



OSMP Study

ERO
Resources

Environmental Analysis of Proposed Developments to the Foothills Open Space Area and Adjoining Lands



Prepared For:

City of Boulder
Real Estate / Open Space Department

Prepared By:

ERO Resources Corporation

In Association With:

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June 1992

MEMO

TO: Luther Green

FROM: Environmental Review Team

DATE: June 16, 1992

RE: Responses to OSD staff comments not incorporated into
Final Foothills Open Space Report

p. 3, ¶3: Access of the site by other trails.

We will be studying trail access from the Wonderland Hills area and other points south in our "Foothills Extension" work order.

p.8, ¶3: Why wasn't data from OSD database used?

Bob Stoecker will be happy to include Open Space wildlife data for all future reports. Bob would like to suggest that Open Space re-evaluate its list of Special Species. Presently, it is an awkward collection of various listings with a cumbersome set of notations. Further, it appears as if Boulder's field biologists are not capable of developing a list on their own, which they are quite capable of doing. Bob suggests that the following species (among others) be reconsidered as "special species": horned lark, pygmy nuthatch, mountain bluebird, ring-necked duck, eastern cottontail, 13-line ground squirrel, plains pocket gopher, and meadow vole. The criteria of "species with habitat restrictions" is of little importance in many instances. Species vulnerable to elimination locally due to loss of locally limited habitat are the species in this category to be mentioned, not those of academic interest. If this is of interest, your staff should contact Bob Stoecker.

p.12, ¶2: The OSD reviewer disagrees with the statement "the overall abundance and diversity of wildlife is not particularly high."

Bob Stoecker made this statement considering the Foothills site within the context of all other Boulder Open Space lands. If someone were to ask him where they could go to see abundant and diverse wildlife populations on Open Space, the Foothills site would be rather far down on his list of suggested sites.

The level benches are indeed good areas for deer to bed down, particularly those near the top of the hogback. Bob does not see any trails significantly conflicting with this. Bob did not want to be an alarmist; after all, deer bedding habitat is not limited in the area. Nonetheless, we have included a recommendation in the report.

Regarding whether deer are commonly seen here in early spring, this is based on Bob's observations while driving along Lee Hill Road to and from his home over the past 17 years.

p.17, ¶2: Address hunting area of coyotes . . . dogs, mountain lion.

Bob does not know how large of an area is used by the coyotes of the Foothills site. Further, he cannot provide any substantive comment regarding how dogs might affect the range over which a coyote might travel. The subject of dogs and wildlife is an important issue that would be most appropriately addressed in the context of all (or categories of) Open Space lands, rather than piecemeal for each individual site. Nonetheless, we have included a comment in the report.

Species Lists

The species lists have been redone in order to include those mentioned by the OSD reviewer. Time does not permit, however, the total redevelopment of these lists solely for the purpose of including all the various special species notations - - this is a more time consuming task than might be realized. In future reports, Bob will plan for this ahead of time.

p. 23, No. 7: Most of trail is "in city" -- no public urination.

This site is too urban and too visible for people to do what they will do, when they gotta do it, regardless of rules or ordinances.

ENVIRONMENTAL ANALYSIS OF
PROPOSED DEVELOPMENTS TO THE
FOOTHILLS OPEN SPACE AREA AND
ADJOINING LANDS

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INTRODUCTION

The City of Boulder Open Space Department (OSD) has requested an environmental analysis of proposed improvements to the Foothills Open Space Area, as well as the potential effects of improvements adjoining the Foothills Open Space Area. The OSD needs the following information relative to the natural resources of the area:

- Effects of current recreation use on the environmental resources of the area;
- Identification of natural resources in the area that are potentially sensitive to visitor use;
- Determination of the likely effects of increased visitor use on these resources;
- Recommendations on monitoring impacts;
- Recommendations for mitigating current or potential future impacts.

This report is a second in a series of reports on Boulder's Open Space Lands by this project team. The first report addressed proposed improvements to the South Mesa trailhead and adjoining open space lands. This report references the South Mesa report for the purposes of perspective and relative comparisons.

OBJECTIVES

This analysis is based on the goal of maintaining the environmental integrity of the site by maintaining, restoring, and improving the site's natural resources and mitigating adverse impacts to those resources due to trail routing and visitor use or other past disturbances. We recognize that the purposes and goals of the OSD are many and varied, and that competing goals and uses can conflict. This report should not be viewed as an attempt to balance competing or conflicting goals and uses but as a decision-

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making tool that focuses upon the conservation and management of natural areas on open space lands with a particular emphasis on:

- sensitive plant communities and/or wildlife habitat;
- flora and/or fauna of special concern;
- water resources;
- general aesthetics.

The overall goal of this analysis is to provide the OSD with natural resource information and recommendations that will assist the OSD in responding to their short-term needs and long-term management plans. To meet this overall goal we identified the following objectives:

- Create a baseline map of the site that shows vegetation/habitat types, soil erosion hazard areas, and existing trails and use areas.
- Collect and present information that builds on existing OSD programs and capabilities.
- Identify areas that are sensitive to visitor use.
- Identify adverse impacts to the site by historical and current use.
- Determine potential adverse impacts to natural resources from projected use and improvements (on-site and off-site).
- Develop recommendations for management, monitoring and mitigation measures.
- Develop a process for future analysis, monitoring, and management.

The most immediate need is to develop a proposed foot trail from the northwest corner of the site to the southeast corner of the site near Wonderland Lake.

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SITE DESCRIPTION

The Foothills Open Space Area (study area) adjoins the City of Boulder at the city's northwestern corner, is approximately 260 acres, and is bound by Four Mile Canyon Creek and Lee Hill Road on the north and Wonderland Lake to the Southeast (Figure 1). The Foothills Trail forms part of the eastern boundary for the study area and the western boundary is formed by a steep foothills ridge (hogback). The Foothills Open Space Area is linked by trails to Open Space properties to the north and northeast that allow access to Boulder Reservoir.

The study area is comprised of four major landscape features:

1. A north-south oriented steep foothills ridge with ponderosa pine savanna and shrublands forms the western boundary of the study area and visually dominates the site.
2. A broad and rolling mixed grass prairie dominates the toe of the foothill ridge and the relatively flat areas that form the eastern boundary of the study area.
3. Four Mile Canyon Creek forms a narrow riparian corridor along the northern boundary of the study area.
4. A series of small shale knolls occur in the northeastern corner of the study area.

EXISTING RECREATION FACILITIES AND USE

Access

Recreational facilities on the site include only trails and trail heads. The Foothills Trail runs north and south along the eastern border of the study area. On-site trails are accessed from the south by an existing paved trail that parallels Silver Lake Ditch, and from an unimproved trail near the west boundary of the site. From the east, trails are

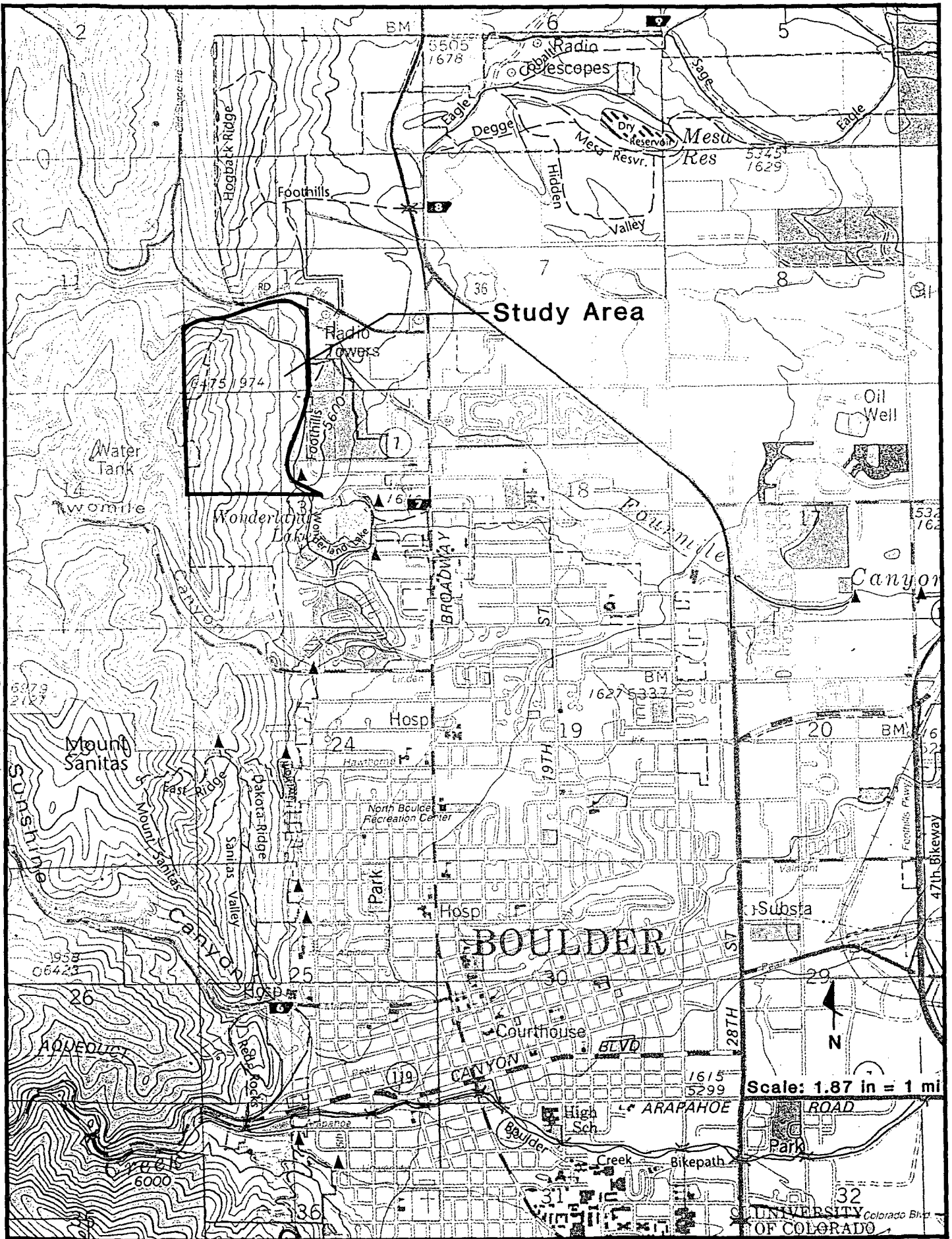


FIGURE 1 Foothills Study Area

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accessed from three locations:

1. A subdivision off the southeast corner of the site;
2. The City of Boulder undeveloped park site; and
3. The OSD trailhead located on the south side of Lee Hill Road at the northeast corner of the site.

Two minor access points, which seem to be for the convenience of adjacent private dwellings, cross Four Mile Canyon Creek from the north. Also from the north, a trail enters the site from the area of a subdivision at the northwest corner of the study area.

Trail Improvements

All trails existing on the site are relatively unimproved. A north-south segment along the entire eastern boundary of the site appears to have been graded once for vehicles, but it is not surfaced. An east-west segment along the northern boundary of the site has similarly once been graded, but has not been improved or surfaced for trail use. A relatively new, short segment connecting the junction of the two above mentioned trails to the OSD trailhead at the northeast corner of the site has also been graded, but has not been improved for drainage or surfaced. This segment has a modest timber structure spanning Four Mile Canyon Creek.

Parking Facilities

Parking is available for trail access in two locations. One parking area, probably unauthorized but tolerated by the City, is on an unimproved city street right-of-way at the end of Locust Avenue at the southeast corner of the study area. Open space trail users are using a graded but otherwise unimproved area for parking on private land south of the OSD trailhead in the northeast corner of the study area. Additional parking on both

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shoulders of Lee Hill Road in the vicinity of the OSD trailhead appears to be tolerated, but is unsafe from a traffic management point of view.

Visitor Use

Use of the existing trails seems to be typical with the following modifying comments. The north-south segment along the entire eastern boundary appears to receive heavier than normal athletic (joggers and runners) use, and a lot of bicycle traffic. Two relatively lightly-used trails emanating from the Locust Avenue subdivisions appear primarily to serve hang gliding enthusiasts. These trails lead to two vegetatively denuded launch points of several hundred square feet each located in the west central portion of the site. A braided system of fairly new trails, again emanating from the Locust Avenue subdivisions, coursing directly west and up slope to a prominent overlook, appears to be primarily used for passive pursuits by residents of that subdivision. Just west and slightly below this overlook, a stone cairn (monument) has been erected. According to OSD staff the cairn was erected by residents neighboring the area, and the cairn was dismantled once by OSD staff. This braided system of trails appears new and still evolving as users continuously seek easier or more direct terrain to negotiate.

PROPOSED IMPROVEMENTS

The following improvements addressed by this analysis are proposed for the Foothills Open Space Area and adjoining lands.

1. Development of a foot trail that will link the northwest corner to the southeast corner of the study area.
2. Future development of City parkland adjacent to the eastern boundary of the study area.
3. A new north Boulder subdivision has been proposed for the general area east of the existing OSD trail head on the south side of Lee Hill Road, between Lee Hill Road and Four Mile Canyon Creek.

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Although we do not believe it is within our scope or purview to comment on the City's proposed plans for the adjoining new park site, some general conclusions about its relationship to the study area can be made at this time:

- A new city park in this location will undoubtedly bring additional recreationally-oriented visitors to this location, which definitely will increase OSD trail usage. Additional usage can be estimated by examining additional parking provided by the proposed park, in addition to parking currently available to OSD trail users.
- Recreational opportunities in a new park may well redirect some of the apparently passive OSD trail use occurring from the Locust Avenue subdivisions. Use of new park recreation facilities may be more attractive to many area residents than frequent exploration of the study area terrain.
- The existing north-south OSD trail segment along the east boundary of the study area, including the two current trail access points associated with it, should be realigned to more sensitively integrate the OSD trail with the new interior trail and circulation system routes that are proposed for the new park.
- It would seem unlikely that any new connective OSD trail segment beyond the discussion immediately above, or as proposed later in this document to accommodate the park site, would be necessary.

The following recommendations pertaining to the proposed subdivision should be considered by OSD:

- OSD should insist that the developer fence or otherwise demarcate their boundaries with a physical structure to discourage random access (except at designated points) and boundary encroachment.
- OSD should provide the developer with packets of OSD information, including maps and OSD regulatory information, for the developer to distribute to prospective real estate purchasers.
- OSD should negotiate with developer to provide for public right-of-way access points to OSD lands from any residential parts of the development.

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Such access needs to be examined on site specific basis as to environmental and management impacts.

- OSD should study development of an off road trailhead to provide parking on a temporary basis (until city park development is complete) on the south side of Lee Hill Road near the existing trail head, to replace parking currently occurring on developer's private land, alleviate danger of current parking on Lee Hill Road shoulder, and to head off potential for OSD visitors impacting new subdivision by parking in business lots or residential streets.
- OSD should coordinate with city parks department to allow OSD trail users a trail head function at the pavilions/tennis/basketball parking area at the northeast corner of their proposed park. If OSD negotiates access points into park and/or OSD lands from the proposed Lee Hill Subdivision, such access can be collected via a park trail skirting the north edge of the park, funneling trail use north to an intersection with the main OSD trail.

METHODS

Information on existing vegetation and wildlife and the effects of recreation use on the natural resources of the study area were generated primarily from site visits in January and February 1992 and the professional experience and expertise of the principal investigators. Information on soil erosion hazards and species of special concern were primarily based on existing references and previous studies.

Vegetation

Vegetation types were mapped on 1 inch = 400 feet blue-line copies of PSCO's 1984 aerial photography. Vegetation types were based upon the habitat type classification (map unit names and abbreviations) used in the recently developed Boulder Wildlife Habitat Database (City of Boulder, draft document, September 1990). These vegetation

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types were used in this study with limited modification to provide continuity with an ongoing Boulder program.

Information on plant species of special concern was based on descriptive and map data provided by the Colorado Natural Areas Program (CNAP). Additionally, personal communications with Janet Coles (CNAP) and Mark Gershman (OSD) were used to identify the potential for occurrences of plant species of special concern in the study area.

Wildlife

The evaluation of wildlife habitats was based on two site visits that were conducted in January 1992 and discussions with a long-time resident. Wildlife species that are of likely occurrence throughout the year were inferred from existing literature as well as the principal investigator's records of wildlife distributions in the major habitats within Boulder County.

Soils

The soils evaluation was performed using existing information supplied primarily from the Soil Conservation Service (SCS). This includes the Boulder County soil survey and associated soil interpretations. A brief field visit was conducted on January 25, 1992 to observe site characteristics.

Recreation and Visual Resources

The existing and potential recreation environments (physical improvements, user characteristics) were addressed relative to impacts to environmental resources, most typically vegetation, wildlife, soils and visual impacts. The assessment was accomplished

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by preparing an inventory and map of the existing study area. Based on field work and photography, resource impacts resulting from recreation use were identified. The proposed improvements for the site and adjoining area were also considered in determining potential impacts.

In evaluating the Foothills Open Space study area, as well as any open space for environmental impacts, primary recreation-related impacts are assessed. The following primary recreation-related impacts were used as a checklist to survey environmental impacts:

- noise (trailheads or access points)
- noise ("backcountry")
- dust
- visual intrusion or congruity
- trash
- vegetative trampling, denuding and soil erosion in any pedestrian high traffic areas within or adjacent to recreation use areas, especially if no paving, groundcover or edge control is provided
- vegetative trampling resulting from informal vehicle parking
- vegetative trampling and bank erosion along creeks and ditches where access and the water amenity attract concentrated and/or continual use
- success or problems associated with introduced plant materials (native or non-native)
- routine or anticipated "wear and tear" on designated trails
- pedestrian and equestrian trail-drainage crossings
- increased use on designated trails
- increased use on social or informal trails
- establishment of new social or informal trails
- user adherence to temporary or permanent trail closures or areas closed for revegetation
- existing or potential human intrusion into areas of sensitive vegetative or wildlife species
- adequacy of regulatory signage to protect environmental resources

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Mapping

A base map for the study area was prepared by using a 1 inch = 400 feet photographic enlargement of a standard U.S.G.S. 7.5 minute quad. Study area features and resources were mapped as overlays to this 400 scale map. Base features, including existing recreation facilities, have been mapped on one overlay. Vegetation types and soil erosion hazards have been mapped on separate overlays. This will facilitate AutoCadd/LandCadd data entry if desired at a future date.

EXISTING NATURAL RESOURCES

Mixed grass prairie dominates the study area with the scattered and generally small ponderosa pines quickly thinning out as they move down the hogback and yield to the drier prairie conditions. The extreme north end of the area, along Four Mile Canyon Creek, provides a narrow and restricted riparian area; and the stream, although small, provides a year-round water source in an otherwise very dry setting. The study area has limited aquatic, riparian, and wetland resources although at least 3 seeps occur along the hillside and Wonderland Lake occurs nearby, but outside the study area to the south. The study area provides beautiful vistas of the Boulder area and furnishes a picturesque backdrop to the northwestern Boulder area.

Vegetation

The vegetation within the study area is moderately diverse; 10 different vegetation types were mapped (Appendix A) within the study area (Vegetation Map, under separate cover). Although the site has a diversity of vegetation types, 4 of the types, (Wet Grassy Meadows, Willow Shrubland, Riparian Forest, and Rush Meadows) occupy an area of less than three acres, and the study area is clearly dominated by Mixed Grass Prairie. The diversity in vegetation types is primarily a function of the ponderosa pine and shrub

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types associated with the steep foothills ridge that meet the lower mixed grass prairie. The study area has limited aquatic, riparian and wetland resources.

For comparison purposes, the study area is not as vegetationally diverse as the South Mesa Open Space Area. The Foothills site lacks the large wetland and riparian areas of the South Mesa site and the desirable native vegetation, in general, appears to be less vigorous at the Foothills site. The difference in vegetation between the two sites is likely the result of:

1. The Foothills site appears to be a drier site than the South Mesa site, and
2. The Foothills site appears to have had a longer and/or more intense history of disturbance.

These two factors are interrelated as a xeric site will recover slower than a mesic site from the same level of disturbance. This is best demonstrated by the north facing slope at the northern end of the study area that supports a vigorous stand of western wheatgrass.

The majority of the study area supports vegetation types dominated by desirable native species. The lower and more flat areas along the eastern boundary of the study area and along the floodplain of Four Mile Canyon Creek are dominated by weedy and less desirable species. At this time, desirable native species do not appear to be colonizing either one of these disturbed areas.

The riparian area along Four Mile Canyon Creek varies in its health and vigor. The upper portion of Four Mile Canyon Creek within the study area is dominated by cottonwoods that appear to be having moderate reproductive success (i.e., scattered saplings within canopy openings). There is a distinct change in vegetation, channel

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gradient and substrate below the upper reach. This "mid reach" has very few cottonwoods and is dominated by coyote willow. In contrast to the upper reach that has a substrate primarily of cobble and boulder, the mid reach portion has a substrate primarily of sand. The mid reach shows virtually no signs of cottonwood reproduction, but the willow appears to be vegetatively spreading. The lower reach of Four Mile Canyon Creek, within the study area, is characterized by a sandy substrate and widely scattered cottonwoods and willows. There appears to be some cottonwood and willow reproduction in this reach.

Wildlife

The major wildlife habitats in the vicinity of the Foothills Open Space Area include mixed grass prairie and scattered ponderosa pine. Wildlife species of both forested and plains ecosystems overlap here, however, the overall abundance and diversity of wildlife relative to other open space properties is not particularly high. The main reason for the low wildlife densities is due to the lack of cover throughout most of the area.

Wildlife of the Area. Mule deer are among the most conspicuous wildlife in the area. They are seen here throughout the winter, and also in early spring when they are feeding on the new spring growth of grasses. Coyotes are commonly seen, and according to a local resident a coyote den occurs on the site (Jack Aragon, personal communication). A prairie dog colony occurs at the southeastern to southcentral portion of the study area. Many other wildlife species with both prairie and lower montane forest affinities occur, however, and Tables 1 and 2 in Appendix B provide lists of those most likely to be encountered.

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Soils

The study area is composed of five map units as shown in Table 1. The SCS soil map was adjusted after the field visit to more accurately tie the map units to landforms (Soils and Erosion Hazard Map, under separate cover).

Table 1. Soil map unit legend.

Map Unit Symbol	Map Unit Name
BaF	Baller stony sandy loam, 9 to 35 percent slopes
NdD	Nederland very cobbly sandy loam, 1 to 12 percent slopes
NuC	Nunn clay loam, 3 to 5 percent slopes
SmF	Sixmile stony loam, 10 to 50 percent slopes
SRO	Sedimentary rock outcrop

Baller soils (BaF) comprise most of the study area and are shallow, stony soils on moderate to steep slopes. They have rapid runoff, low available water capacity, and a high risk of erosion. Only a few acres of Nederland soils (NdD) occur in the study area. They are deep, cobbly soils that occur on alluvial fans. They have slow to medium runoff, moderate available water capacity, and slight risk of erosion. Nunn soils (NuC) are deep clayey soils that occur on alluvial fans and valley sideslopes. They have medium runoff, high available water capacity, and moderate risk of erosion. Sixmile soils (SmF) are moderately deep clay loam soils that occur on forested hogback scarp slopes. They usually have a stony surface layer. They have rapid runoff, moderate to high available water capacity, and a high risk of erosion. Map unit SRO is primarily composed of sparsely vegetated shale, limestone and sandstone outcrops. Any soil on this map unit is thin and highly susceptible to erosion.

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Recreation and Visual Resources

Variety of Terrain. The site is gifted with almost equal quantities of very rugged and steep terrain, as well as mild and quite negotiable terrain. Although almost the entire site faces east, some north facing slopes on the north end of the site add to the visual variety.

Access. Access to the site from public right-of-way or other public land is available on almost the entire east side of the site. Along this stretch there is very favorable topography and almost no natural or physical barriers.

Views & Vistas. The site is eminently visible from the Boulder urban area, except where obstructed by urban forest or structures. More remarkable are three fairly accessible lookout points located about mid to upper-terrain in the south half of the study area (Soil and Erosion Hazard Map). From these points, each on a topographically significant point populated with Ponderosa Pine, the view of the Boulder Valley and Boulder urbanized area is outstanding. Other view points, mainly mid to upper-terrain on the north quarter of the site are equally endowed, but much more difficult to reach.

Four Mile Canyon Creek Riparian Corridor. The portion of Four Mile Canyon Creek contiguous to the OSD site is not spectacular, but contains enough woody vegetation and water to be an attraction of curiosity to many open space visitors. If the riparian area were more attractive, it would undoubtedly receive increased use that would lead to degradation.

Shale Knoll Landforms. Unlike Four Mile Canyon Creek, the shale knolls are just unusual and curious enough, with their exposed rock spines (just walking over the

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weather-splintered rocks makes an unusual kind of "tinkling" sound), that visitors have worn a path over them. On the north end of the western-most knoll, a curious old masonry structure has been built directly into the base of the knoll. The uniqueness of these landforms will make it difficult to keep visitors entirely from the sensitive vegetation existing there.

Wind. The typically strong foothills winds, in combination with favorable topography and easy access, make this site an apparently locally favored hang gliding launch site. There are two locations about mid site currently being used in pursuit of this activity (Soil and Erosion Hazard Map).

SENSITIVE SITE FEATURES

Sensitive Vegetation Types

The riparian vegetation along Four Mile Canyon Creek could be sensitive to heavy visitor use; however, its location adjacent to Lee Hill Road, sparse woody canopy, and disturbed vegetation most likely make the riparian area less attractive to visitors than one might expect. Four Mile Canyon Creek is the only perennial water course within the study area and the only vegetation type with large deciduous trees. At this time, disturbance to the riparian vegetation does not appear to be the result of visitor use, but appears to be more a function of historic grazing patterns and heavy sediment loads. Cottonwood reproduction is very low throughout much of the riparian corridor and prolonged trampling by visitors could significantly further reduce the survival of cottonwood seedlings and saplings.

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The shale knolls in the northeastern corner of the study area (mapped as ROC) are sensitive to erosion and support Bell's twinpod (*Physaria bellii*), a plant species of special concern. Trails and visitor traffic should be diverted away from these knolls.

Plant Species of Special Concern

The study area contains a confirmed population of *Physaria bellii* (Bell's twinpod). It is suspected that favorable habitat for *Gaura neomexicana* ssp. *coloradensis* (Colorado butterflyweed) exists there as well, although no present occurrences of the plant have been confirmed.

Bell's twinpod occurs on limestone and shale outcroppings in Larimer, Boulder and Jefferson counties. It blooms about mid-April, producing showy yellow four-petaled flowers from a rosette of gray-green leaves. The fruit of the *Physaria* is an inflated pod, from which the genus name "physa" (meaning bellows) is derived. Currently, this species is federally listed as a Category 2 plant which means that the plant will be considered for listing as threatened or endangered once sufficient data have been gathered to document existing populations and factors affecting the species' continued existence. The proposed trail route in the northeast portion of the site has been designed to avoid the rock outcroppings where *B. bellii* is found.

The Colorado Natural Areas Program notes that favorable habitat for the Colorado butterflyweed may be found in the study area along the floodplain of Four Mile Canyon Creek. The plant occurs in moist prairie meadows in the transition zone between streams and floodplains. Historically, populations have been reported at various locations in southern Wyoming. One plant was collected from the Foothills site in 1984. Currently, confirmed populations exist across the state line in southeast Wyoming and

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western Nebraska. *Gaura neomexicana* ssp. *coloradensis* is federally listed as a Category 1 plant which means that sufficient scientific data have been gathered to warrant its upgrade to threatened or endangered and it will likely be upgraded once rule-making tasks are completed.

Sensitive Wildlife Habitat Features

The environmental sensitivity of the Foothills study area is much less related to potential wildlife disturbances than it is to visual impacts. Sensitive wildlife habitats are limited to the riparian vegetation along Four Mile Canyon Creek, and to the shrubby draws and scattered ponderosa pines which are largely restricted to the upper slopes of the hogback.

Soils and Erosion Hazard

Presented in Table 2 are soil and land properties and interpretations germane to the intended use of the soils. The ratings are based on restrictive soil features such as wetness, slope and surface soil texture. Flooding is not considered in the ratings, nor does it appear to be a factor in the proposed uses of the Foothills study area.

Risk of erosion considers both the erodibility of the soil by water, and landscape features. The K factor indicates the susceptibility of unprotected soil to sheet and rill erosion by water. Estimates are based primarily on soil texture. The higher the value, the more susceptible the soil is to erosion by water. The erosion hazard for each map unit reflects the combination of surface texture, slope, and runoff. Map units BaF and SmF are particularly susceptible to erosion if disturbed (Soils and Erosion Hazard Map). The presence of interbedded sedimentary rock (shale, sandstone and limestone) in these map units poses a significant threat to facilities development. Under natural conditions, the

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rock and vegetative cover has provided adequate protection from heavy rainfall events and snowmelt. Map unit NuC is rated as moderate because of the high erodibility of topsoil. Nederland soils (NdD), located at the southeastern corner of the study area (trail outlet area) have a low erosion hazard.

Limitations for trails and picnic areas refer to the suitability of soil factors that affect this use. A slight limitation indicates that soil properties are generally favorable; conversely, a severe limitation means that special design, intense maintenance or costly soil reclamation, or a combination of these, is usually required. These facilities are associated with heavy foot traffic and should require little or no cutting or filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface. Usage of the present trail along the eastern boundary and the trail access from Lee Hill Road has created many low spots, which tend to accumulate rainfall and snowmelt. This puddling gives way to rutting from bicycle traffic, widening of the trail to avoid puddles and ruts and, inevitably, erosion in some areas.

Table 2. Soil properties and interpretations for recreation development.

Map Unit	Risk of Erosion		Limitations for:		Hydric Soils	
	K Factor ¹	Hazard	Trails	Picnic Areas	% of Unit	Landscape Position
BaF	.10/.05	high	severe	severe	3	swales
NdD	.05/.05	slight	slight	moderate	--	--
NuC	.32/.28	moderate	slight	slight	1	swales
SmF	.24/.24	high	severe	severe	4	swales
SRO	--	--	severe	severe	--	--

¹Surface value/subsurface value.

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Map unit SRO should be avoided for any use because of the instability of shale. The map units BaF and SmF were rated as severe for trail and picnic area usage because of steep slopes, rocks and the high risk of erosion if disturbed. Placement of trails through these map units is not recommended due to the above factors and the problems associated with thinly bedded sedimentary rocks, particularly clay shales. The presence of gently sloping benches midway up the slope in map unit BaF might be excluded from this restriction. Development in the bench areas will require standard erosion control protection measures. Nederland soils (NdD) are well suited for trail and picnic area development because of favorable slopes and low risk of erosion, but this map unit is of minor extent in the study area. Nunn soils (NuC) were rated as moderate for picnic area development because bare soil areas tend to be dusty when dry. Trail development on these soils, however, does not appear to be limited. However, trails with heavy use, such as the Foothills Trail, will need improvements to control rutting, puddling, and erosion.

Hydric soils were highlighted in Table 2 to indicate potential wetland areas. If encountered, wetlands should be avoided for development due to both their potential importance as infrequently occurring environments and because of the limitations for development posed by wetness. In the Foothills study area, potential wetland areas are limited to inclusions of swales in map units BaF, NuC, and SmF.

IMPACTS TO NATURAL RESOURCES

Existing Impacts

The most significant impacts to natural resources are attributable to historical land use, natural disturbances, and recreation use. Historical land use (most likely livestock grazing) has disturbed vegetation along Four Mile Canyon Creek and the lower eastern portion of the study area. These areas are dominated by weedy and undesirable species.

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The prairie dog colony in the southeastern portion of the study area further compounds disturbance to the historically disturbed lower eastern portion of the study area as has the current use of the Foothills Trail. Due to these ongoing disturbances, it is unlikely that these disturbed areas will be colonized by desirable native species. Social trails and launching areas for hang gliders have disturbed vegetation and increased erosion within the study area.

Potential Conflicts with Proposed Improvements and Natural Resources

The proposed improvements to the study area and adjoining areas (new trail and proposed City park) will affect the use of the study area and affect the site's natural resources. However, proper planning of these improvements can greatly lessen the potential impacts to natural resources. Proper closing and consolidation of social trails and creation of a "high trail-low trail" system will route and disperse traffic throughout the study area while avoiding sensitive site features. Proper planing and integration of the proposed City park with the adjoining Foothills Open Space area could divert (as well as contribute) some types of recreation use from the study area. Impacts to wildlife in this area are not likely to be a major problem given the trail alignments proposed. Almost any alignment that is visually acceptable - - does not scar the vista by traversing too high on the slope - - will be satisfactory from a wildlife perspective. Every protection should be given to preserving the existing riparian vegetation along Four Mile Canyon Creek.

RECOMMENDED SITE IMPROVEMENTS

The following recommendations consider improvements proposed by OSD as well as improvements the project team believes would benefit the study area.

1. Routing of a proposed higher elevation trail to connect the southeast and the northwest portions of the study area could best be accomplished by routing the

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trail from approximately the location of the existing lower hang glide launch site north to near the western-most shale knoll (Existing Recreation Resources Map).

Rationale: There is a north-south topographic bench existing much of this proposed route, which seems to be the only suitable trail location given the combination of erodible soils and difficult topography. There does not seem to be any topographically appropriate way to route a trail to the northwest corner of the study area that fully utilizes the northwest quarter of the site. While it may still be more direct and convenient to solely utilize the existing east edge trail connecting to the existing north edge trail, increasing trail usage suggests that both a highland and a lowland route may help to disperse use.

2. The existing network of social trails on and around the shale knolls should be consolidated into a simple loop system. An interpretive station should be provided at the south end of one of the knolls with a graded and surfaced trail to accommodate heavy use.

Rationale: The vegetation and knolls are sensitive to trampling and require limited trail access. Use in this area appears to be heavy; trail surfaces need to be improved. An interpretive station may satisfy the curiosity of users, so mounting of knolls themselves may not be necessary.

3. The two private access points from the north end of site across creek should be closed. All other existing points of access to existing trails should be maintained. Parking, signage, fencing, gates, and the trash collection system should be upgraded as appropriate, at least temporarily at the existing trailhead location at Lee Hill Road. When the new City park comes on line, the existing access point at the west end of Locust Avenue, and possibly the Lee Hill Road trailhead, should be eliminated in favor of some convenient new access point within the park with parking and other services and conveniences.

Rationale: Private access points are not needed for public use, and the public access trailhead is not far away. All other current access points are logical and needed, except for one at the west end of Locust Avenue - access in this area should eventually come via the new City park. The existing Lee Hill Road trailhead is barely adequate for existing trail use and should be upgraded at least temporarily, and should also be considered for future inclusion within the new city park.

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4. All heavily used trail segments on the east edge of the site should be upgraded with grading and surfacing to accommodate current and future use. The central portion of the east edge trail should be adjusted to integrate alignment and access to new park features at an appropriate time.

Rationale: Existing trails on the east side of the site are heavily used, and unimproved soil conditions are not adequate to support current use. Trails are becoming wider as users skirt muddy, rutted, and rocky areas. Trail use in the new park should complement OSD trail use, and vice versa, to the mutual benefit of both.

5. The southernmost east-west trail network leading from Locust Avenue subdivisions to southernmost look-out should be razed and restored. Use should be relocated to upgraded trail (grade & surface as appropriate) on approximate alignment of southernmost hang glider's trail. Consider public meeting with Locust Avenue subdivisions residents to obtain their cooperation on trail relocation.

Rationale: This existing trail is problematic in that soil conditions are not particularly favorable, grade of trail is extreme, and it looks to have never been originally designed, but instead evolved and is still evolving. Adjustments could be made to this trail, more or less in place, and surface improvements made as needed. We think there is more favorable terrain nearby, and that a relocated trail would be the best long term solution. A public meeting would be beneficial since this trail appears to be used mostly by this neighborhood, and they undoubtedly feel possessive about it.

6. Is there a better location in OSD inventory for hang gliding? It appears there would be more accessible sites, if hang gliding is permitted on OSD lands at all.

Rationale: Hang gliding on this site is environmentally damaging unless extensive surfacing is applied to impacted areas.

7. If the proposed new City park does not provide restrooms, provide restrooms at Lee Hill Road trail head.

Rationale: The study area is too visible and too close to urban area for visitors to be relieving themselves somewhere along the trail.

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General Recommendations

1. Erosion hazard on disturbed areas with slopes over 12 percent is severe; must consider control measures on both trails and cut banks. Trail development on these slopes should be avoided due to presence of shale and potential slope failure.
2. Minimize disturbances such as cut and fill on slopes greater than 12%. Switchback trails should be avoided in the NW portion of the property.
3. Avoid limestone-shale outcrop area in the NE part of the study area.
4. Avoid wetland areas.
5. Avoid the Four Mile Canyon Creek riparian area.
6. Dogs should be controlled in the area due to the numerous deer in the study area.
7. Additional monitoring of deer use on western benches should be performed to determine the likelihood of deer displacement due to recommended trail alignment.

LONG RANGE MANAGEMENT AND MONITORING RECOMMENDATIONS

OSD's long range management plans or goals for the Foothills study area are unknown; the monitoring of site conditions and trends needs to be designed and evaluated relative to OSD management plans and goals. The following recommendations are based upon the objective of conservation and management of the study area's natural resources and does not attempt to balance competing and/or conflicting goals.

1. **Recommended monitoring sites.** Sites recommended for monitoring impacts associated with visitor use have been identified on the Proposed Trails Map. These sites should be inspected in early spring and fall. Color photos and notes that specifically describe and quantify problems where possible (e.g., the width of the trail or dimensions of the disturbed area) should be taken. Each time the monitoring site is inspected, all quantifications will be measured and new photos taken.

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Based upon monitoring results, specific actions can be taken if an area becomes degraded (e.g., design improvements and modifications, temporary or permanent closure for vegetation restoration).

2. **Riparian vegetation.** Riparian vegetation monitoring should focus on continued reproduction of woody riparian species (particularly cottonwoods and willows) and maintenance of total woody riparian area (i.e., track losses due to informal trails, and natural causes).

A series of permanent belt transects can be established by permanently locating 2 stakes 30 meters apart and recording all cottonwood and willow seedlings and saplings within 2 meters of either side of the line defined by the stakes. The belt transects can be rapidly sampled annually and compared over time for trends. If reproduction rapidly declines and younger trees and shrubs are not recruited into the riparian population, the area will eventually decline.

Trends in total area can be reviewed by periodic aerial photography or well placed on-the-ground photography.

3. **Maintenance of vegetation type distributions.** Grasslands are frequently associated with disturbance regimes (e.g., grazing and fire). Colonization of the mixed prairie grasslands by woody species is possible; however, it does not appear at this time that there is a threat of losing the mixed grass prairie areas to invasion by woody species. Loss of grasslands to woody species can best be monitored by periodic (5 year interval) review of gross vegetation mapping similar to the mapping effort for this analysis. A more likely threat to the study area is continued or expanded disturbance of the mixed grass prairie, particularly along the eastern border of the study area. Recreational use and/or expansion of the prairie dog colony could increase the area of weedy and undesirable species. Areas of undesirable species along the eastern border of the study area should be delineated and periodically monitored for expansion/contraction and changes in species composition.
4. **Visitation.** Monitor visitor use with a trail counter, vehicle counts, registration boxes, or on-site observation.

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APPENDIX A: VEGETATION TYPE DESCRIPTIONS

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The classification of vegetation types (existing plant community types) follows the habitat type classification system developed for the Boulder Wildlife Habitat Database (City of Boulder, draft, 1990) with some changes. Deviations from the Boulder Wildlife Habitat Database include the additions of Open Shrubland/Mixed Grass Prairie and the addition of "Steep/Sparse Vegetation" to the "Rock Outcrops" type. The map abbreviation follows the vegetation type name in parentheses.

Ponderosa Pine Savanna (PPS) - The Ponderosa Pine Savanna type occurs along the elevated (ca. 6,000 to 6,400 feet) western boundary of the study area. This type is characterized by widely spaced ponderosa pines (*Pinus ponderosa*) with an understory dominated by grasses. The grass understory varies from a dominance of tall grasses, primarily big bluestem (*Andropogon gerardii*) to dominance by short grasses, primarily blue grama (*Bouteloua gracilis*). Common understory vegetation includes: mountain muhly (*Muhlenbergia montana*), Western wheatgrass (*Agropyron smithii*), little bluestem (*Schizachyrium scoparius*), Scribner's needlegrass (*Stipa scribnerii*), sideoats grama (*Bouteloua curtipendula*), cheatgrass (*Bromus tectorum*), sun sedge (*Carex heliophila*), Oregon grape (*Mahonia repens*), wild tarragon (*Artemesia dracuncululus*), winged eriogonum (*Eriogonum altatum*), Spanish bayonet (*Yucca glauca*), snakeweed (*Xanthocephalum sarothrae*), and prickly pear (*Opuntia* spp.).

Mixed Mountain Shrubland (MMS) - The Mixed Mountain Shrubland type is characterized by a variety of shrub species including mountain snowberry (*Symphoricarpos orephilus*), mountain mahogany (*Cercocarpus montanus*), squaw currant (*Ribes cerum*), chokecherry, and skunkbush sumac. This type occurs primarily on the more moist north facing slopes and shaded valleys of the study area. This type is heavily utilized by mule deer.

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Mixed Plains Shrubland (MPS) - This type occurs at slightly lower elevations than the Ponderosa Pine Savanna type along the western boundary of the study site. This type has a mix of shrubs including chokecherry (*Prunus virginiana*), wild plum (*Prunus americana*), and skunkbush sumac (*Rhus trilobata*). An herbaceous understory of cheatgrass, western wheatgrass or mountain muhly is commonly present. On this site the Mixed Plains Shrublands are associated with rock outcrops and shallow soils.

Open Shrubland/Mixed Grass Prairie (OSG) - This type is similar to the Mixed Plains Shrubland type but much more open. This type occurs on the drier slopes and mesa tops that border the Ponderosa Pine Savanna type.

Riparian Forest (RPF) - The Riparian Forest type occurs along Four Mile Canyon Creek and is dominated by cottonwoods (*Populus deltoides*) and willows (*Salix amygdaloides* and *S. exigua*). Other commonly occurring woody species include: red-osier dogwood (*Cornus stolonifera*) chokecherry, wild plum, hawthorn (*Crataegus erythropoda*), currants (*Ribes* spp.) and poison ivy (*Toxicodendron rydbergii*). The herbaceous understory includes bluegrass, Canada wild-rye (*Elymus canadensis*), smooth brome and orchard grass (*Dactylis glomerata*).

Willow Shrubland (WLS) - The willow shrubland occurs along Four Mile Canyon Creek. The thickets are typically dominated by coyote willow (*Salix exigua*) and scattered individuals of peachleaf willow (*Salix amygdaloides*).

Rush Meadows (RSM) - A small wetland dominated by Baltic rush (*Juncus balticus*) occurs in a drainage swale near the southern portion of the study area.

Mixed Grass Prairie (

MGP) - This is the most common vegetation type in the study area and also the most variable. The Mixed Grass Prairie type is equivalent to Bunin's (1985) Mid-Height

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Grassland. Commonly occurring species in areas mapped as MGP include: blue grama, sideoats grama, red three-awn (*Aristida longiseta*), western wheatgrass, cheatgrass, wild tarragon, prairie sage (*Artemisia ludoviciana*), pasture sage (*A. frigida*), Spanish bayonet, and prickly pear. In scattered locations, particularly with increasing elevation, tall grasses such as big bluestem, little bluestem, and switchgrass (*Panicum virgatum*) occur mixed with mid grasses or, in a few small isolated instances, occur in nearly pure tallgrass stands. The lower eastern boundary of the study site has had a history of disturbance. These disturbed areas are dominated by cheatgrass, prickly pear, snakeroot, and Spanish bayonet. It appears the disturbance was most likely a combination of historical grazing by livestock and current prairie dog use. The Foothills Trail cuts through most of the disturbed area.

Rock Outcrops-Steep/Sparse Vegetation (ROC) - This type is limited to the shale outcrops at the northeastern corner of the study area. These sites are often called "shale barrens" due to the typically sparse vegetation cover. Commonly occurring species include: Indian ricegrass, (*Oryzopsis hymenoides*), western wheatgrass, cheatgrass, red three-awn, little bluestem (on the tops of the knolls), side-oats grama, sunflower (*Helianthus pumilus*), false buckwheat (*Eriogonum brevicaule*), Oregon grape, rose (*Rose* sp.), mountain mahogany (*Cercocarpus montanus*), common shadbush (*Amelanchier alnifolia*), prickly pear, Spanish bayonet and snakeroot. A species of special concern, *Physaria bellii* also occurs in this type within the study area.

Wet Grassy Meadows (WGM) - One small area of this type occurs at a seep near the center of the eastern boundary of the study area. This type is dominated by reed canary grass (*Phalaris arundinacea*).

Table 1. Birds likely to be seen along the Foothills Trail

<u>Common name</u>	<u>Scientific name</u>
Red-tailed hawk	<i>Buteo jamaicensis</i>
Swainson's hawk	<i>Buteo swainsoni</i>
Northern harrier	<i>Circus cyaneus</i>
American kestrel	<i>Falco sparverius</i>
Mourning dove	<i>Zenaida macroura</i>
Common nighthawk	<i>Chordeiles minor</i>
Broad-tailed hummingbird	<i>Selasphorus platycercus</i>
Rufous hummingbird	<i>Selasphorus rufus</i>
Belted kingfisher	<i>Ceryle alcyon</i>
Common flicker	<i>Colaptes auratus</i>
Hairy woodpecker	<i>Picoides villosus</i>
Downy woodpecker	<i>Picoides pubescens</i>
Willow flycatcher	<i>Empidonax trailli</i>
Western wood-pewee	<i>Contopus sordidulus</i>
Black-billed magpie	<i>Pica pica</i>
American crow	<i>Corvus brachyrhynchos</i>
Black-capped chickadee	<i>Parus atricapillus</i>
Pygmy nuthatch	<i>Sitta pygmaea</i>
House wren	<i>Troglodytes aedon</i>
American robin	<i>Turdus migratorius</i>
Mountain bluebird	<i>Sialia currucoides</i>
Townsend's solitaire	<i>Myadestes townsendi</i>
Ruby-crowned kinglet	<i>Regulus calendula</i>
Black-headed grosbeak	<i>Pheucticus melanocephalus</i>
Rufous-sided towhee	<i>Pipilo erythrophthalmus</i>
Dark-eyed junco	<i>Junco hyemalis</i>

APPENDIX B: WILDLIFE

American tree sparrow	<i>Spizella arborea</i>
Chipping sparrow	<i>Spizella passerina</i>
White-crowned sparrow	<i>Zonotrichia leucophrys</i>
Lincoln's sparrow	<i>Melospiza lincolnii</i>

Table 2. Mammals of probable occurrence near the Foothills Trail

<u>Common name</u>	<u>Scientific name</u>
Yellow-bellied marmot	<i>Marmota flaviventris</i>
Abert's squirrel	<i>Sciurus aberti</i>
Fox squirrel	<i>Sciurus niger</i>
Northern Pocket gopher	<i>Thomomys talpoides</i>
Deer mouse	<i>Peromyscus maniculatus</i>
Rock mouse	<i>Peromyscus difficilis</i>
Northern grasshopper mouse	<i>Onychomys leucogaster</i>
Bushy-tailed woodrat	<i>Neotoma cinerea</i>
Coyote	<i>Canis latrans</i>
Raccoon	<i>Procyon lotor</i>
Striped skunk	<i>Mephitis mephitis</i>
Mule deer	<i>Odocoileus hemionus</i>