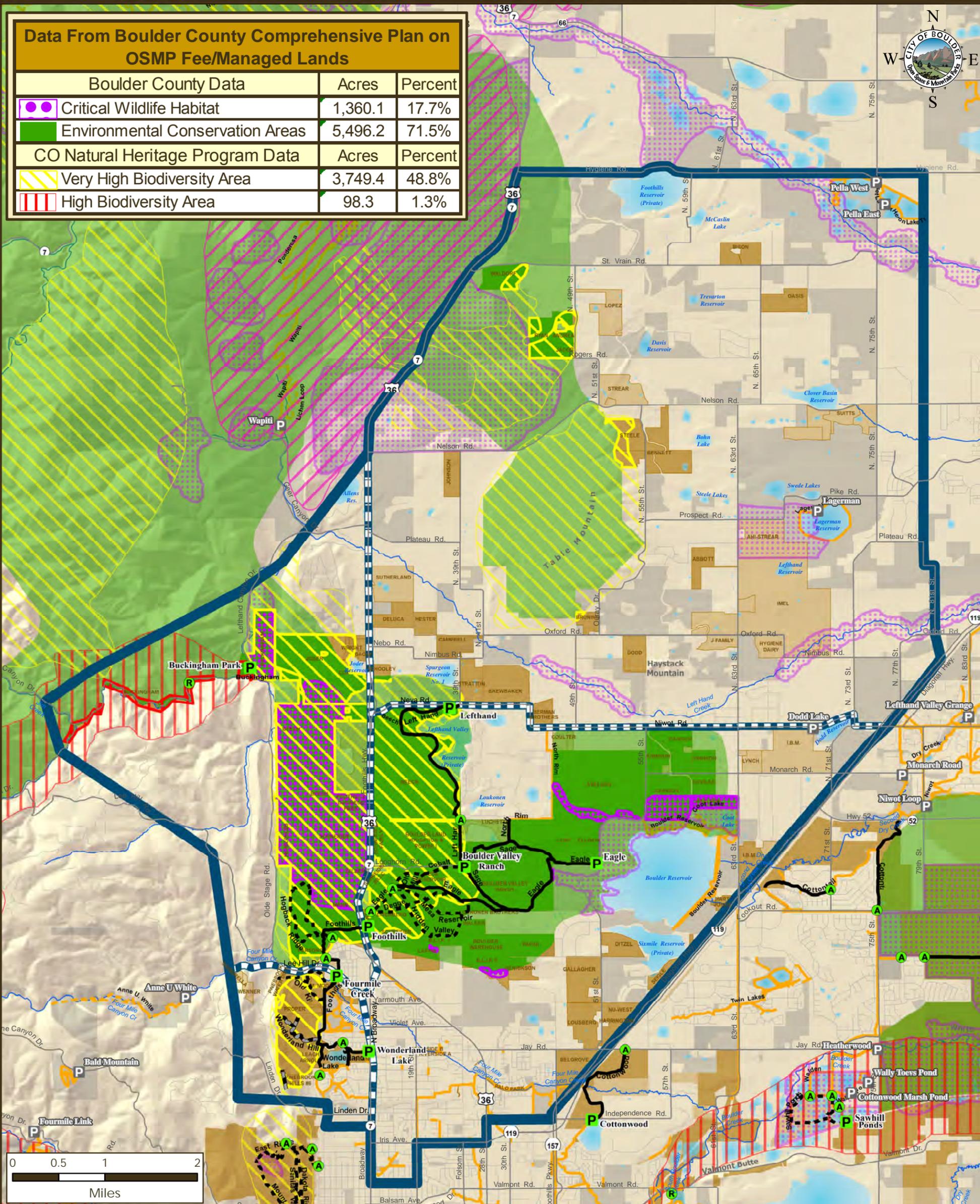
- P OSMP Trailhead
- A OSMP Access Point
- R OSMP Recreational Feature Access
- P Boulder County Trailhead
- OSMP Hiking/Equestrian Trail
- OSMP Multi-Use Trail
- OSMP Gliding Access
- Non-OSMP Managed Hiking Trail
- Non-OSMP Managed Multi-Use Trail
- North TSA Boundary
- North TSA Subarea
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- OSMP Easement or Jointly Owned, County-Managed Land
- Other Government Land

Natural Resources Maps

North Trail Study Area Plan

Data From Boulder County Comprehensive Plan on OSMP Fee/Managed Lands

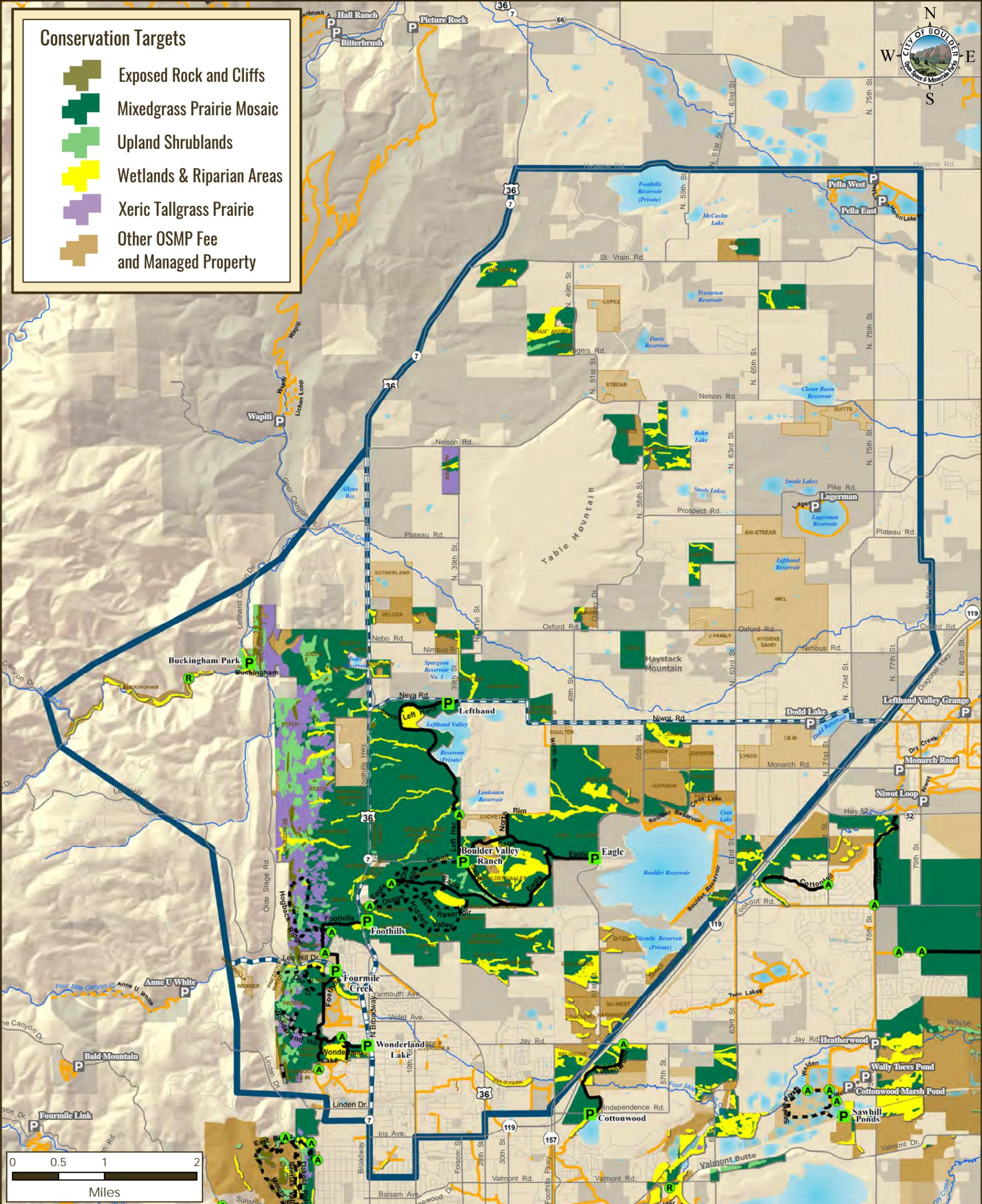
Boulder County Data		Acres	Percent
	Critical Wildlife Habitat	1,360.1	17.7%
	Environmental Conservation Areas	5,496.2	71.5%
CO Natural Heritage Program Data		Acres	Percent
	Very High Biodiversity Area	3,749.4	48.8%
	High Biodiversity Area	98.3	1.3%



MAP N1: BOULDER COUNTY COMPREHENSIVE PLAN

- OSMP Trailhead
- OSMP Hiking/Equestrian Trail
- North TSA Boundary
- OSMP Access Point
- OSMP Multi-Use Trail
- North TSA Subarea
- OSMP Recreational Feature Access
- OSMP Gliding Access
- OSMP Fee and Managed Property
- Non-OSMP Managed Hiking Trail
- OSMP Easement or Jointly Owned, County-Managed Land
- Boulder County Trailhead
- Non-OSMP Managed Multi-Use Trail
- Other Government Land

North Trail Study Area Plan

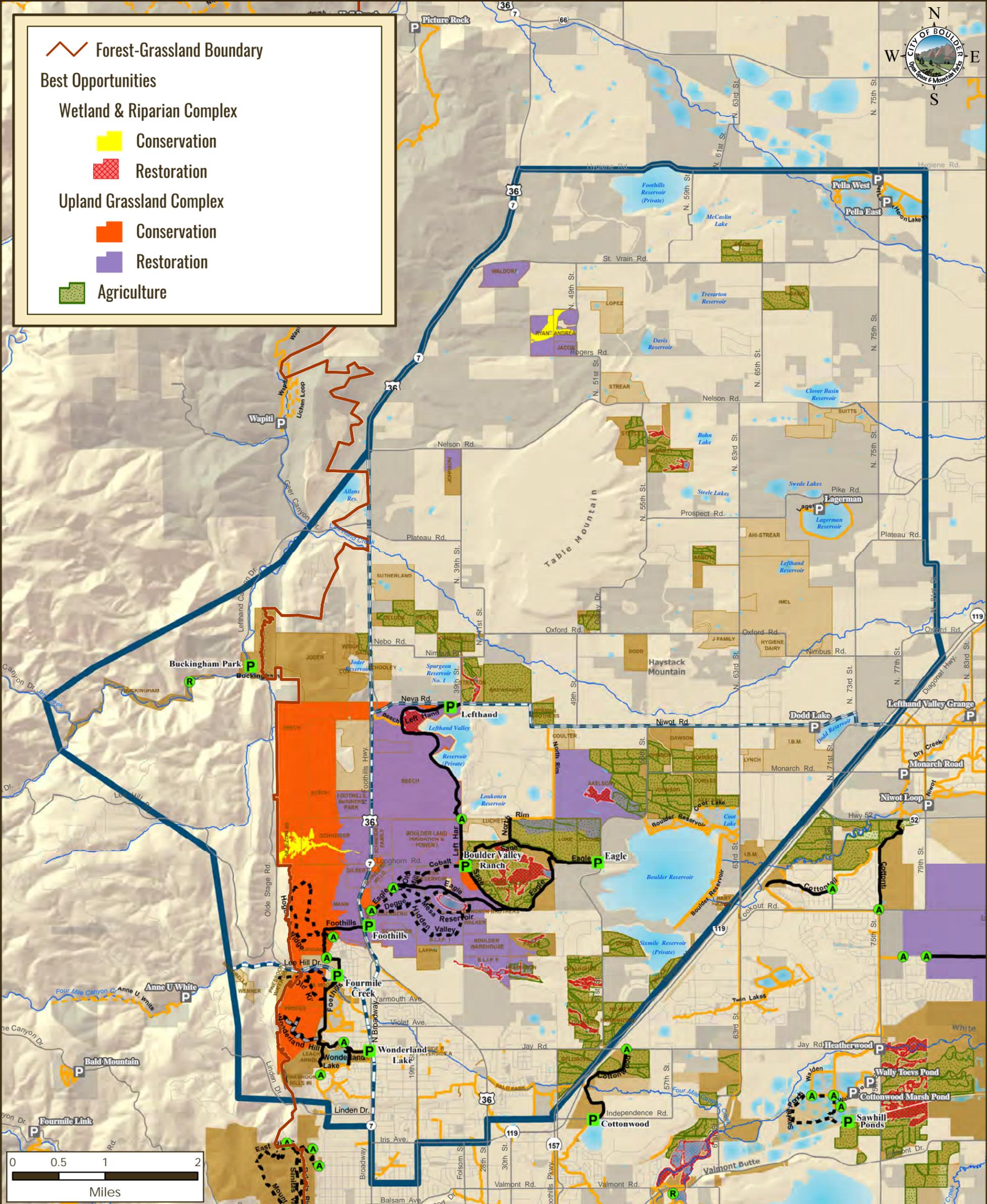


MAP N2: CONSERVATION TARGETS

- | | | |
|----------------------------------|----------------------------------|-----------------------------------------------------|
| OSMP Trailhead | OSMP Hiking/Equestrian Trail | North TSA Boundary |
| OSMP Access Point | OSMP Multi-Use Trail | North TSA Subarea |
| OSMP Recreational Feature Access | OSMP Gliding Access | OSMP Easement or Jointly Owned, County-Managed Land |
| Boulder County Trailhead | Non-OSMP Managed Hiking Trail | Other Government Land |
| | Non-OSMP Managed Multi-Use Trail | |

North Trail Study Area Plan

Date: 6/10/2015

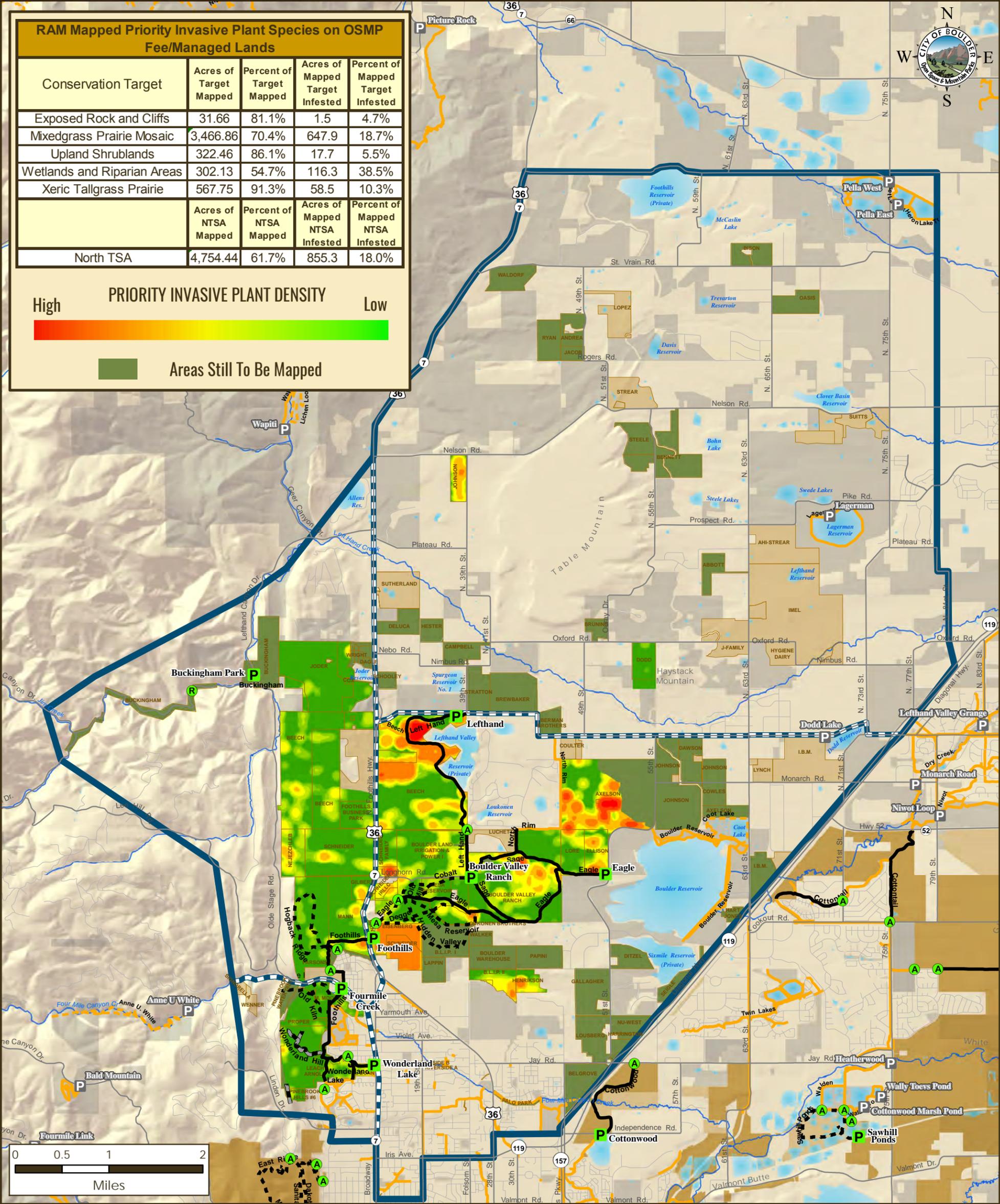


MAP N3: GRASSLAND ECOSYSTEM MANAGEMENT PLAN BEST OPPORTUNITY AREAS

- | | | |
|----------------------------------|----------------------------------|-----------------------------------------------------|
| OSMP Trailhead | OSMP Hiking/Equestrian Trail | North TSA Boundary |
| OSMP Access Point | OSMP Multi-Use Trail | North TSA Subarea |
| OSMP Recreational Feature Access | OSMP Gliding Access | OSMP Fee and Managed Property |
| Boulder County Trailhead | Non-OSMP Managed Hiking Trail | OSMP Easement or Jointly Owned, County-Managed Land |
| | Non-OSMP Managed Multi-Use Trail | Other Government Land |

North Trail Study Area Plan

RAM Mapped Priority Invasive Plant Species on OSMP Fee/Managed Lands				
Conservation Target	Acres of Target Mapped	Percent of Target Mapped	Acres of Mapped Target Infested	Percent of Mapped Target Infested
Exposed Rock and Cliffs	31.66	81.1%	1.5	4.7%
Mixedgrass Prairie Mosaic	3,466.86	70.4%	647.9	18.7%
Upland Shrublands	322.46	86.1%	17.7	5.5%
Wetlands and Riparian Areas	302.13	54.7%	116.3	38.5%
Xeric Tallgrass Prairie	567.75	91.3%	58.5	10.3%
	Acres of NTSA Mapped	Percent of NTSA Mapped	Acres of Mapped NTSA Infested	Percent of Mapped NTSA Infested
North TSA	4,754.44	61.7%	855.3	18.0%



MAP N4: DENSITY OF PRIORITY INVASIVE PLANT SPECIES

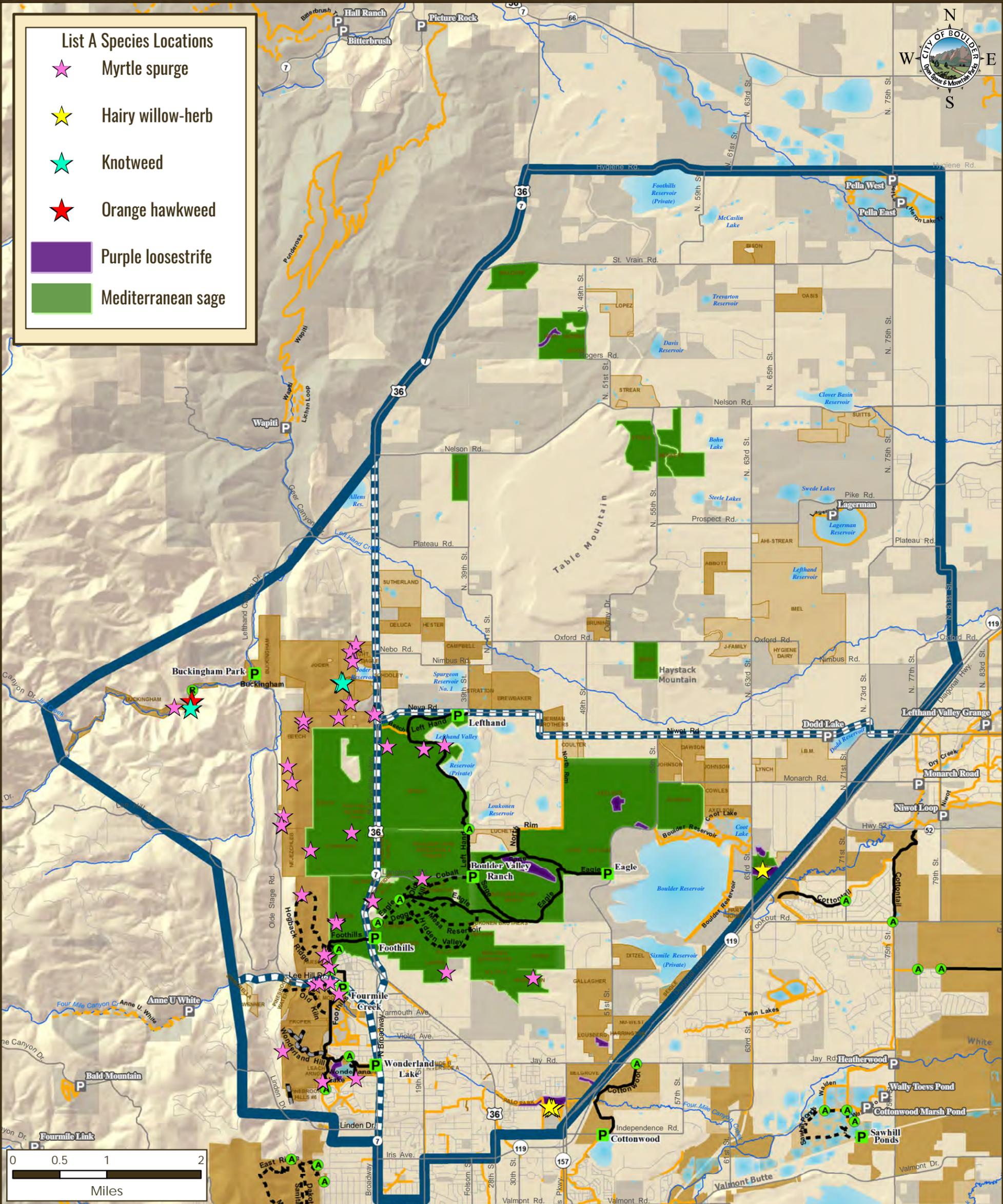
- P OSMP Trailhead
- A OSMP Access Point
- R OSMP Recreational Feature Access
- P Boulder County Trailhead
- OSMP Hiking/Equestrian Trail
- OSMP Multi-Use Trail
- OSMP Gliding Access
- Non-OSMP Managed Hiking Trail
- Non-OSMP Managed Multi-Use Trail
- North TSA Boundary
- North TSA Subarea
- OSMP Fee and Managed Property
- OSMP Easement or Jointly Owned, County-Managed Land
- Other Government Land

North Trail Study Area Plan

Date: 6/12/2015

List A Species Locations

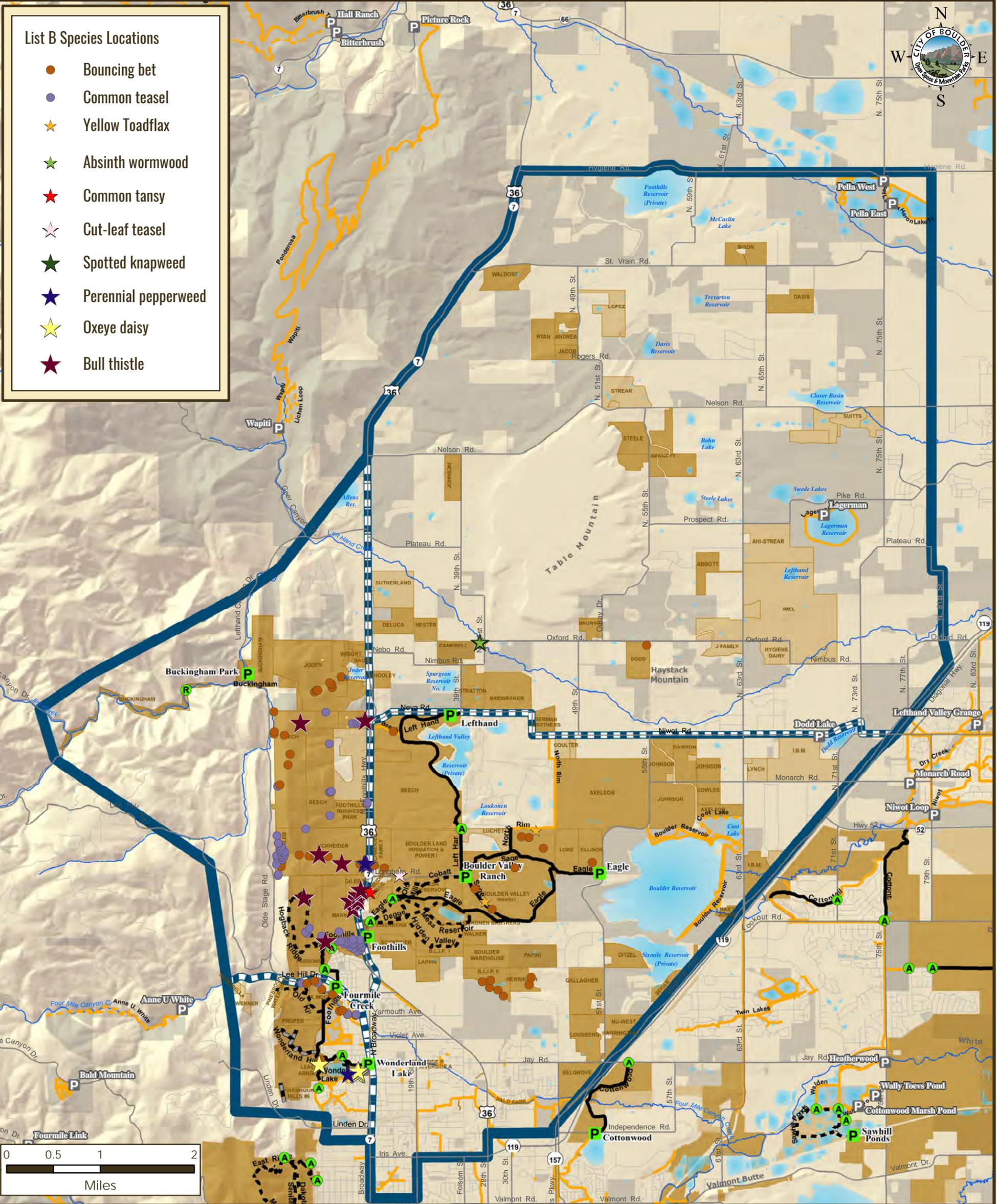
- ★ Myrtle spurge
- ★ Hairy willow-herb
- ★ Knotweed
- ★ Orange hawkweed
- Purple loosestrife
- Mediterranean sage



MAP N5: IPM STATE MANDATED LIST A SPECIES

- | | | |
|-------------------------------------------|----------------------------------|-----------------------------------------------------|
| P OSMP Trailhead | OSMP Hiking/Equestrian Trail | North TSA Boundary |
| A OSMP Access Point | OSMP Multi-Use Trail | North TSA Subarea |
| R OSMP Recreational Feature Access | OSMP Gliding Access | OSMP Fee and Managed Property |
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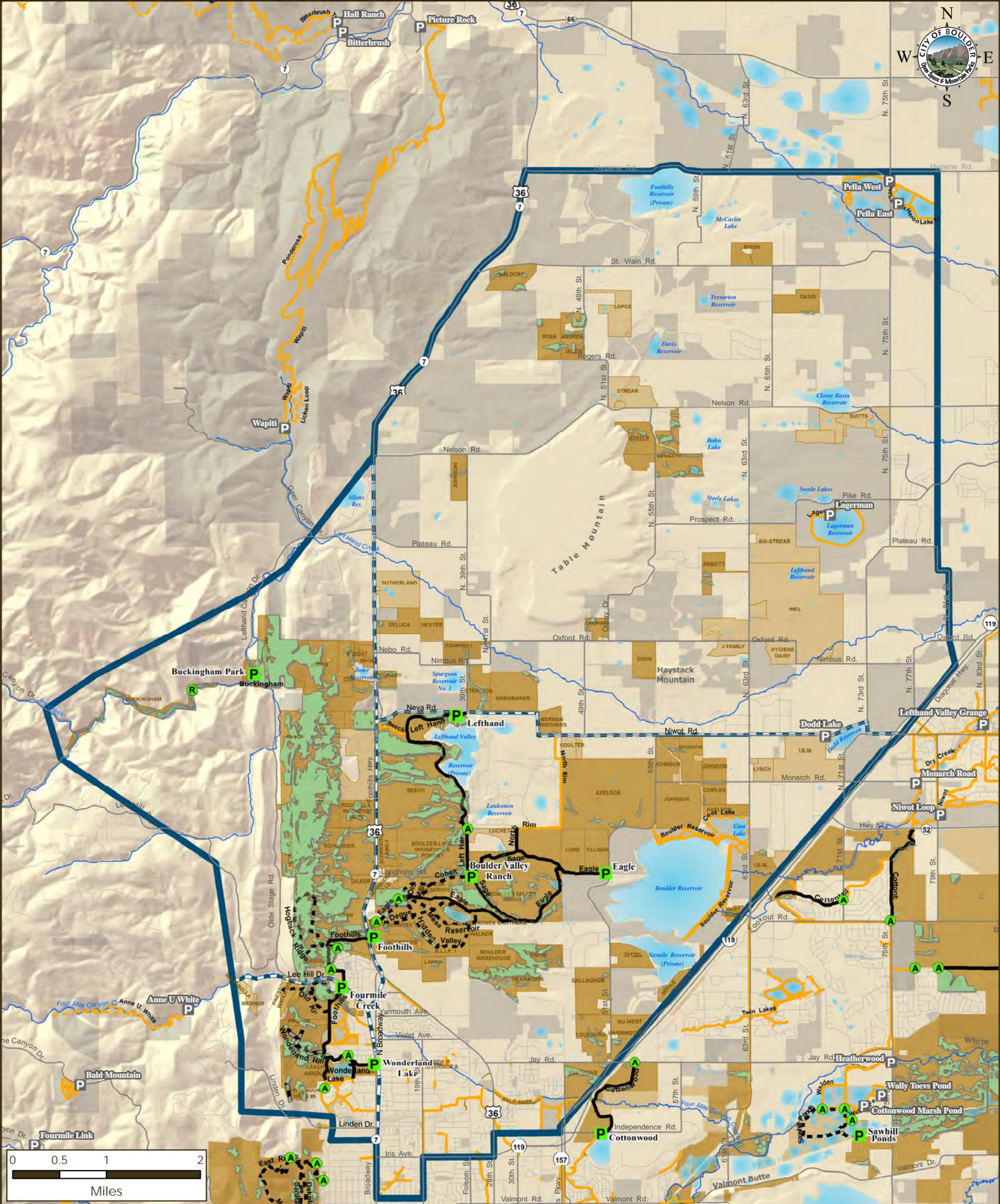
North Trail Study Area Plan



MAP N6: IPM STATE MANDATED LIST B SPECIES

- | | | |
|----------------------------------|----------------------------------|-----------------------------------------------------|
| OSMP Trailhead | OSMP Hiking/Equestrian Trail | North TSA Boundary |
| OSMP Access Point | OSMP Multi-Use Trail | North TSA Subarea |
| OSMP Recreational Feature Access | OSMP Gliding Access | OSMP Fee and Managed Property |
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North Trail Study Area Plan

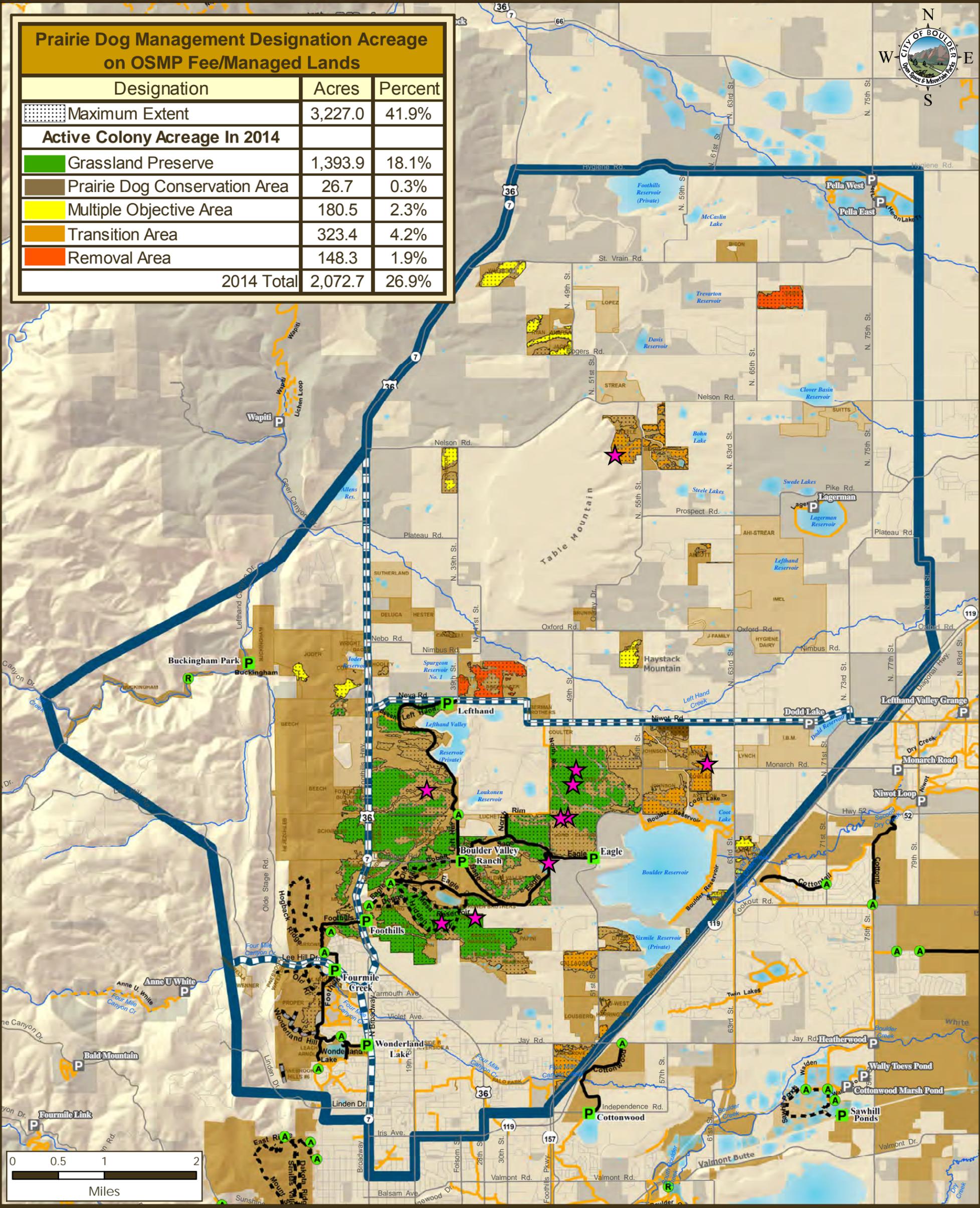


MAP N7: RARE PLANTS AND COMMUNITIES

- | | | |
|----------------------------------|----------------------------------|-----------------------------------------------------|
| Rare Plants & Communities | OSMP Hiking/Equestrian Trail | North TSA Boundary |
| OSMP Trailhead | OSMP Multi-Use Trail | North TSA Subarea |
| OSMP Access Point | OSMP Gliding Access | OSMP Fee and Managed Property |
| OSMP Recreational Feature Access | Non-OSMP Managed Hiking Trail | OSMP Easement or Jointly Owned, County-Managed Land |
| Boulder County Trailhead | Non-OSMP Managed Multi-Use Trail | Other Government Land |

North Trail Study Area Plan

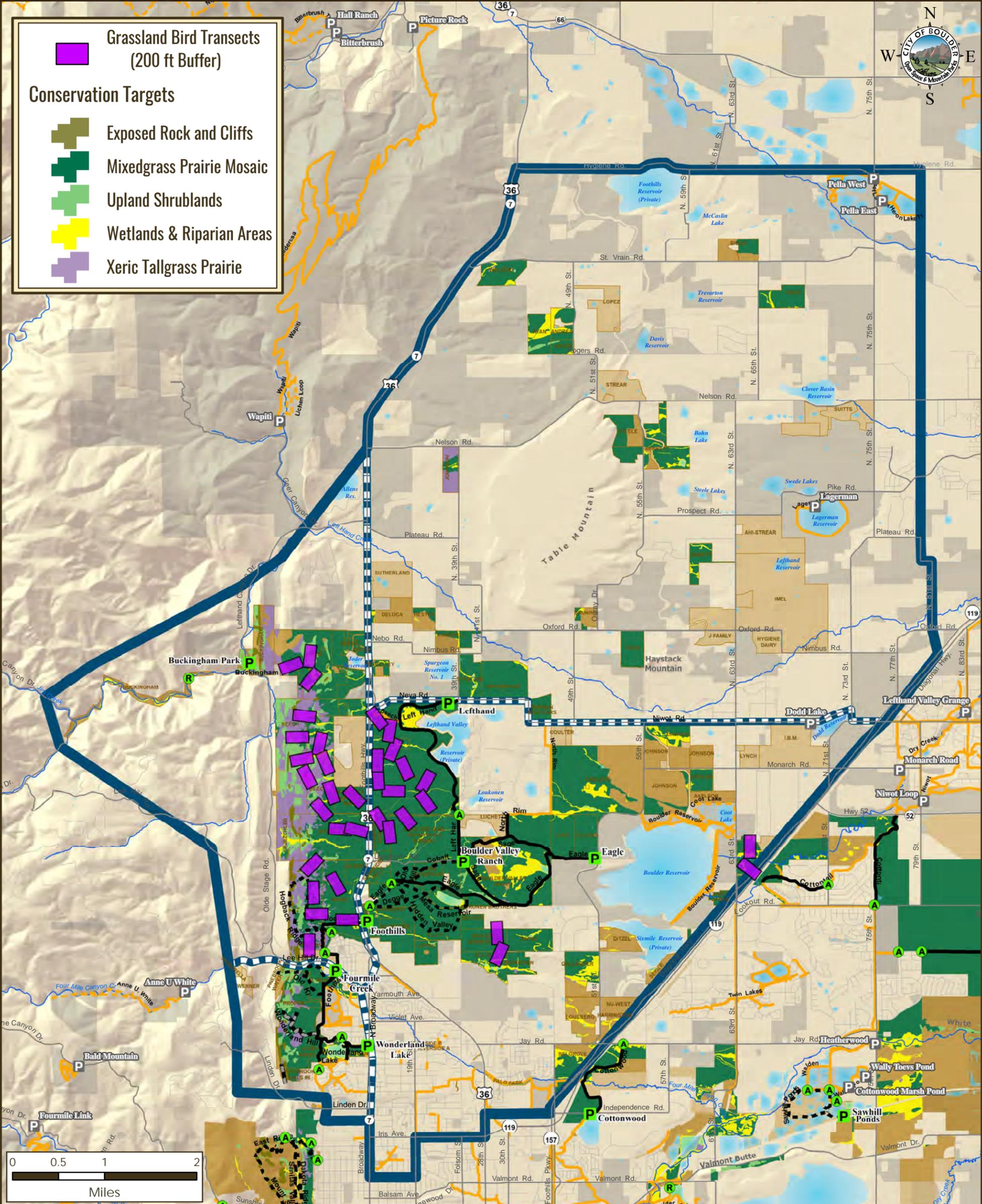
Prairie Dog Management Designation Acreage on OSMP Fee/Managed Lands		
Designation	Acres	Percent
 Maximum Extent	3,227.0	41.9%
Active Colony Acreage In 2014		
 Grassland Preserve	1,393.9	18.1%
 Prairie Dog Conservation Area	26.7	0.3%
 Multiple Objective Area	180.5	2.3%
 Transition Area	323.4	4.2%
 Removal Area	148.3	1.9%
2014 Total	2,072.7	26.9%



MAP N8: 2014 PRAIRIE DOG EXTENT

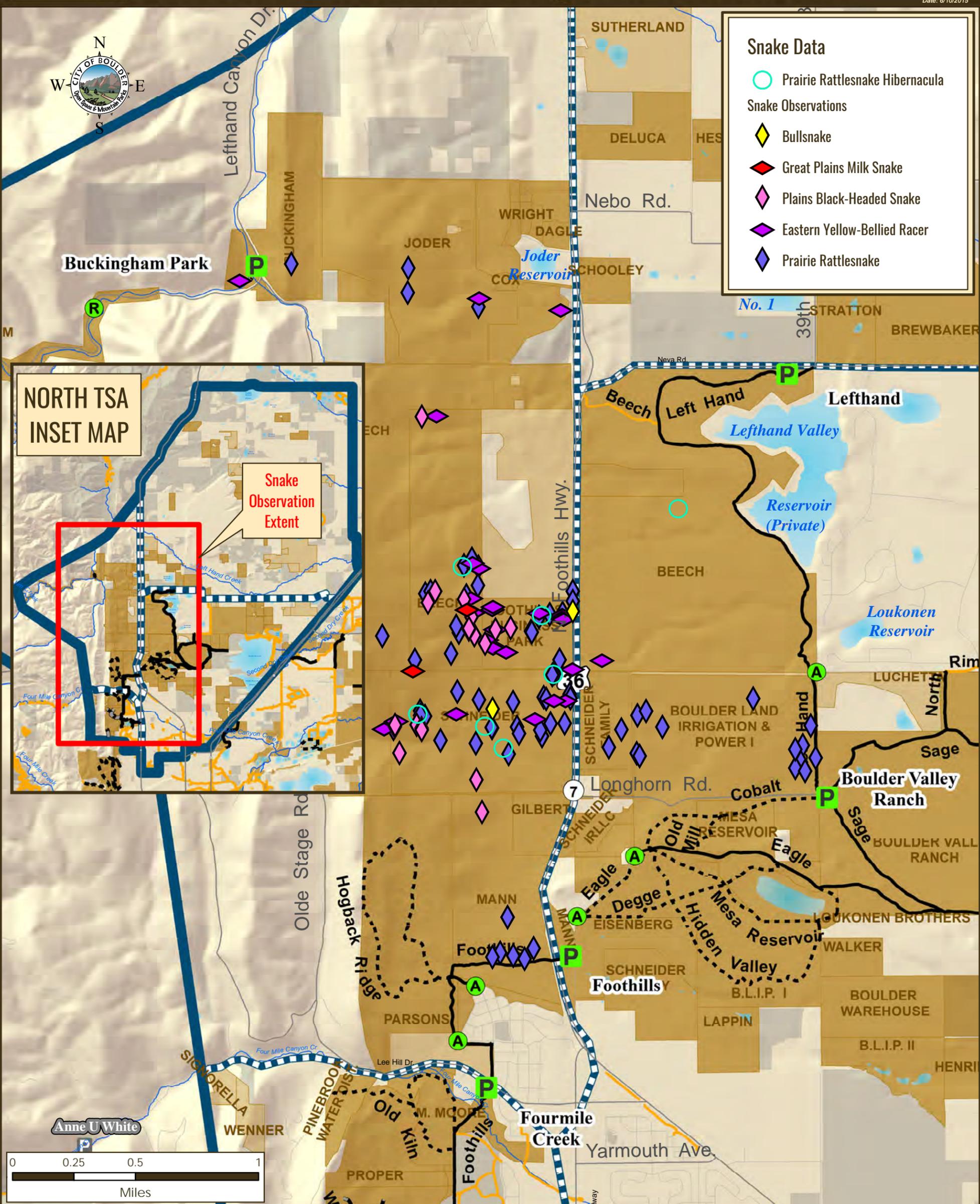
-  Burrowing Owl Sighting
-  OSMP Hiking/Equestrian Trail
-  North TSA Boundary
-  OSMP Trailhead
-  OSMP Multi-Use Trail
-  North TSA Subarea
-  OSMP Access Point
-  OSMP Gliding Access
-  OSMP Fee and Managed Property
-  OSMP Recreational Feature Access
-  Non-OSMP Managed Hiking Trail
-  OSMP Easement or Jointly Owned, County-Managed Land
-  Boulder County Trailhead
-  Non-OSMP Managed Multi-Use Trail
-  Other Government Land

North Trail Study Area Plan



- | | | |
|----------------------------------|----------------------------------|-----------------------------------------------------|
| OSMP Trailhead | OSMP Hiking/Equestrian Trail | North TSA Boundary |
| OSMP Access Point | OSMP Multi-Use Trail | North TSA Subarea |
| OSMP Recreational Feature Access | OSMP Gliding Access | OSMP Fee and Managed Property |
| Boulder County Trailhead | Non-OSMP Managed Hiking Trail | OSMP Easement or Jointly Owned, County-Managed Land |
| | Non-OSMP Managed Multi-Use Trail | Other Government Land |

North Trail Study Area Plan



Snake Data

- Prairie Rattlesnake Hibernacula
- Snake Observations**
- ◆ Bullsnares
- ◆ Great Plains Milk Snake
- ◆ Plains Black-Headed Snake
- ◆ Eastern Yellow-Bellied Racer
- ◆ Prairie Rattlesnake

NORTH TSA INSET MAP

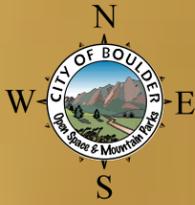
Snake Observation Extent

MAP N10: SNAKE OBSERVATIONS

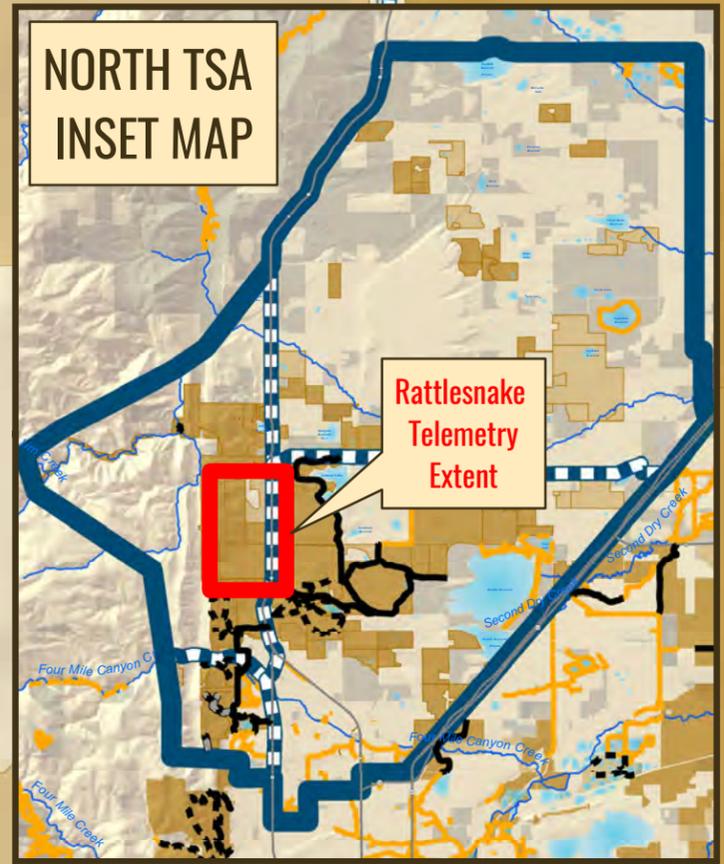
■ OSMP Trailhead	OSMP Hiking/Equestrian Trail	North TSA Boundary
● OSMP Access Point	OSMP Multi-Use Trail	North TSA Subarea
○ OSMP Recreational Feature Access	OSMP Gliding Access	OSMP Fee and Managed Property
■ Boulder County Trailhead	Non-OSMP Managed Hiking Trail	OSMP Easement or Jointly Owned, County-Managed Land
	Non-OSMP Managed Multi-Use Trail	Other Government Land



North Trail Study Area Plan



Snake Telemetry Data		
Point	Snake ID	Distance
	210	
	211	
	212	
	220	
	221	
	303	
	504	
	909	
	910	
	913	
	914	
	915	
	916	
	2114	



BEECH

FOOTHILLS
BUSINESS
PARK



SCHNEIDER

SCHNEIDER
FAMILY



MAP N11: RATTLESNAKE TELEMETRY DATA

- | | | |
|----------------------------------|----------------------------------|-----------------------------------------------------|
| OSMP Trailhead | OSMP Hiking/Equestrian Trail | North TSA Boundary |
| OSMP Access Point | OSMP Multi-Use Trail | North TSA Subarea |
| OSMP Recreational Feature Access | OSMP Gliding Access | OSMP Fee and Managed Property |
| Boulder County Trailhead | Non-OSMP Managed Hiking Trail | OSMP Easement or Jointly Owned, County-Managed Land |
| | Non-OSMP Managed Multi-Use Trail | Other Government Land |

North Trail Study Area Plan

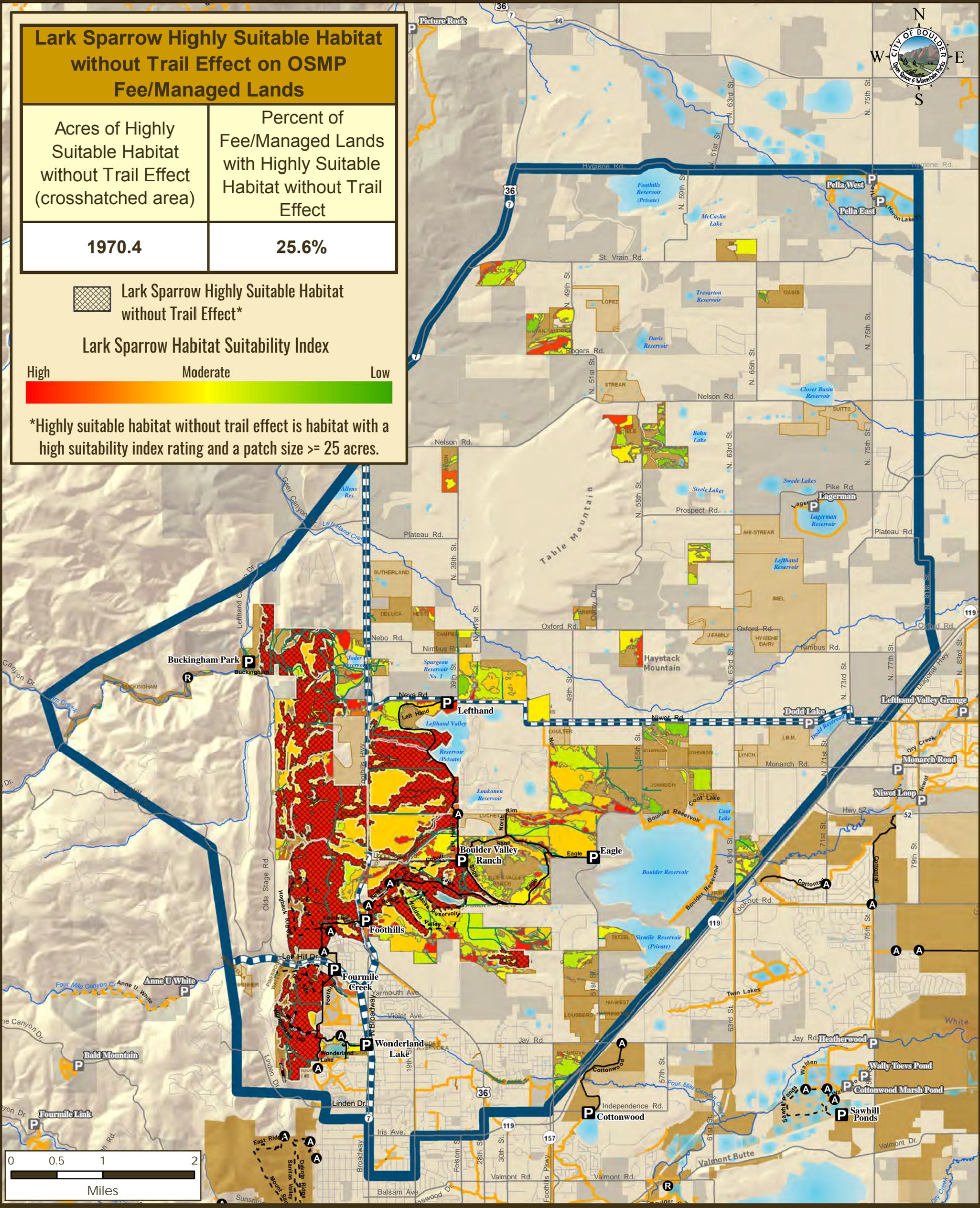
Lark Sparrow Highly Suitable Habitat without Trail Effect on OSMP Fee/Managed Lands	
Acres of Highly Suitable Habitat without Trail Effect (crosshatched area)	Percent of Fee/Managed Lands with Highly Suitable Habitat without Trail Effect
1970.4	25.6%

 Lark Sparrow Highly Suitable Habitat without Trail Effect*

Lark Sparrow Habitat Suitability Index

High Moderate Low

*Highly suitable habitat without trail effect is habitat with a high suitability index rating and a patch size ≥ 25 acres.



MAP N12: LARK SPARROW HIGHLY SUITABLE HABITAT WITHOUT TRAIL EFFECT

- | | | |
|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
|  OSMP Trailhead |  OSMP Hiking/Equestrian Trail |  North TSA Boundary |
|  OSMP Access Point |  OSMP Multi-Use Trail |  North TSA Subarea |
|  OSMP Recreational Feature Access |  OSMP Gliding Access |  OSMP Fee and Managed Property |
|  Boulder County Trailhead |  Non-OSMP Managed Hiking Trail |  OSMP Easement or Jointly Owned, County-Managed Land |
|  Undesignated Trail |  Non-OSMP Managed Multi-Use Trail |  Other Government Land |

North Trail Study Area Plan

Lark Sparrow Highly Suitable Habitat after Trail Effect on OSMP Fee/Managed Lands

Acres of Highly Suitable Habitat after Trail Effect (crosshatched area)	Percent of Fee/Managed Lands with Highly Suitable Habitat after Trail Effect
640.6	8.3%

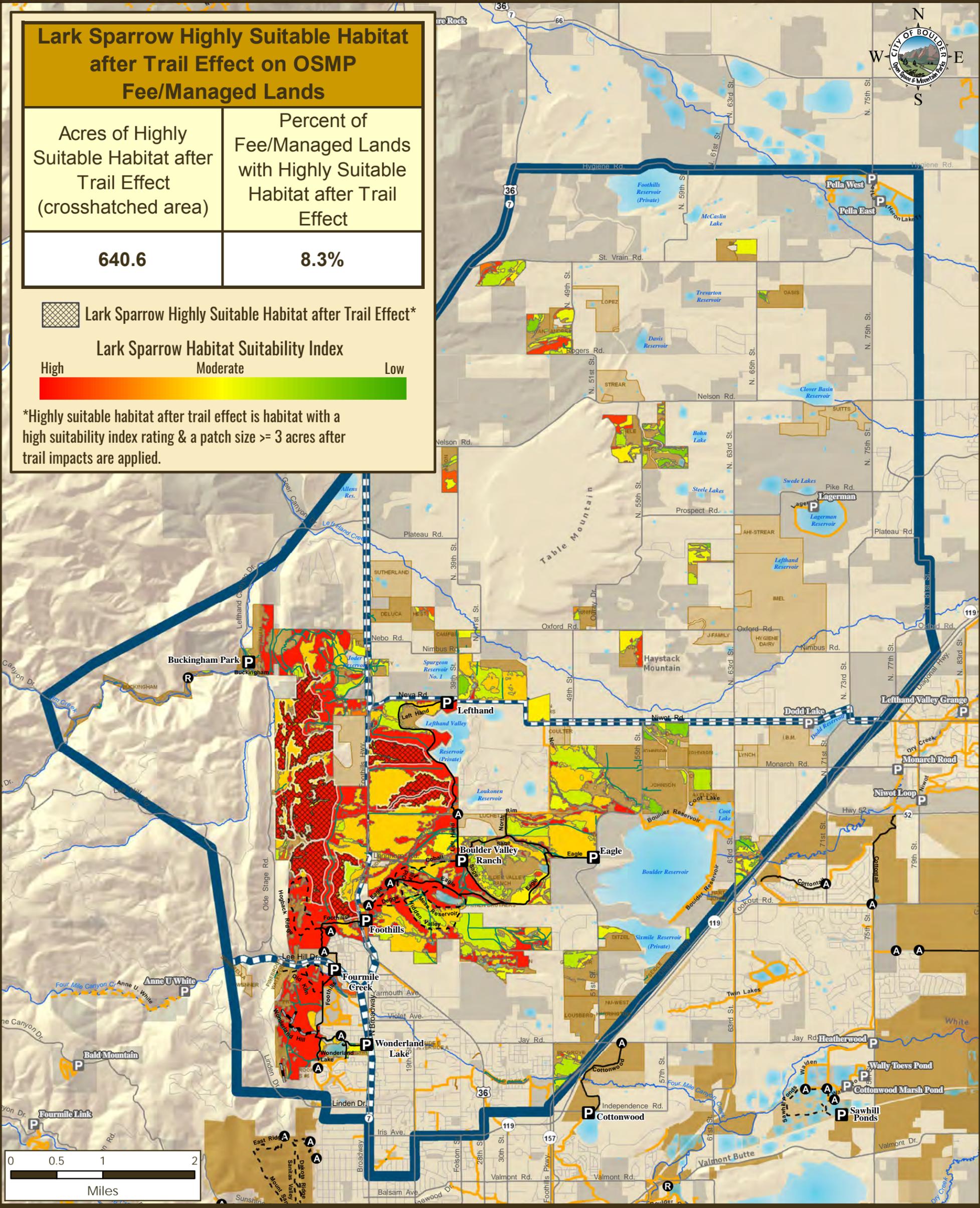


Lark Sparrow Highly Suitable Habitat after Trail Effect*

Lark Sparrow Habitat Suitability Index



*Highly suitable habitat after trail effect is habitat with a high suitability index rating & a patch size ≥ 3 acres after trail impacts are applied.



MAP N13: LARK SPARROW HIGHLY SUITABLE HABITAT AFTER TRAIL EFFECT

- OSMP Trailhead
- OSMP Access Point
- OSMP Recreational Feature Access
- Boulder County Trailhead
- Undesignated Trail
- OSMP Hiking/Equestrian Trail
- OSMP Multi-Use Trail
- OSMP Gliding Access
- Non-OSMP Managed Hiking Trail
- Non-OSMP Managed Multi-Use Trail
- North TSA Boundary
- North TSA Subarea
- OSMP Fee and Managed Property
- OSMP Easement or Jointly Owned, County-Managed Land
- Other Government Land

North Trail Study Area Plan

Prairie Rattlesnake Highly Suitable Habitat without Trail Effect on OSMP Fee/Managed Lands

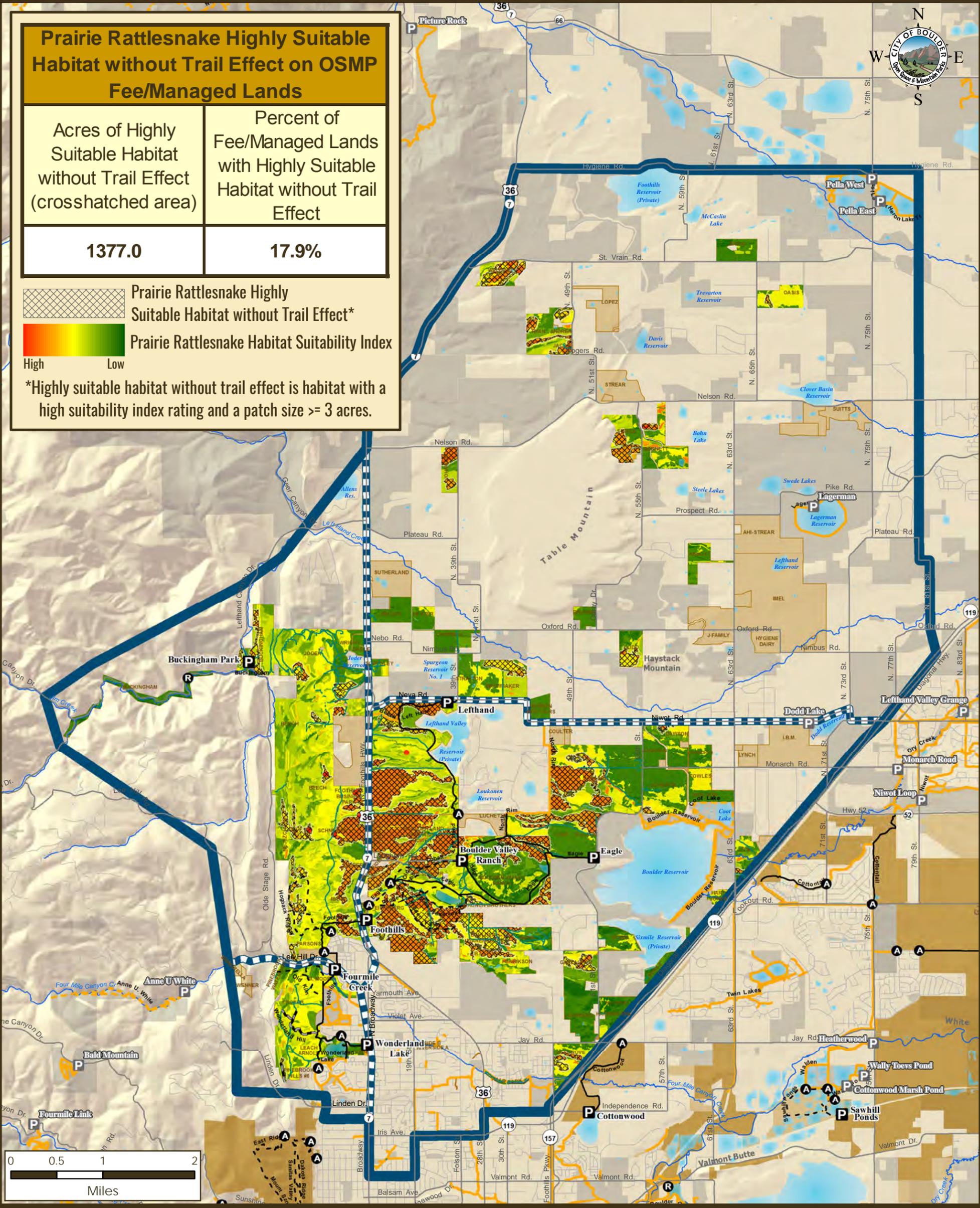
Acres of Highly Suitable Habitat without Trail Effect (crosshatched area)	Percent of Fee/Managed Lands with Highly Suitable Habitat without Trail Effect
1377.0	17.9%

 Prairie Rattlesnake Highly Suitable Habitat without Trail Effect*

 Prairie Rattlesnake Habitat Suitability Index

High Low

*Highly suitable habitat without trail effect is habitat with a high suitability index rating and a patch size >= 3 acres.



MAP N14: PRAIRIE RATTLESNAKE HIGHLY SUITABLE HABITAT WITHOUT TRAIL EFFECT

-  OSMP Trailhead
-  OSMP Access Point
-  OSMP Recreational Feature Access
-  Boulder County Trailhead
-  Undesignated Trail
-  OSMP Hiking/Equestrian Trail
-  OSMP Multi-Use Trail
-  OSMP Gliding Access
-  Non-OSMP Managed Hiking Trail
-  Non-OSMP Managed Multi-Use Trail
-  North TSA Boundary
-  North TSA Subarea
-  OSMP Fee and Managed Property
-  OSMP Easement or Jointly Owned, County-Managed Land
-  Other Government Land

North Trail Study Area Plan

Prairie Rattlesnake Highly Suitable Habitat after Trail Effect on OSMP Fee/Managed Lands

Acres of Highly Suitable Habitat after Trail Effect (crosshatched area)	Percent of Fee/Managed Lands with Highly Suitable Habitat after Trail Effect
1219.0	15.8%



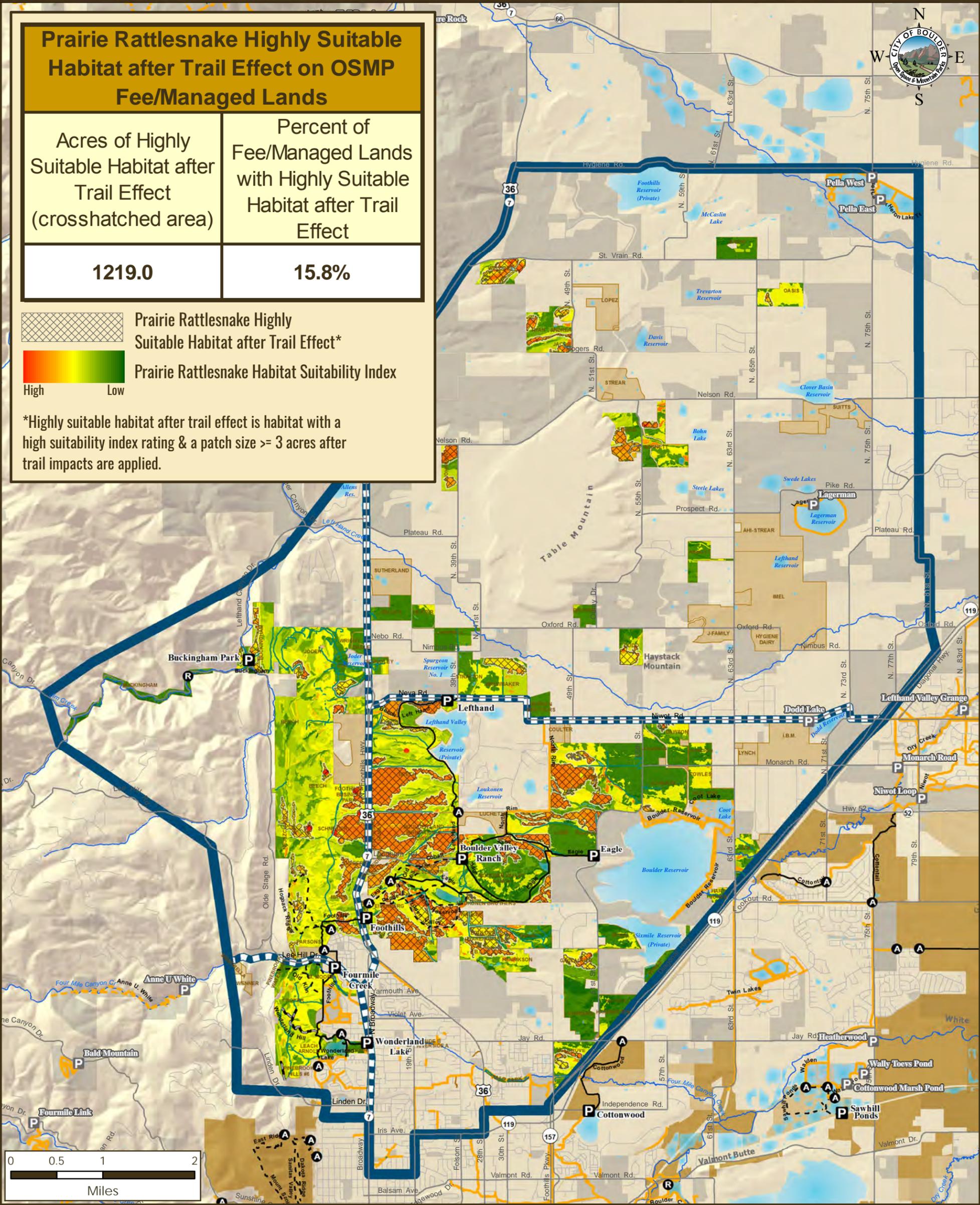
Prairie Rattlesnake Highly Suitable Habitat after Trail Effect*



Prairie Rattlesnake Habitat Suitability Index

High Low

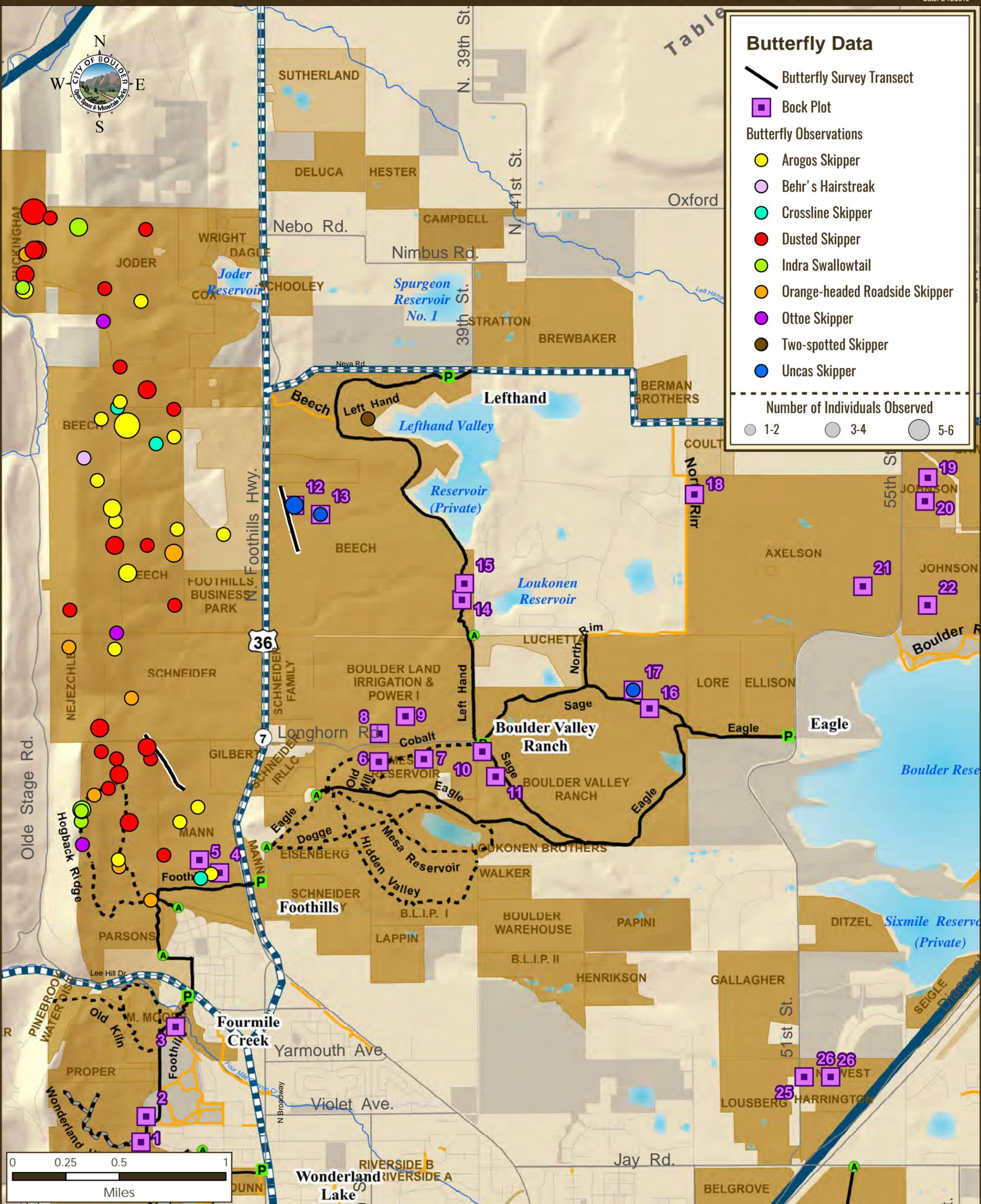
*Highly suitable habitat after trail effect is habitat with a high suitability index rating & a patch size ≥ 3 acres after trail impacts are applied.



MAP N15: PRAIRIE RATTLESNAKE HIGHLY SUITABLE HABITAT AFTER TRAIL EFFECT

- OSMP Trailhead
- OSMP Access Point
- OSMP Recreational Feature Access
- Boulder County Trailhead
- Undesignated Trail
- OSMP Hiking/Equestrian Trail
- OSMP Multi-Use Trail
- OSMP Gliding Access
- Non-OSMP Managed Hiking Trail
- Non-OSMP Managed Multi-Use Trail
- North TSA Boundary
- North TSA Subarea
- OSMP Fee and Managed Property
- OSMP Easement or Jointly Owned, County-Managed Land
- Other Government Land

North Trail Study Area Plan



MAP N16: RARE/TRACKED BUTTERFLIES

- OSMP Trailhead
- OSMP Access Point
- OSMP Recreational Feature Access
- Boulder County Trailhead
- OSMP Hiking/Equestrian Trail
- OSMP Multi-Use Trail
- OSMP Gliding Access
- Non-OSMP Managed Hiking Trail
- Non-OSMP Managed Multi-Use Trail
- North TSA Boundary
- North TSA Subarea
- OSMP Fee and Managed Property
- OSMP Easement or Jointly Owned, County-Managed Land
- Other Government Land

North Trail Study Area Plan

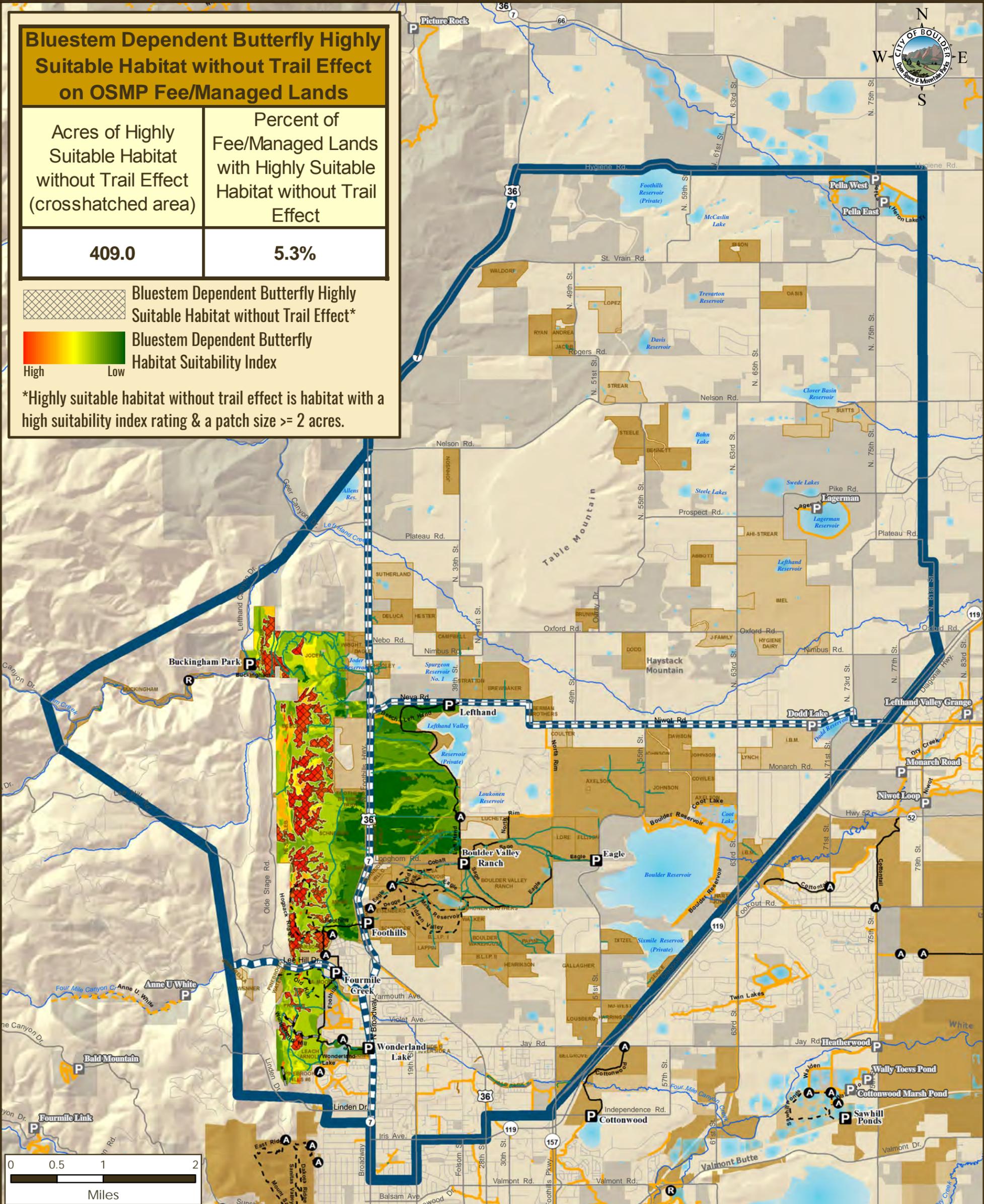
Bluestem Dependent Butterfly Highly Suitable Habitat without Trail Effect on OSMP Fee/Managed Lands

Acres of Highly Suitable Habitat without Trail Effect (crosshatched area)	Percent of Fee/Managed Lands with Highly Suitable Habitat without Trail Effect
409.0	5.3%

 Bluestem Dependent Butterfly Highly Suitable Habitat without Trail Effect*

 Bluestem Dependent Butterfly Habitat Suitability Index
High Low

*Highly suitable habitat without trail effect is habitat with a high suitability index rating & a patch size \geq 2 acres.



MAP N17: BLUESTEM DEPENDENT BUTTERFLY HIGHLY SUITABLE HABITAT WITHOUT TRAIL EFFECT

-  OSMP Trailhead
-  OSMP Access Point
-  OSMP Recreational Feature Access
-  Boulder County Trailhead
-  Undesignated Trail
-  OSMP Hiking/Equestrian Trail
-  OSMP Multi-Use Trail
-  OSMP Gliding Access
-  Non-OSMP Managed Hiking Trail
-  Non-OSMP Managed Multi-Use Trail
-  North TSA Boundary
-  North TSA Subarea
-  OSMP Fee and Managed Property
-  OSMP Easement or Jointly Owned, County-Managed Land
-  Other Government Land

North Trail Study Area Plan

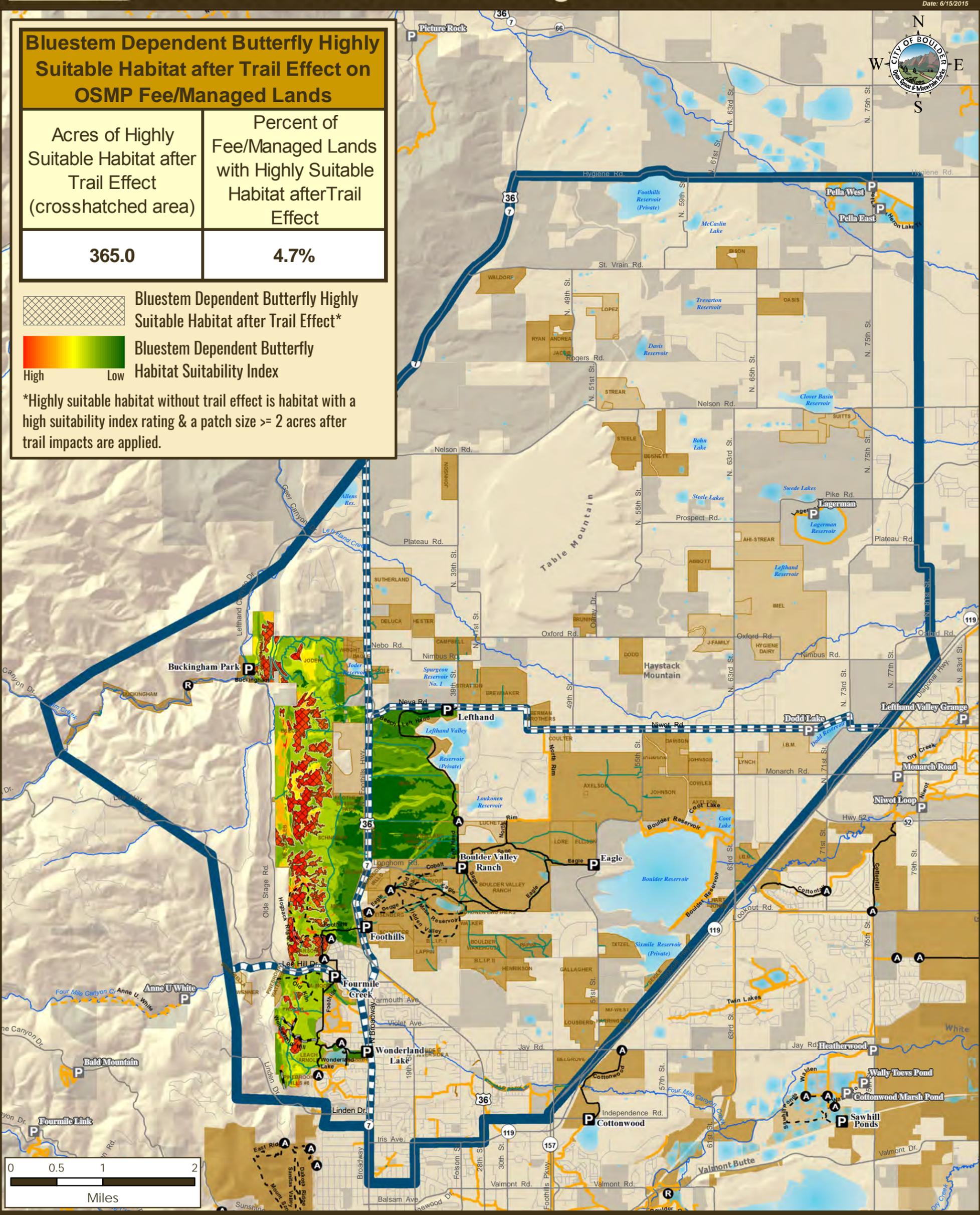
Bluestem Dependent Butterfly Highly Suitable Habitat after Trail Effect on OSMP Fee/Managed Lands

Acres of Highly Suitable Habitat after Trail Effect (crosshatched area)	Percent of Fee/Managed Lands with Highly Suitable Habitat after Trail Effect
365.0	4.7%

 Bluestem Dependent Butterfly Highly Suitable Habitat after Trail Effect*

 Bluestem Dependent Butterfly Habitat Suitability Index
High Low

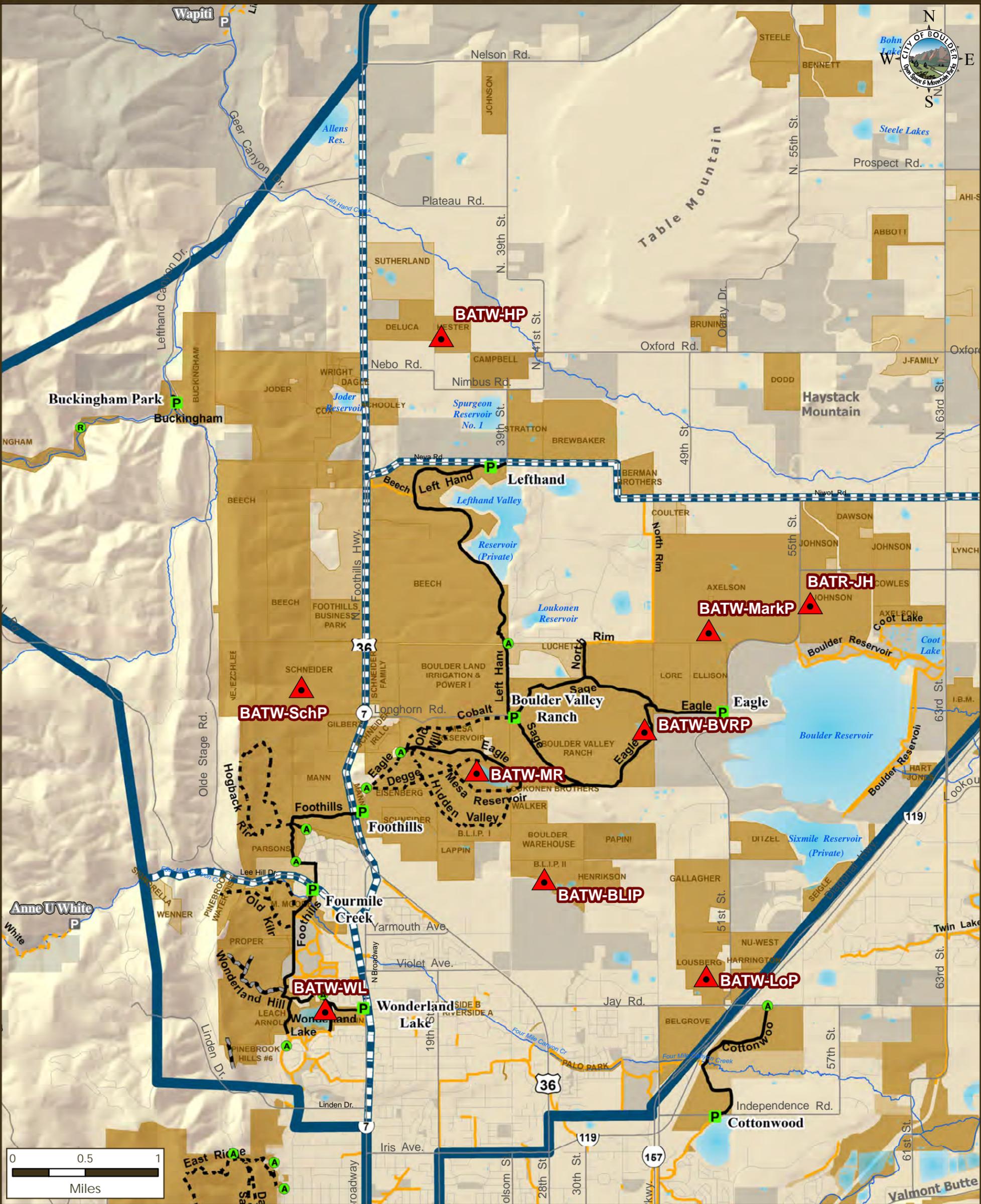
*Highly suitable habitat without trail effect is habitat with a high suitability index rating & a patch size ≥ 2 acres after trail impacts are applied.



MAP N18: BLUESTEM DEPENDENT BUTTERFLY HIGHLY SUITABLE HABITAT AFTER TRAIL EFFECT

-  OSMP Trailhead
-  OSMP Access Point
-  OSMP Recreational Feature Access
-  Boulder County Trailhead
-  Undesignated Trail
-  OSMP Hiking/Equestrian Trail
-  OSMP Multi-Use Trail
-  OSMP Gliding Access
-  Non-OSMP Managed Hiking Trail
-  Non-OSMP Managed Multi-Use Trail
-  North TSA Boundary
-  North TSA Subarea
-  OSMP Fee and Managed Property
-  OSMP Easement or Jointly Owned, County-Managed Land
-  Other Government Land

North Trail Study Area Plan

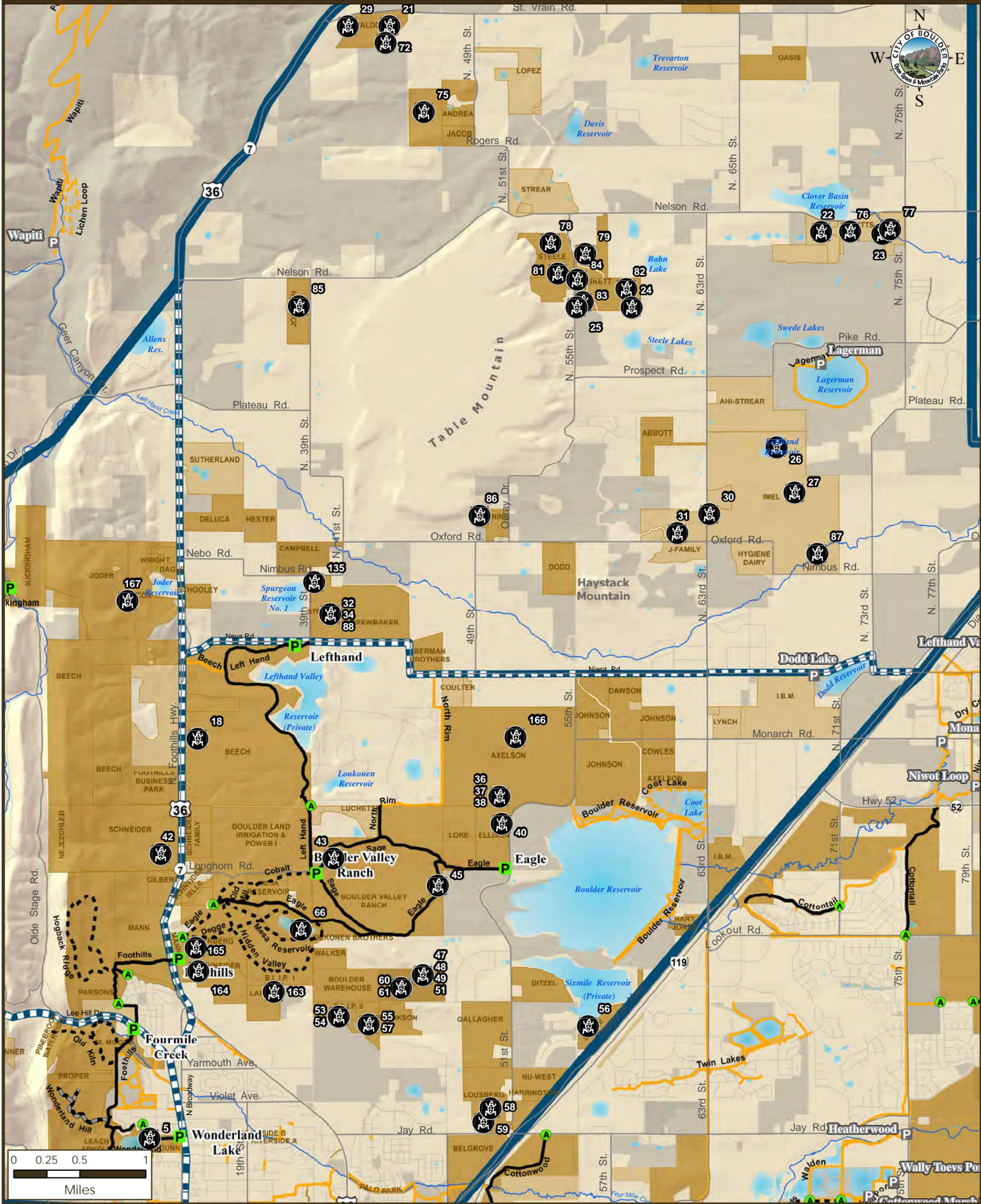


MAP N19: BAT SURVEY LOCATIONS

- | | | | | | |
|--|----------------------------------|--|----------------------------------|--|-----------------------------------------------------|
| | Bat Survey Location | | OSMP Hiking/Equestrian Trail | | North TSA Boundary |
| | OSMP Trailhead | | OSMP Multi-Use Trail | | North TSA Subarea |
| | OSMP Access Point | | OSMP Gliding Access | | OSMP Fee and Managed Property |
| | OSMP Recreational Feature Access | | Non-OSMP Managed Hiking Trail | | OSMP Easement or Jointly Owned, County-Managed Land |
| | Boulder County Trailhead | | Non-OSMP Managed Multi-Use Trail | | Other Government Land |

North Trail Study Area Plan

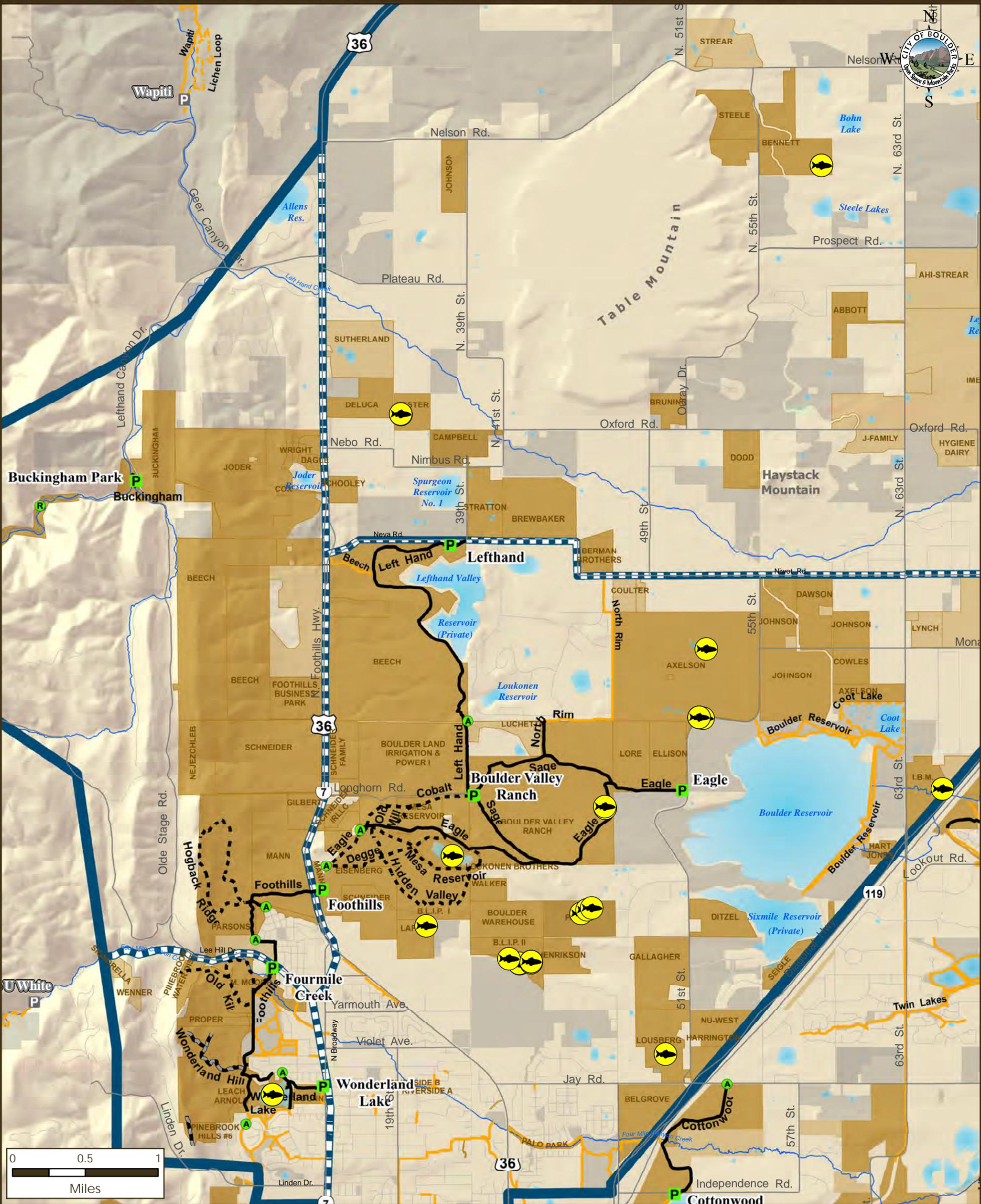
Date: 6/10/2015



MAP N20: AMPHIBIAN SURVEY LOCATIONS

- | | | | | | |
|--|----------------------------------|--|----------------------------------|--|-----------------------------------------------------|
| | Amphibian Survey Location | | OSMP Hiking/Equestrian Trail | | North TSA Boundary |
| | OSMP Trailhead | | OSMP Multi-Use Trail | | North TSA Subarea |
| | OSMP Access Point | | OSMP Gliding Access | | OSMP Fee and Managed Property |
| | OSMP Recreational Feature Access | | Non-OSMP Managed Hiking Trail | | OSMP Easement or Jointly Owned, County-Managed Land |
| | Boulder County Trailhead | | Non-OSMP Managed Multi-Use Trail | | Other Government Land |

North Trail Study Area Plan



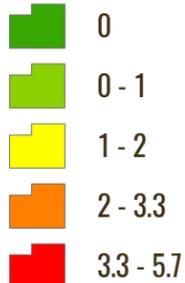
MAP N21: FISH SURVEY LOCATIONS

- | | | | | | |
|--|----------------------------------|--|----------------------------------|--|-----------------------------------------------------|
| | Fish Survey Location | | OSMP Hiking/Equestrian Trail | | North TSA Boundary |
| | OSMP Trailhead | | OSMP Multi-Use Trail | | North TSA Subarea |
| | OSMP Access Point | | OSMP Gliding Access | | OSMP Fee and Managed Property |
| | OSMP Recreational Feature Access | | Non-OSMP Managed Hiking Trail | | OSMP Easement or Jointly Owned, County-Managed Land |
| | Boulder County Trailhead | | Non-OSMP Managed Multi-Use Trail | | Other Government Land |

North Trail Study Area Plan

Bobolink Data

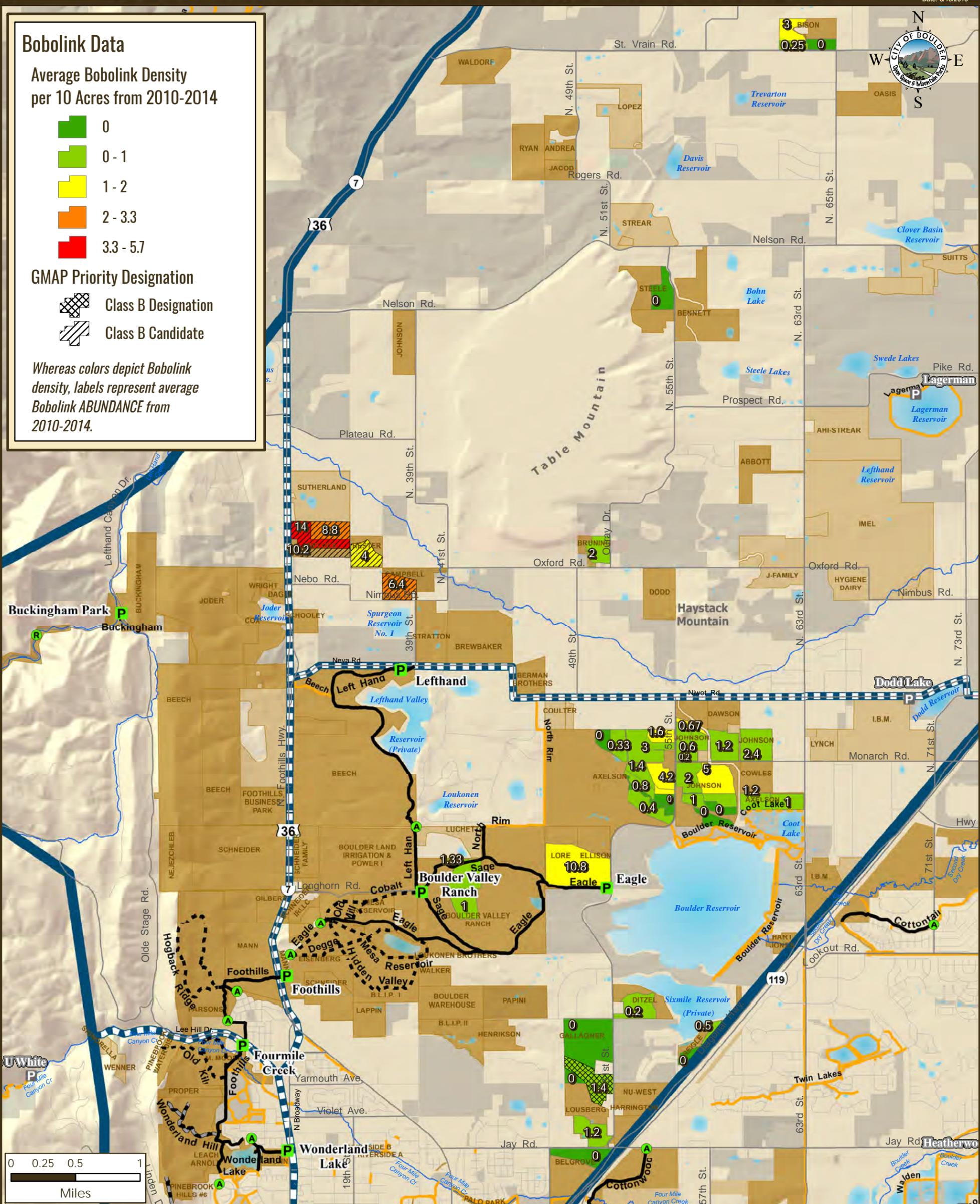
Average Bobolink Density per 10 Acres from 2010-2014



GMAP Priority Designation



Whereas colors depict Bobolink density, labels represent average Bobolink ABUNDANCE from 2010-2014.



MAP N22: BOBOLINK DENSITY

- OSMP Trailhead
- OSMP Hiking/Equestrian Trail
- North TSA Boundary
- OSMP Access Point
- OSMP Multi-Use Trail
- North TSA Subarea
- OSMP Recreational Feature Access
- OSMP Gliding Access
- OSMP Fee and Managed Property
- Non-OSMP Managed Hiking Trail
- OSMP Easement or Jointly Owned, County-Managed Land
- Boulder County Trailhead
- Non-OSMP Managed Multi-Use Trail
- Other Government Land

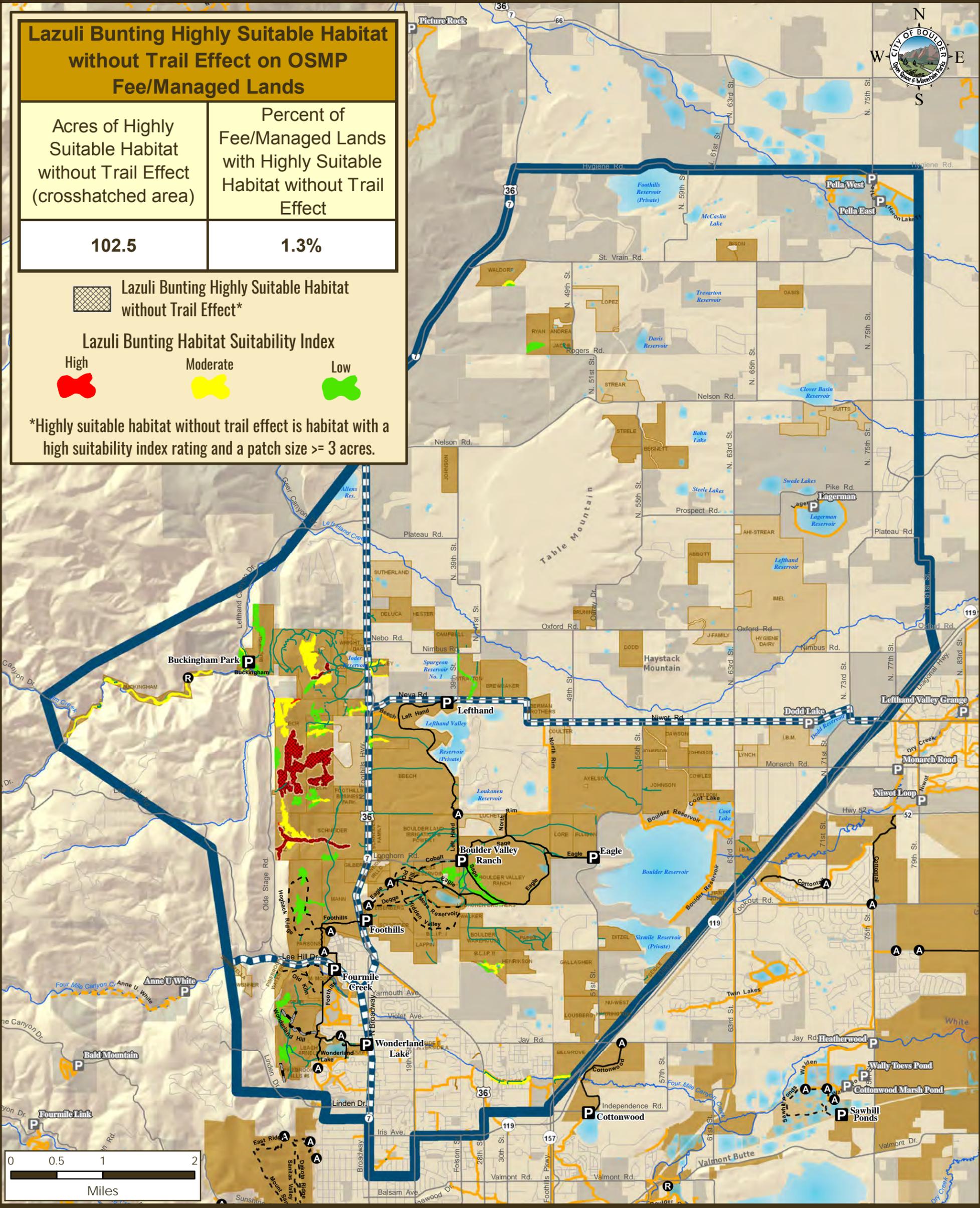
North Trail Study Area Plan

Lazuli Bunting Highly Suitable Habitat without Trail Effect on OSMP Fee/Managed Lands	
Acres of Highly Suitable Habitat without Trail Effect (crosshatched area)	Percent of Fee/Managed Lands with Highly Suitable Habitat without Trail Effect
102.5	1.3%

 Lazuli Bunting Highly Suitable Habitat without Trail Effect*

Lazuli Bunting Habitat Suitability Index
 High  Moderate  Low 

*Highly suitable habitat without trail effect is habitat with a high suitability index rating and a patch size ≥ 3 acres.



MAP N23: LAZULI BUNTING HIGHLY SUITABLE HABITAT WITHOUT TRAIL EFFECT

 OSMP Trailhead	 OSMP Hiking/Equestrian Trail	 North TSA Boundary
 OSMP Access Point	 OSMP Multi-Use Trail	 North TSA Subarea
 OSMP Recreational Feature Access	 OSMP Gliding Access	 OSMP Fee and Managed Property
 Boulder County Trailhead	 Non-OSMP Managed Hiking Trail	 OSMP Easement or Jointly Owned, County-Managed Land
 Undesignated Trail	 Non-OSMP Managed Multi-Use Trail	 Other Government Land

North Trail Study Area Plan

Lazuli Bunting Highly Suitable Habitat after Trail Effect on OSMP Fee/Managed Lands

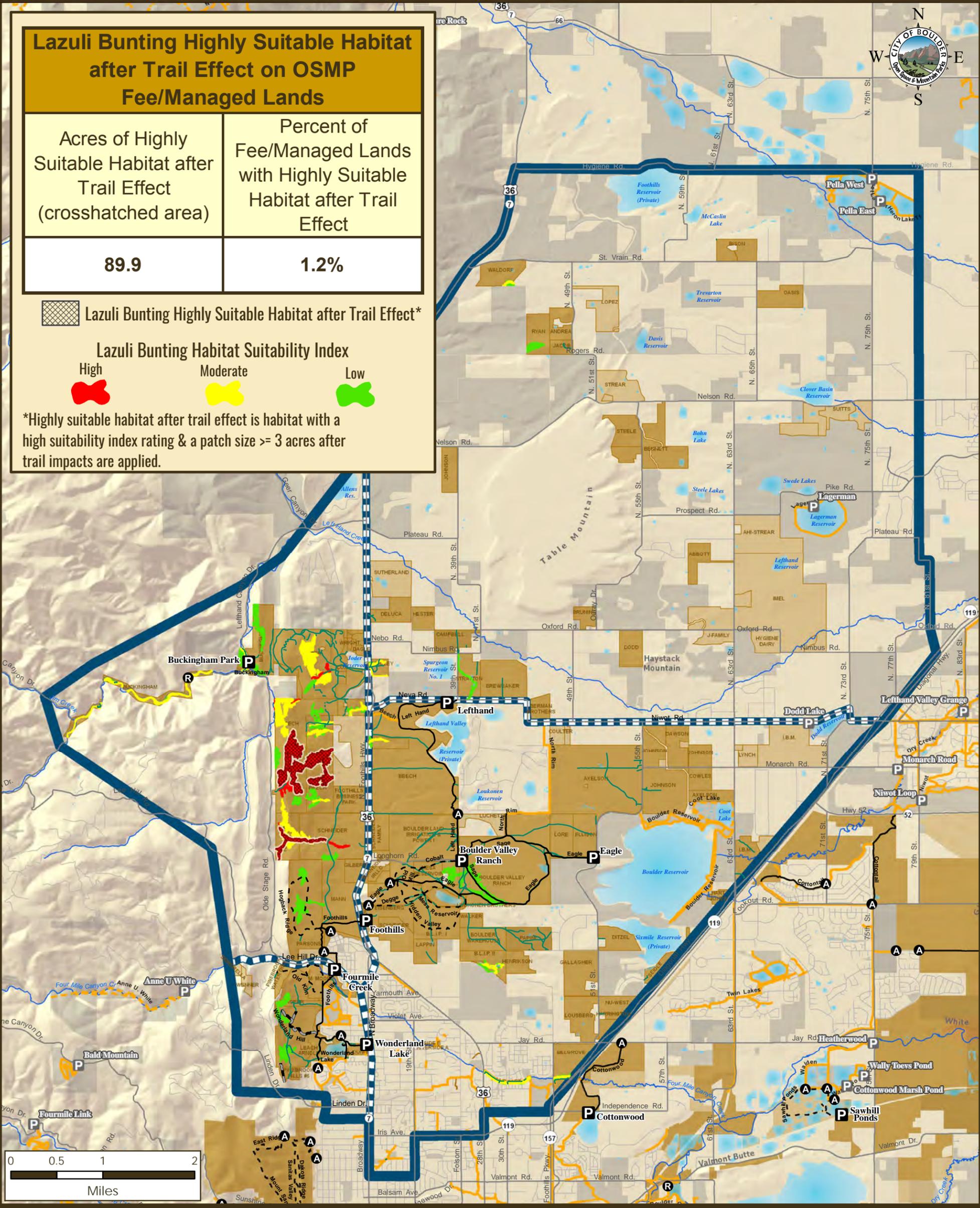
Acres of Highly Suitable Habitat after Trail Effect (crosshatched area)	Percent of Fee/Managed Lands with Highly Suitable Habitat after Trail Effect
89.9	1.2%

Lazuli Bunting Highly Suitable Habitat after Trail Effect*

Lazuli Bunting Habitat Suitability Index

High Moderate Low

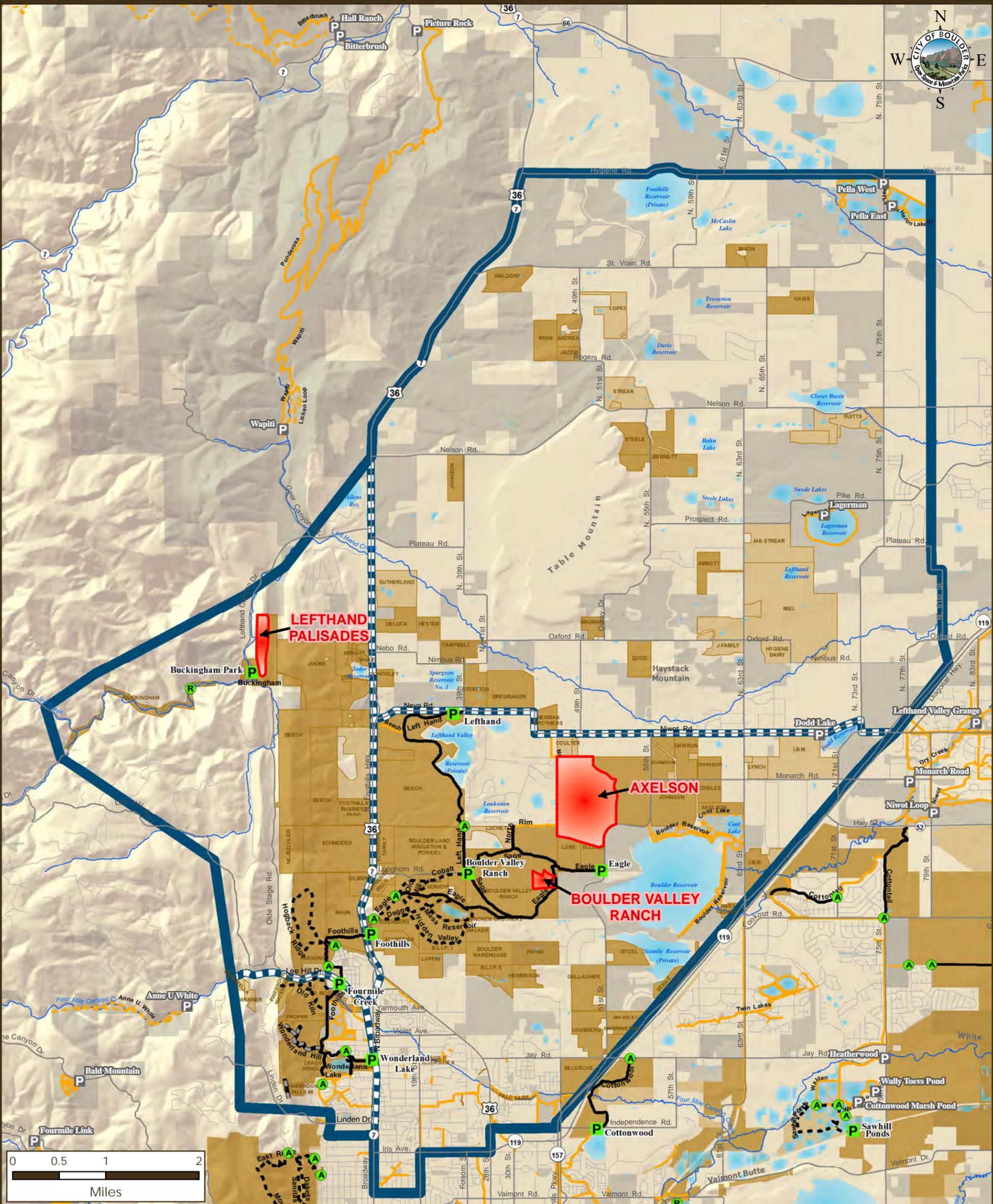
*Highly suitable habitat after trail effect is habitat with a high suitability index rating & a patch size ≥ 3 acres after trail impacts are applied.



MAP N24: LAZULI BUNTING HIGHLY SUITABLE HABITAT AFTER TRAIL EFFECT

- OSMP Trailhead
- OSMP Access Point
- OSMP Recreational Feature Access
- Boulder County Trailhead
- Undesignated Trail
- OSMP Hiking/Equestrian Trail
- OSMP Multi-Use Trail
- OSMP Gliding Access
- Non-OSMP Managed Hiking Trail
- Non-OSMP Managed Multi-Use Trail
- North TSA Boundary
- North TSA Subarea
- OSMP Fee and Managed Property
- OSMP Easement or Jointly Owned, County-Managed Land
- Other Government Land

North Trail Study Area Plan



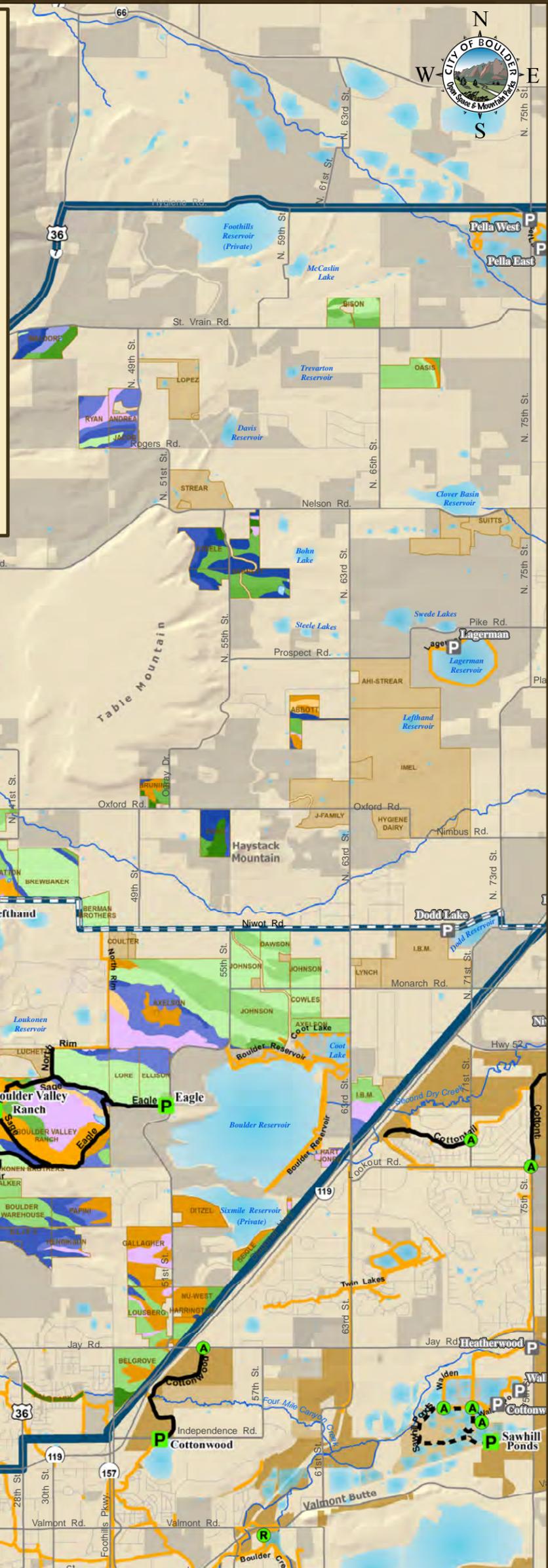
MAP N25: RAPTOR CLOSURES

- | | | |
|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
|  Seasonal Raptor Closure |  OSMP Hiking/Equestrian Trail |  North TSA Boundary |
|  OSMP Trailhead |  OSMP Multi-Use Trail |  North TSA Subarea |
|  OSMP Access Point |  OSMP Gliding Access |  OSMP Fee and Managed Property |
|  OSMP Recreational Feature Access |  Non-OSMP Managed Hiking Trail |  OSMP Easement or Jointly Owned, County-Managed Land |
|  Boulder County Trailhead |  Non-OSMP Managed Multi-Use Trail |  Other Government Land |

North Trail Study Area Plan

SSURGO Soil Orders

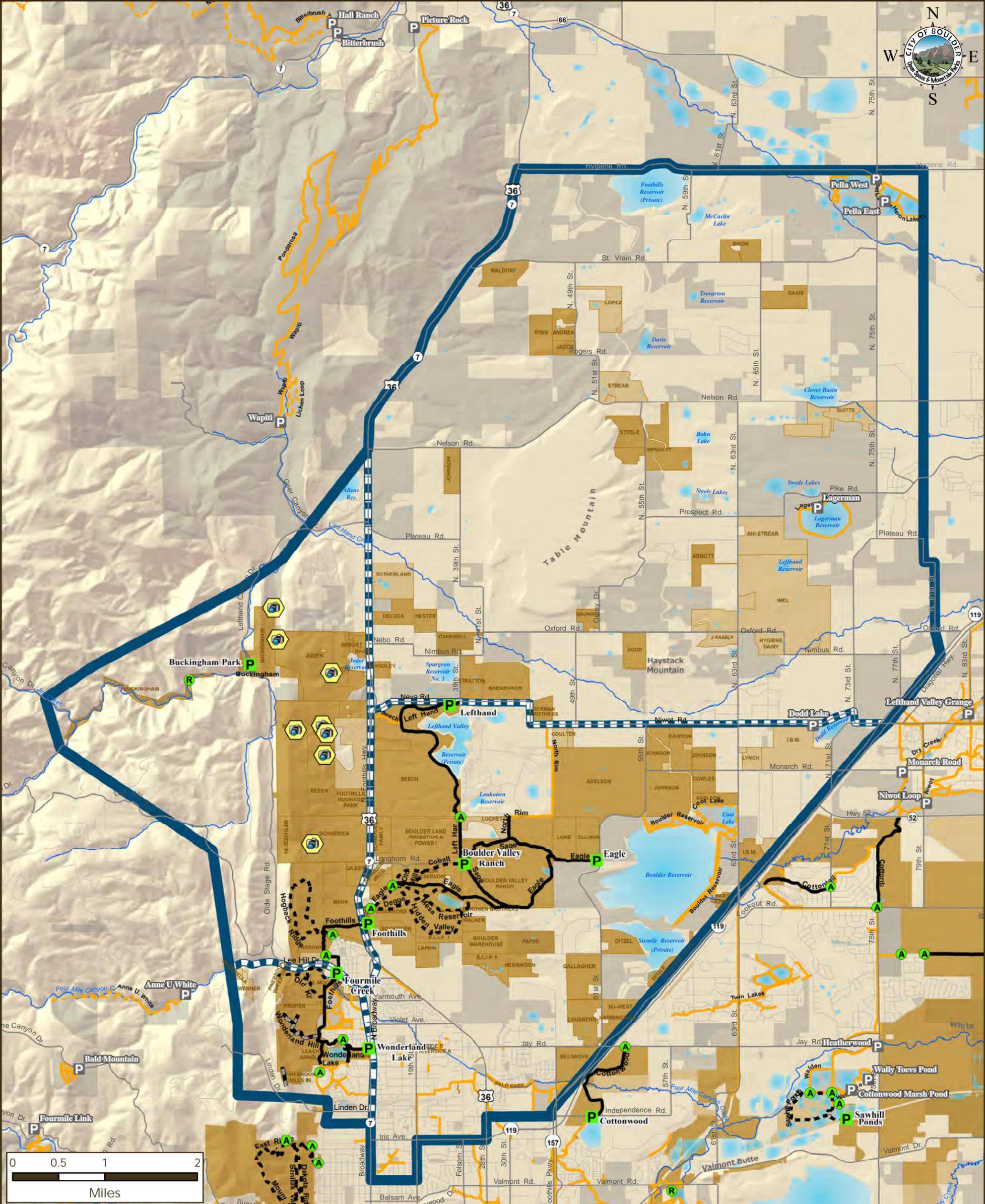
Mollisols	Alfisols
Valmont cobbly clay loam	Fern Cliff-Allens Park-Rock outcrop complex
Pactic Argiustolls	Goldvale-Rock outcrop complex
Pactic Argiustolls-Aquic Argiudolls complex	Pinata-Rock outcrop complex
Valmont clay loam	Entisols
Typical Haplustolls-Cathedral family-Rock outcrop complex	Colluvial land
Ratake-Cathedral families-Rock outcrop complex	Manvel loam
Niwot soils	Samsil-Shingle complex
Nunn clay loam	Terrace escarpments
Kutch clay loam	Samsil clay
Nederland very cobbly sandy loam	Sixmile stony loam
Laporte very fine sandy loam	Inceptisols
Juget-Rock outcrop complex	Longmont clay
Ascalon-Otero complex	Bullwark-Catamount families-Rock outcrop complex
Calkins sandy loam	Aridisols
Hargreave fine sandy loam	Heldt clay
Ascalon sandy loam	Renohill loam
Baller stony sandy loam	Renohill silty clay loam
	Non Soils
	Water
	Rock Outcrop; Misc. Ground Covering



MAP N26: SOILS

OSMP Trailhead	OSMP Hiking/Equestrian Trail	North TSA Boundary
OSMP Access Point	OSMP Multi-Use Trail	North TSA Subarea
OSMP Recreational Feature Access	OSMP Gliding Access	OSMP Fee and Managed Property
Boulder County Trailhead	Non-OSMP Managed Hiking Trail	OSMP Easement or Jointly Owned, County-Managed Land
	Non-OSMP Managed Multi-Use Trail	Other Government Land

North Trail Study Area Plan

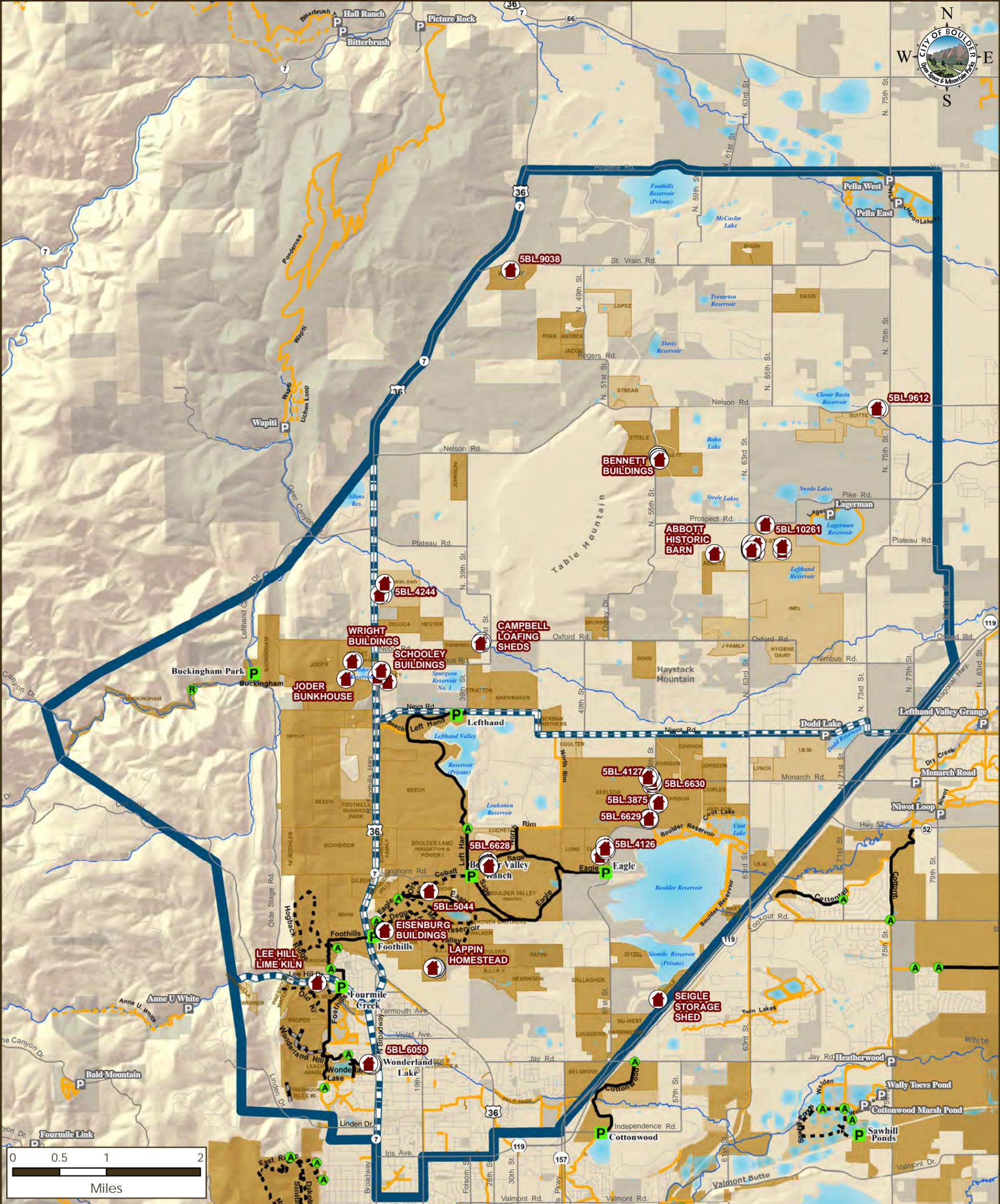


MAP N27: WILDLIFE CAMERA LOCATIONS

- | | | | | | |
|-------------------------------------------------------------------------------------|----------------------------------|-------------------------------------------------------------------------------------|----------------------------------|---------------------------------------------------------------------------------------|-----------------------------------------------------|
|  | Wildlife Camera Location |  | OSMP Hiking/Equestrian Trail |  | North TSA Boundary |
|  | OSMP Trailhead |  | OSMP Multi-Use Trail |  | North TSA Subarea |
|  | OSMP Access Point |  | OSMP Gliding Access |  | OSMP Fee and Managed Property |
|  | OSMP Recreational Feature Access |  | Non-OSMP Managed Hiking Trail |  | OSMP Easement or Jointly Owned, County-Managed Land |
|  | Boulder County Trailhead |  | Non-OSMP Managed Multi-Use Trail |  | Other Government Land |

Cultural Resources Maps

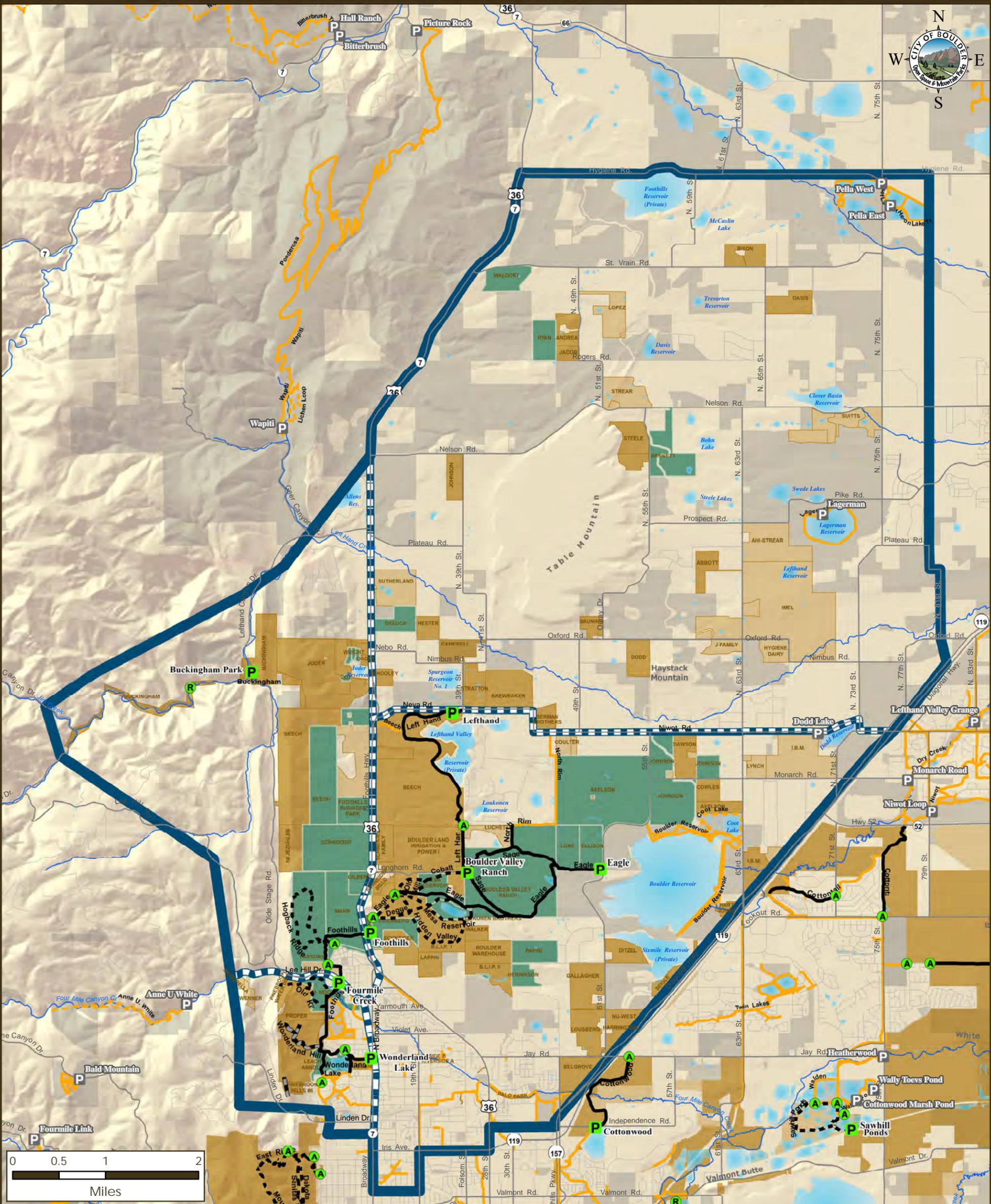
North Trail Study Area Plan



MAP C1: HISTORIC ARCHAEOLOGICAL SITES

- | | | |
|----------------------------------|----------------------------------|-----------------------------------------------------|
| Historic Archaeological Site | OSMP Hiking/Equestrian Trail | North TSA Boundary |
| OSMP Trailhead | OSMP Multi-Use Trail | North TSA Subarea |
| OSMP Access Point | OSMP Gliding Access | OSMP Fee and Managed Property |
| OSMP Recreational Feature Access | Non-OSMP Managed Hiking Trail | OSMP Easement or Jointly Owned, County-Managed Land |
| Boulder County Trailhead | Non-OSMP Managed Multi-Use Trail | Other Government Land |

North Trail Study Area Plan



MAP C2: HISTORICAL BUILDINGS, STRUCTURES AND OBJECTS

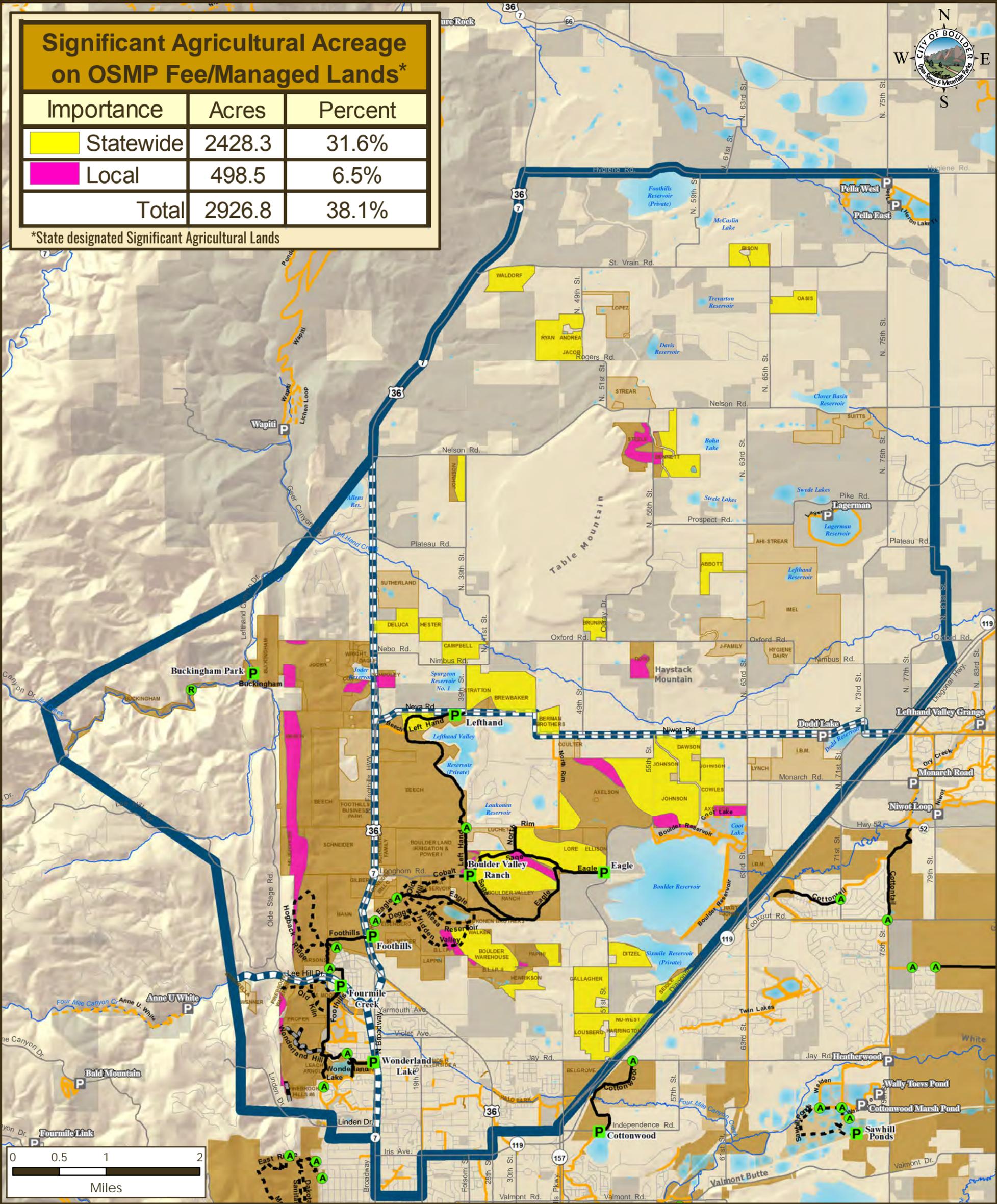
- Property With Significant Archaeological Site(s)
- OSMP Trailhead
- OSMP Access Point
- OSMP Recreational Feature Access
- Boulder County Trailhead
- OSMP Hiking/Equestrian Trail
- OSMP Multi-Use Trail
- OSMP Gliding Access
- Non-OSMP Managed Hiking Trail
- Non-OSMP Managed Multi-Use Trail
- North TSA Boundary
- North TSA Subarea
- OSMP Fee and Managed Property
- OSMP Easement or Jointly Owned, County-Managed Land
- Other Government Land

Agricultural Resources Maps

North Trail Study Area Plan

Significant Agricultural Acreage on OSMP Fee/Managed Lands*		
Importance	Acres	Percent
 Statewide	2428.3	31.6%
 Local	498.5	6.5%
Total	2926.8	38.1%

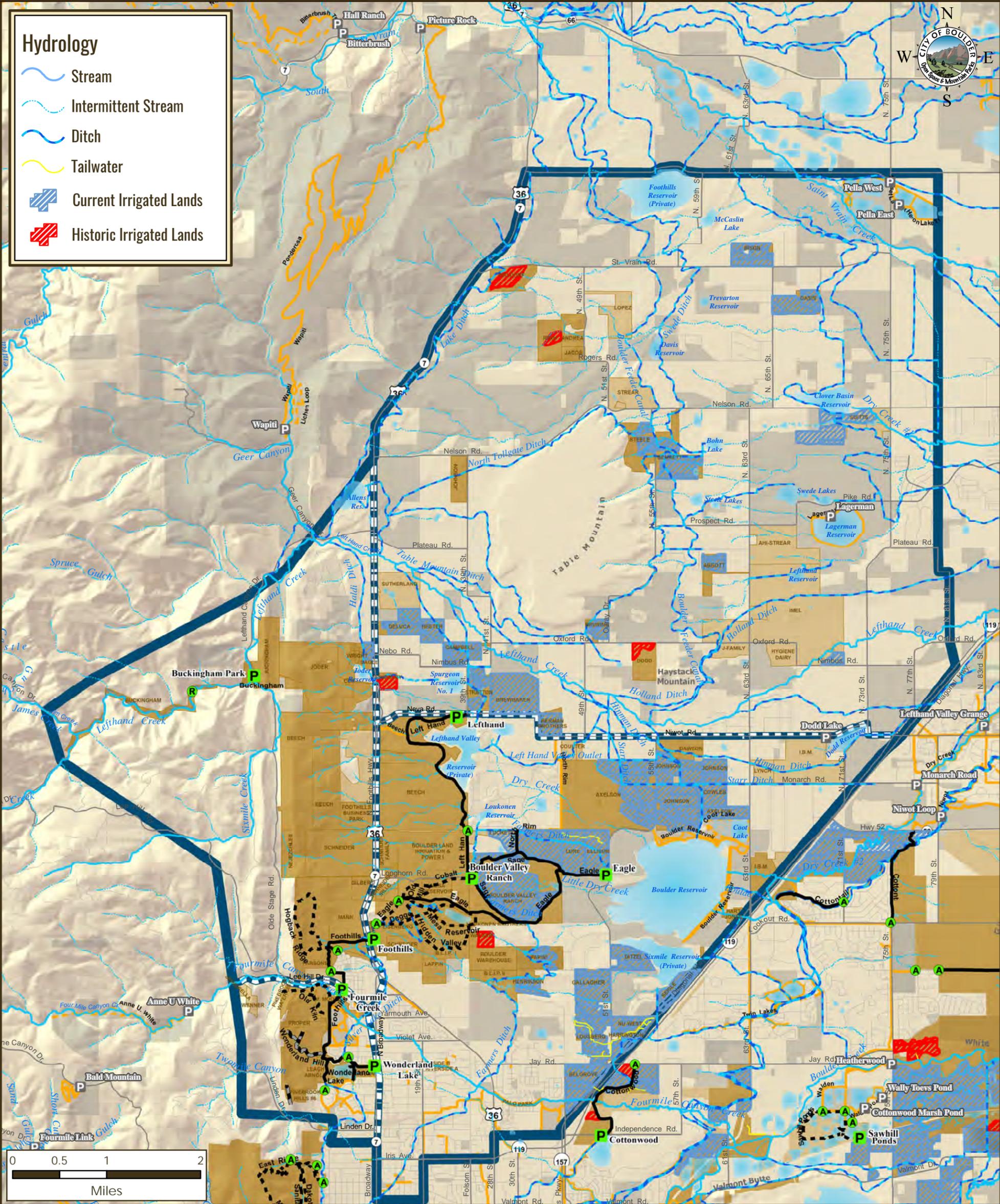
*State designated Significant Agricultural Lands



MAP A1: SIGNIFICANT AGRICULTURAL LANDS

- P OSMP Trailhead
- A OSMP Access Point
- R OSMP Recreational Feature Access
- P Boulder County Trailhead
- OSMP Hiking/Equestrian Trail
- OSMP Multi-Use Trail
- OSMP Gliding Access
- Non-OSMP Managed Hiking Trail
- Non-OSMP Managed Multi-Use Trail
- North TSA Boundary
- North TSA Subarea
- OSMP Fee and Managed Property
- OSMP Easement or Jointly Owned, County-Managed Land
- Other Government Land

North Trail Study Area Plan



MAP A2: AGRICULTURAL WATER

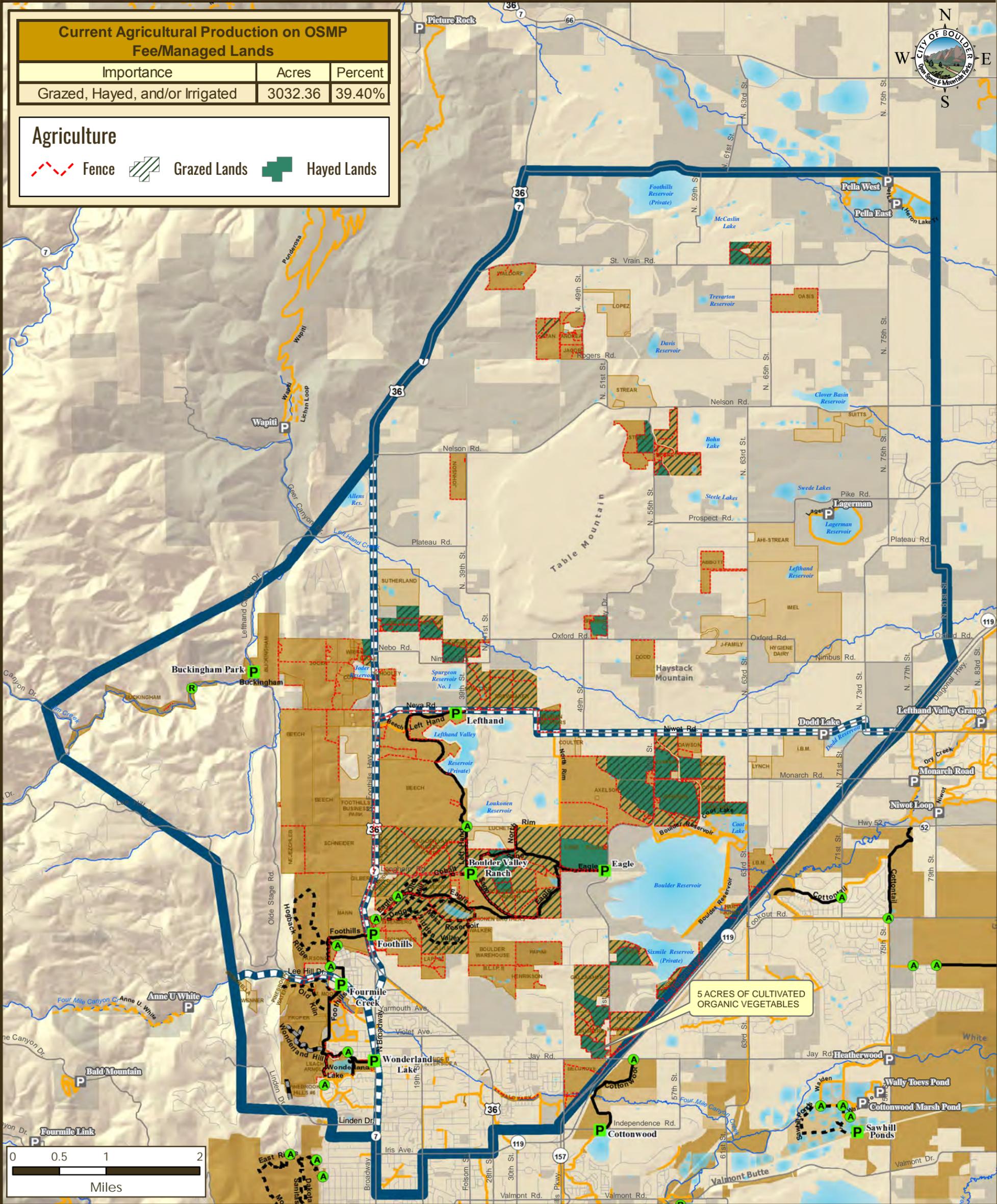
- P OSMP Trailhead
- A OSMP Access Point
- R OSMP Recreational Feature Access
- P Boulder County Trailhead
- OSMP Hiking/Equestrian Trail
- OSMP Multi-Use Trail
- OSMP Gliding Access
- Non-OSMP Managed Hiking Trail
- Non-OSMP Managed Multi-Use Trail
- North TSA Boundary
- North TSA Subarea
- OSMP Fee and Managed Property
- OSMP Easement or Jointly Owned, County-Managed Land
- Other Government Land

North Trail Study Area Plan

Current Agricultural Production on OSMP Fee/Managed Lands		
Importance	Acres	Percent
Grazed, Hayed, and/or Irrigated	3032.36	39.40%

Agriculture

- Fence
- Grazed Lands
- Hayed Lands



MAP A3: AGRICULTURAL LAND USE

- OSMP Trailhead
- OSMP Access Point
- OSMP Recreational Feature Access
- Boulder County Trailhead
- OSMP Hiking/Equestrian Trail
- OSMP Multi-Use Trail
- OSMP Gliding Access
- Non-OSMP Managed Hiking Trail
- Non-OSMP Managed Multi-Use Trail
- North TSA Boundary
- North TSA Subarea
- OSMP Fee and Managed Property
- OSMP Easement or Jointly Owned, County-Managed Land
- Other Government Land