

LONG TERM MANAGEMENT PLAN
WITH AN EMPHASIS ON
THE OHLONE TIGER BEETLE,
SCOTTS VALLEY SPINEFLOWER,
AND SCOTTS VALLEY POLYGONUM

GLENWOOD OPEN SPACE PRESERVE
SCOTTS VALLEY, CALIFORNIA

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1.0 INTRODUCTION

1.1 Overview

This Long Term Management Plan (LTMP) has been developed by the City of Scotts Valley (City) and the Land Trust of Santa Cruz County (Land Trust) for the Glenwood Open Space Preserve in Scotts Valley, California. This LTMP describes the long-term management and monitoring of species listed under the Federal Endangered Species Act (FESA) and the California State Endangered Species Act (CESA), and other sensitive species and habitats within the Glenwood Open Space Preserve. The LTMP also describes management and public use of the Glenwood Open Space Preserve including construction and maintenance of a public access trail system and associated pasture infrastructure designed to enhance and protect sensitive species habitat.

Near-term activities include the construction of a public access trail system that will be phased in based on available funding. Long-term activities include management of sensitive species habitats, through grazing, and management of public access with the primary goal of enhancing and protecting special-status, sensitive, and listed species and sensitive habitats (e.g. native grasslands, wetlands).

1.2 Property Description

The Glenwood Open Space Preserve is approximately bounded by the Salvation Army Redwood Glen Camp and Conference Center to the west, Canham Road to the north, Tabor Road neighborhood to the east, and Scotts Valley High School, Siltanen Park, and Vine Hill Elementary School to the south (Figure 1). Glenwood Drive bisects the Glenwood Open Space Preserve into two units, referred to herein as the East Preserve and West Preserve. The East Preserve consists of four pastures and a stock pond divided by internal fences. The Glenwood Open Space Preserve is located on the Felton and Laurel U.S. Geological Survey 7.5' Quadrangles. The Glenwood Open Space Preserve contains 170 acres and is divided into nine parcels owned by the City (with APN: 023-241-16; 023-241-17; 023-241-18; 023-241-19; 023-241-20; 023-241-21; 023-241-22; 023-241-23; 023-241-24), one parcel owned by the Land Trust (APN 023-241-25) and portions of one parcel owned by Scotts Valley Water District (APN 023-241-13).

The Glenwood Open Space Preserve is occupied by the Federally Endangered Ohlone tiger beetle (OTB, *Cicindela ohlone*) and Scotts Valley spineflower (*Chorizanthe robusta* var. *hartwegii*). Additionally, the Glenwood Open Space Preserve resides within Critical Habitat for Scotts Valley spineflower and Scotts Valley polygonum (*Polygonum hickmanii*); therefore, the latter species, although not observed within the Glenwood Open Space Preserve, is covered in this LTMP.

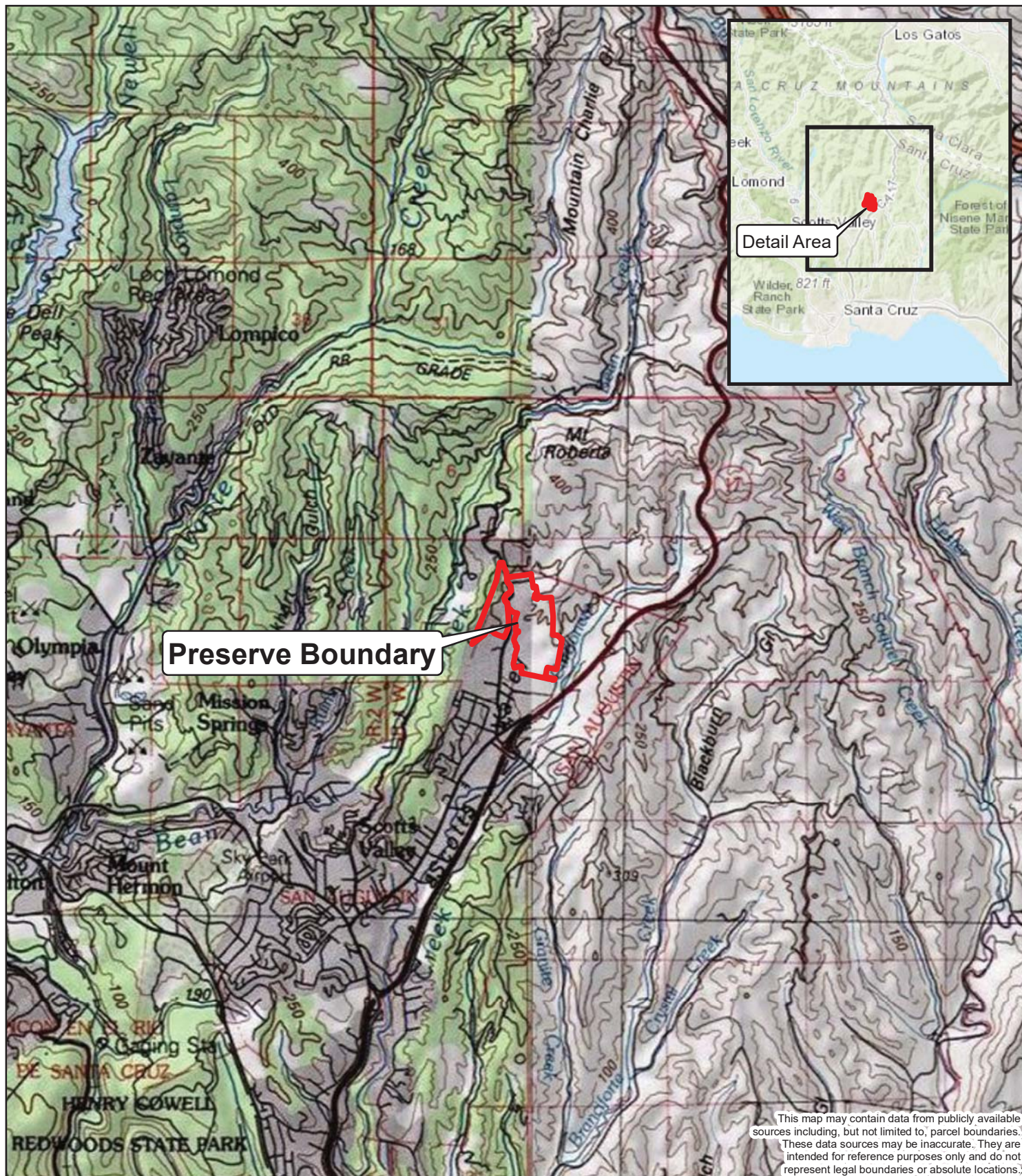


Figure 1. Location Map

Glenwood Preserve
Santa Cruz County, California



Map Prepared Date: 11/3/2017
Map Prepared By: sgillespie
Base Source: Esri Streaming - USA Topo
Data Source(s): WRA

1.3 Glenwood Open Space Preserve History

Table 1 outlines the history of the Glenwood Open Space Preserve, beginning prior to 2001 through present time.

Table 1. Glenwood Open Space Preserve History

Dates	History
Prior to 2001	Various development and conservation alternatives were considered for the property. A formal project proposal in the 1990s included plans for 145 new houses placed throughout the property. The development would have impacted native species, riparian areas and wetlands. In response to City regulations and community concern, the developer reduced the scope to a smaller housing development in an area that would have less impact on natural resources. As a part of the approval process the developer granted an Offer to Dedicate a conservation easement over several lots (C, D, E and the residential Lots 45, 46, 47, 48 and 49 (Tabor Drive Lots)).
2001	The reduced Glenwood Residential Development project with 44 units went forward with approval of the Glenwood Project Environmental Impact Report (EIR) and associated Mitigation and Monitoring Reporting Program. This EIR called for coordination with the US Fish and Wildlife Service (the Service) when public access was contemplated and preparation of an Open Space Management Plan to guide management of sensitive resources. A Development Agreement for the subdivision was prepared which was approved by the City Council on September 5, 2001. This Development Agreement required the housing development to manage the Glenwood Open Space Preserve until June 30, 2009 at which time management reverted to the City.
2003	<p>The Land Trust entered into a grant agreement with the Wildlife Conservation Board of the State of California (WCB) for \$3,100,000 to protect natural resources on the property, and designate a portion of those funds to the City. The City used \$1,437,000 to purchase Lots C, D and the Tabor Drive Lots from the developer. The developer donated Lot B to the City. Lot E came into City ownership as well.</p> <p>The City granted a Conservation Easement to the Land Trust over Lot B. The City then donated a separate Conservation Easement to the Land Trust over Lots C, D and the Tabor Drive Lots.</p> <p>The Land Trust used \$1,070,000 from WCB funds to purchase Lot E from the City. The City then paid \$1,070,000 to the Land Trust, which established an endowment with those funds for the purpose of funding ecosystem management responsibilities.</p> <p>The Conservation Easements:</p> <ul style="list-style-type: none"> • Are a restriction in the property deeds and can be enforced as legally binding • Cover the entire property, except the inholding (Lot E) that is owned by the Land Trust, • Prohibit development, billboards, dumping, • Protect sensitive vegetation and biotic resources, with exceptions for management of those resources. <p>The Open Space Management Plan (June 2003):</p> <ul style="list-style-type: none"> • Prohibits public access until an LTMP is developed. • Define the responsibilities of the Glenwood Open Space Preserve Manager under this LTMP as: <ul style="list-style-type: none"> ○ Oversee monitoring and maintenance of existing conditions of the habitat occupied by the OTB and Scotts Valley spineflower; ○ Maintain existing habitat values for other sensitive species and special-status habitat areas; ○ Implement and manage a grazing program and fencing for the East Preserve;

	<ul style="list-style-type: none"> ○ Develop and implement a public awareness program to restrict public access to the Glenwood Open Space Preserve and; ○ Install and maintain educational and interpretive signing around sensitive habitat areas. <p>The City of Scotts Valley Management Memorandum of Understanding (MOU):</p> <ul style="list-style-type: none"> • Directs the City and Land Trust to prepare and execute an LTMP Management Contract under which the Land Trust acts as the Glenwood Open Space Preserve Manager in charge of management and monitoring obligations following the Interim Period (during which the developer was responsible for these activities) • Outlines the creation and management of the \$1,070,000 endowment.
2009	<p>The City of Scotts Valley Management MOU Amendment</p> <ul style="list-style-type: none"> • Management Contract between City and Land Trust is postponed until the LTMP is completed (City and Land Trust now prefer an MOU to a contract). • LTMP should assess the feasibility of the endowment to fund the plan's management and monitoring requirements.
2001 - 2015	<p>Consulting services from Phil Greer (Wetland Research Associates now WRA, Inc.), Richard Arnold (Entomological Consulting Services, Ltd.), Kathleen Lyons (Biotic Resources Group), and Lawrence Ford (Lawrence D. Ford, Rangeland Conservation Science) included preparation of the Open Space Management Plan (2003), management of the Preserve and preparation of a draft Long Term Management Plan.</p> <ul style="list-style-type: none"> • Coordination with the Service indicated the potential need for take authorization, for the federally listed species that inhabit the property. This was due to the potential for take associated with recreational use and public access of the site.
2016	<ul style="list-style-type: none"> • Through further coordination with the Service, it was determined that take authorization is not currently required for trail building and public access if impacts to federally listed species are avoided. The Service recommended that the Glenwood Open Space Preserve apply for a Section 10(a)(1)(A) permit if OTB colonize areas outside of currently occupied habitat. <p>The Service indicated that the potential for take of federally listed species is unlikely, but may occur in the future, outside of a 100' buffer around occupied and historic OTB habitat. To ensure unlawful take of federally listed species is avoided, the Service requested:</p> <ul style="list-style-type: none"> • The City and the Land Trust submit a copy of the LTMP. • Share with the Service a copy or outline of the Final Agreement (MOU) between the Land Trust and the City. • The Glenwood Open Space Preserve works with a qualified biologist (Richard Arnold or other) to implement a monitoring strategy that characterizes OTB population and take in occupied and historically occupied habitat. • Submits annual monitoring reports. • Immediately contact the Service in the event of take of OTB associated with recreational use of the site. • The Glenwood Open Space Preserve conduct annual monitoring of the trail system to survey for OTB. Trails are considered a recovery action due to the suitable habitat they will create through increased bare ground that serves as breeding habitat. • Avoid trail building in occupied Scotts Valley spineflower habitat. • Continue to survey for Scotts Valley polygonum within potential habitat.
2017	<p>This LTMP is completed.</p>

2.0 SITE DESCRIPTION AND BIOLOGICAL RESOURCES

2.1 Site Description

2.1.1 Climate

The climate of the Glenwood Open Space Preserve is Mediterranean with cool, wet winters and warm, dry summers. Summer daytime temperatures range from approximately 65°F to 90°F, night temperatures range from approximately 47°F to 53°F, with average high temperature of 77°F. Winter daytime temperatures range from approximately 55°F to 75°F, night temperatures range from approximately 38°F to 53°F and average low temperature of 45°F. Annual precipitation is approximately 30.5 inches (UC-IPM 2009). Most precipitation falls as rain. The rainy season is from approximately October to April, with the majority of rainfall occurring between December and March.

2.1.2 Geology and Soils

Elevation of the Glenwood Open Space Preserve ranges from 650 to 1,010 feet. Topography is dominated by a north to south sloping valley formed by Carbonera Creek. The Glenwood Open Space Preserve includes the adjacent slopes to the west and east up to the ridgeline.

Underlying geology is dominated by Purisima sandstone and Santa Cruz mudstone with substantial open ridgetops of exposed rock and shallow soils. Soils are mapped as Bonnydoon loams, Danville loams, Nisene-Aptos complex, and Soquel loam (USDA 1980).

Soils in the valleys are primarily of Danville loams, which are deep, well-drained soils with slow permeability found on alluvial fans and valley bottoms. Soil on the slopes and ridges is Bonnydoon loam, which is a shallow, somewhat excessively drained soil with moderate permeability. Soils in the northern portion of the Glenwood Open Space Preserve are primarily of the Nisene-Aptos complex, which are deep, well-drained soils derived from residuum weathered from siltstone or sandstone. The area occupied by OTB has been determined by NRCS to be an inclusion of Watsonville loam.

2.1.3 Hydrology

Glenwood Open Space Preserve is located in the San Lorenzo River watershed. The West Branch of Carbonera Creek and the smaller tributary along Glenwood Drive to the west run from north to south through the Glenwood Open Space Preserve. Carbonera Creek is a seasonal to perennial flowing stream with dense willow and oak-bay riparian along sections. A perennial stock pond resides in the central portion of the Glenwood Open Space Preserve, with a spillway that drains into the east branch of Carbonera Creek. This spillway contains a natural bedrock and soil bottom. Several ephemeral drainages drain the ridges within the Glenwood Open Space Preserve into either branch of Carbonera Creek.

2.1.4 Vegetation

The Glenwood Open Space Preserve is composed of several upland and aquatic plant communities common to coastal California. Previous studies documented aquatic communities (e.g., Section 404 wetlands, Section 1600 streams). The boundaries of upland communities were not mapped; however, these communities have been described in detail through several studies. The dominant tree community within the Glenwood Open Space Preserve is coast live oak-bay woodlands (*Quercus agrifolia-Umbellularia californica*) with groves of coast redwood (*Sequoia*

sempervirens). Patches of shrubland are spread throughout the Glenwood Open Space Preserve, with coyote brush (*Baccharis pilularis*) the dominant shrub species. The remainder of the Glenwood Open Space Preserve is composed of herb-dominated communities, primarily non-native grasslands with patches of native grassland and wildflower fields.

2.1.4.1 Upland

Vegetation within the Glenwood Open Space Preserve consists of approximately 60 percent non-native annual grassland with the remainder consisting of wetlands, willow riparian, wildflower fields, native grassland, coyote brush scrub, oak-bay forest, and redwood forest. Herbaceous communities within the Glenwood Open Space Preserve (i.e. grasslands, wildflower fields) exhibit temporal and spatial shifts related to topographic, climatic, and edaphic conditions as well as current and long-term land use practices including fire suppression, dairy ranching, horse, and cattle grazing. For example, observations over three years of sky lupine (*Lupinus nanus*) in non-native annual grasslands in central California noted that lupine blooms have a statistically higher bloom density and duration during years experiencing fall drought (November and December) followed by favorable winter rains (January through March) (Knops and Barthel 1996). Annual monitoring of transects in the Glenwood Open Space Preserve conducted by WRA resulted in similar findings, with areas classified as non-native annual grasslands frequently exhibiting dominance or sub-dominance of both native and non-native forbs (WRA 2009). Therefore, drawing sharp distinctions between non-native annual grassland, wildflower fields, and native grasslands is likely to reflect abiotic factors affecting species dominance and richness for that particular monitoring year.

Non-native annual grassland is found primarily on ridgetops and slopes. In general, these grasslands are dominated by annual grasses, including silver hair grass (*Aira caryophyllea*), slender wild oat (*Avena barbata*), small rattlesnake grass (*Briza minor*), soft chess (*Bromus hordeaceus*), ripgut brome (*B. diandrus*), Mediterranean barley (*Hordeum marinum*), foxtail barley (*H. murinum*), and Italian ryegrass (*Festuca perennis* [*Lolium multiflorum*]). However, years experiencing substantial winter drought, are often accompanied by an increase in, and at times a dominance of, forb species including redstem filaree (*Erodium botrys*), sheep sorrel (*Rumex acetosella*), red sandspurry (*Spergularia rubra*), as well as swaths of native annual forbs (see below).

Wildflower fields are located on relatively shallow soils and all aspects, but tend to be on or near ridgelines. Dominant species may shift annually dependent on favorable or unfavorable climatic conditions, and include a suite of non-native annual grasses as well as native forbs including rusty popcornflower (*Plagiobothrys nothofulvus*), miniature lupine (*Lupinus bicolor*), sky lupine, cream cups (*Platystemon californicus*), California goldfields (*Lasthenia californica*), and owl's-clovers (*Castilleja densiflora*, *C. exserta*).

Native grasslands tend to be located on shallower, often stony, soils on south- and west-facing ridge and hillslopes. Dominants include a suite of non-native grasses with substantial or characteristic cover of purple needlegrass (*Stipa pulchra* [*Nassella pulchra*]¹), six-weeks fescue (*Festuca microstachys* [*Vulpia microstachys*]), and California oat grass (*Danthonia californica*).

The Glenwood Open Space Preserve contains substantial grassland areas with low vegetative cover associated with exposed fractured bedrock and adjacent shallow soils on ridges and upper

¹ Plant species scientific nomenclature follows the *Jepson Manual, 2nd Edition* (Baldwin et al. 2012), with *Jepson Manual, 1st Edition* (Hickman 1993) in brackets. *Jepson Manual, 1st Edition* names included herein to retain continuity with previous documentation for the Glenwood Open Space Preserve.

slopes. Some of these areas support Scotts Valley spineflower and Mt Diablo cottonweed (*Micropus amphibolus*). An approximate 3-acre area in the southwest portion of the Glenwood Open Space Preserve contains level clay loam soil with bare ground patches that provide habitat for OTB.

Coyote brush scrub is found primarily on ridges and slopes bordering grasslands and is dominated by coyote brush and non-native annual grasses. Oak-bay forests and woodlands occur primarily on north-facing slopes and consist of coast live oak (*Quercus agrifolia*), California bay (*Umbellularia californica*), California buckeye (*Aesculus californica*), and a mixed understory of grasses and forbs. Redwood forests are found in the northeast and northwest portions of the Glenwood Open Space Preserve, primarily on north-facing slopes, and are dominated by coast redwood, Douglas fir (*Pseudotsuga menziesii*), California bay, Sonoma rose (*Rosa spithamea*), sword fern (*Polystichum munitum*), and a mix of native forbs. These forests are primarily second growth, with only a few trees exhibiting old-growth characters (e.g. epicormic branching, broken tops, cat faces).

2.1.4.2 Wetlands and Riparian

Glenwood Open Space Preserve contains approximately 8.5 acres of state and federal jurisdictional wetlands and 4 acres of riparian area. The wetlands are located primarily in the East Preserve. In the Canham Pasture wetland swales receive runoff from an offsite low-density residential development. Surface flow enters well-defined vegetated channels at the northern boundary of the Glenwood Open Space Preserve through two culverts under Canham Drive. At the lower end of the Canham Pasture the channels join and form a wide wetland meadow. Vegetation is dominated by Italian ryegrass, pennyroyal (*Mentha pulegium*), Mediterranean barley, meadow barley (*H. brachyantherum*), semaphore grass (*Pleuropogon californicus*), iris-leaved rush (*Juncus xiphioides*), and seep monkeyflower (*Mimulus guttatus*).

A large wetland swale and wetland meadow complex occurs in the southern portion of the East Preserve in the Tabor Pasture. Hydrology is primarily from adjacent upland slopes directed through undefined swales. Flow slows in the flatter, bottomlands in this area. Vegetation is dominated by Mediterranean barley, pennyroyal, rabbit's-foot grass (*Polypogon monspeliensis*), hyssop loosestrife (*Lythrum hyssopifolia*), Choris's popcornflower (*Plagiobothrys chorisianus* var. *chorisianus*), annual bluegrass (*Poa annua*), and fiddle dock (*Rumex pulcher*). Choris's popcornflower is a sensitive wetland species that was monitored 2003 – 2009 (California Native Plant Society (CNPS) Rank 1B.2).

A large contiguous riparian area occurs along the West Branch of Carbonera Creek and the smaller tributary along Glenwood Drive to the west. These channels contain a distinct bed and bank with sorted sediments, occasional debris deposits, and water stains on the banks. Hydrology of Carbonera Creek is primarily seasonal to nearly perennial with pools often remaining until the return of autumn rains. The smaller tributary contains seasonal hydrology supplied by the large wetland meadow complex in Canham Pasture. The vegetation of both riparian areas is dominated by arroyo willow (*Salix lasiolepis*), red willow (*S. laevigata*), coyote brush, coast redwood, coast live oak, California bay, elderberry (*Sambucus nigra* [*S. mexicana*]), California blackberry (*Rubus ursinus*), and herbaceous wetland species.

2.1.5 Existing Land Use and Adjacent Land Uses

Currently, the Glenwood Open Space Preserve is managed as open space without public access. Historically, the area was grazed with dairy cattle, then by horses. Since 2014, a small herd of cow/calf pairs have been utilized as the primary management strategy for the sensitive species

and habitats present in the Glenwood Open Space Preserve. Scotts Valley Water District maintains a storage tank in and a paved access road through the northeast portion of the Glenwood Open Space Preserve.

Adjacent land uses include low density, rural residential to the north, medium density residential to the east and south, accessible open space to the west, and a high school to the southwest.

2.2 Special-Status Wildlife Species

Certain species are tracked by the California Department of Fish and Wildlife (CDFW), regardless of their Federal legal or protection status. This list is referred to as the special-status species list. Species on this list include, for example, (1) those that are biologically rare, very restricted in distribution, or declining throughout their range but not currently threatened with extirpation, (2) species considered by CDFW to be a species of special concern, and (3) those species officially listed or proposed for listing under FESA and CESA.

2.2.1 *Ohlone Tiger Beetle*

2.2.1.1 Status and Distribution

The OTB is a federally-listed endangered species (USFWS 2001). The primary threat to this species is the loss and alteration of its coastal terrace prairie habitat. Freitag et al. (1993) noted that the OTB is restricted to clay-based, marine terraces, which support native grassland remnants in the coastal mid-Santa Cruz County area. Much of its former habitat in Santa Cruz, San Mateo, and Monterey counties had been converted for development or other land uses before the species was recognized in 1993.

Of the approximately 110 species of tiger beetles that have been described in North America (Boyd and Associates 1982), OTB exhibits one of the most restricted geographic ranges. Historically, it has been reported at only 17 coastal terrace locations, on Watsonville loam soil, at low- to mid-elevations (less than 1,200 feet) in central and western Santa Cruz County, but is currently known to occur at only nine of those sites.

2.2.1.2 Species Description

Collection records indicate that most adult OTB are active from mid-January through mid-May, although the duration and timing of the adult activity period can vary from year-to-year and between places within a particular year. Specifically, beetles have been observed in the range from January 17 through May 11 (Freitag et al. 1993, BUGGY Data Base 2015).

The diurnally active adults and larvae of OTB are associated with sunny areas of bare or sparsely vegetated ground. Adults run rapidly in and near the larval habitat. They are strong flyers, at least for short distances. Because they are cold-blooded, are active during the winter and spring months, and favor microhabitats that are sparsely vegetated and can become quite warm during their activity period, adults and larvae typically spend a considerable portion of their daily activity thermoregulating.

Both adults and larvae of tiger beetles are opportunistic, preying on smaller, soft-bodied insects and invertebrates. Adults possess good visual acuity and are found on sunny glades of bare or sparsely vegetated soil, where they actively search for potential prey. In contrast, larvae remain in their tunnels, and ambush prey that wander within their striking distance. Primary prey items

of OTB are ants. Prey for other species of tiger beetles have been identified as ants, adult and larval stages of flies (*Diptera*), other tiny insects, small beetles, and worms (Larochelle 1974).

The OTB has one generation per year and four life stages: egg, larva, pupa, and adult. Throughout the adult activity period, females lay eggs after they emerge and mate. Eggs are laid singly in the soil, immediately below the surface. In about two weeks, a tiny larva emerges and digs a shallow tunnel, or larval burrow, in the ground at the same location where the egg was laid. Larvae are active until the onset of the following rainy season, usually in late October or early November. During this several-month period, they molt three times, with each stage between molts referred to as an instar. With each larval instar, the diameter and depth of the burrow is enlarged to maximum sizes of about 5-6 mm in diameter and 10-20 cm in depth. Upon occurrence of the first ground-soaking rain in the fall, the larva plugs the upper portion of its burrow and pupates. In the following winter or early spring, a new adult beetle emerges from the larval burrow.

2.2.1.3 Habitat Characteristics and Use

OTB inhabits areas characterized by remnant stands of native grassland, in particular coastal terrace prairie. California oat grass and purple needlegrass are two native grasses known to occur at all sites. Within these grasslands, the beetle has been observed where the vegetation is sparse or bare ground is prevalent, primarily on level ground and less frequently on slopes. The substrate at each known beetle location consists of shallow, poorly drained clay or sandy clay soils that have accumulated over a layer of bedrock known as Santa Cruz Mudstone (Freitag et al. 1993). According to the Soil Survey of Santa Cruz County, the soils present at most known OTB sites are Watsonville Loams (USDA 1980). Although the county's soil map (USDA 1980) does not indicate that Watsonville Loam is present at a few of the OTB sites, including Glenwood Open Space Preserve, NRCS test pits within the occupied habitat on these sites confirmed inclusions (i.e. areas too small to map) of Watsonville Loam. This work is captured in the methods section of a paper on OTB (Knisley and Arnold 2013).

The larvae of most tiger beetles occur in a narrower range of microhabitats than their adult stages; presumably because they tolerate less variation in many physical factors, especially soil type, moisture, composition, and temperature (Pearson 1988, Shelford 1907, Shelford 1909). Larvae of other tiger beetle species that live in grasslands typically build their tunnels at the edges of the bare or sparsely vegetated portions of the grassland where adult beetles are most commonly observed. The larvae of the OTB follow a similar pattern, as larval burrows are found along dirt trails and at the edges of barrens or sparsely vegetated areas.

2.2.1.4 Occurrence in the Glenwood Open Space Preserve

The OTB adults and larval burrows have been observed in the most southerly portion of the East Preserve on a sparsely vegetated, relatively flat ridge (Figure 2 and Figure 3). Between 2000 and 2017 repeated seasonal transect counts were used to census adults (Table 2), while larval burrow censuses have been conducted annually since 2003 (Table 3). During this period, the area occupied by larval burrows has ranged from 0.07 to 0.35 acre, with considerable year-to-year fluctuations in adult and burrow numbers as well as occupied area (indicated as "Occupied Ohlone Tiger Beetle Larval Burrow Area" in Figure 2 and Figure 3). At the present time, adults are routinely observed along portions of the trails and in bare spots within the grassland that lie outside of the occupied burrow area within the Beetle Pasture (indicated as "Occupied Ohlone Tiger Beetle Adult Area in Figure 2 and Figure 3). Historically, adult OTB has been observed elsewhere in the Beetle Pasture, i.e., outside the occupied burrow area. For example, prior to past fire control management practices that included disking and mowing of the southern and eastern pasture boundaries with neighboring properties, both adults and larval burrows were

observed adjacent to the fences (indicated as “Historic Ohlone Tiger Beetle Adult / Larval Area in Figure 2 and 3). Shrub establishment, adjacent tree growth, irrigation runoff from adjacent homes, and many years without grazing in the panhandle area (grazing has returned to this area since 2014) may have further reduced habitat suitability in this area.

In 2006, an adult OTB was observed along the trail between the OTB pasture and the pond; the vicinity was surveyed and no larval burrows were observed. It is not unusual for some adults to occasionally disperse from the Beetle Pasture in search of prey items or oviposition sites, but since the monitoring surveys are focused within the Beetle Pasture, these events have not been detected routinely. During a capture-recapture study (Arnold and Knisley, unpublished), adults were observed moving as far as 485 meters between sightings. Other tiger beetles have been documented to disperse as far as 25 kilometers (Knisley and Schultz 1997).

Table 2. Summary of Adult Ohlone Tiger Beetle Census 2004 – 2017





Transect Survey Year	Ohlone tiger beetle Numbers by Transect Interval							Transect Total
	A	B	C	D	E	F	G	
2004	0	40	23	30	33	113	N/A	239
2005	0	5	5	6	14	49	N/A	79
2006	0	2	4	31	15	46	N/A	98
2007	0	4	10	53	37	51	2	157
2008	0	29	14	15	41	17	0	116
2009	0	23	21	46	30	6	1	127
2010	0	8	8	37	25	3	0	81
2011	0	8	18	34	35	11	0	106
2012	0	18	44	57	41	8	9	177
2013	0	17	60	102	83	5	14	281
2014	7	16	35	165	74	12	11	320
2015	8	32	45	178	80	8	12	363
2016	4	77	45	331	30	69	34	590
2017	0	22	7	294	3	60	79	465

Glenwood Preserve

Scott's Valley,
California

Figure 2.
Ohlone Tiger Beetle
Observations



-  Glenwood Preserve
-  Occupied Ohlone Tiger Beetle Larval Burrow Area
-  Occupied Ohlone Tiger Beetle Adult Area
-  Historic Ohlone Tiger Beetle Adult/Larval Burrow Area



0 50 100 200
Feet

Map Prepared Date: 11/3/2017
Map Prepared By: sgillespie
Base Source: Esri Streaming Imagery
Data Source(s): WRA, Land Trust Santa Cruz
County, Entomological Consulting Services, Ltd.

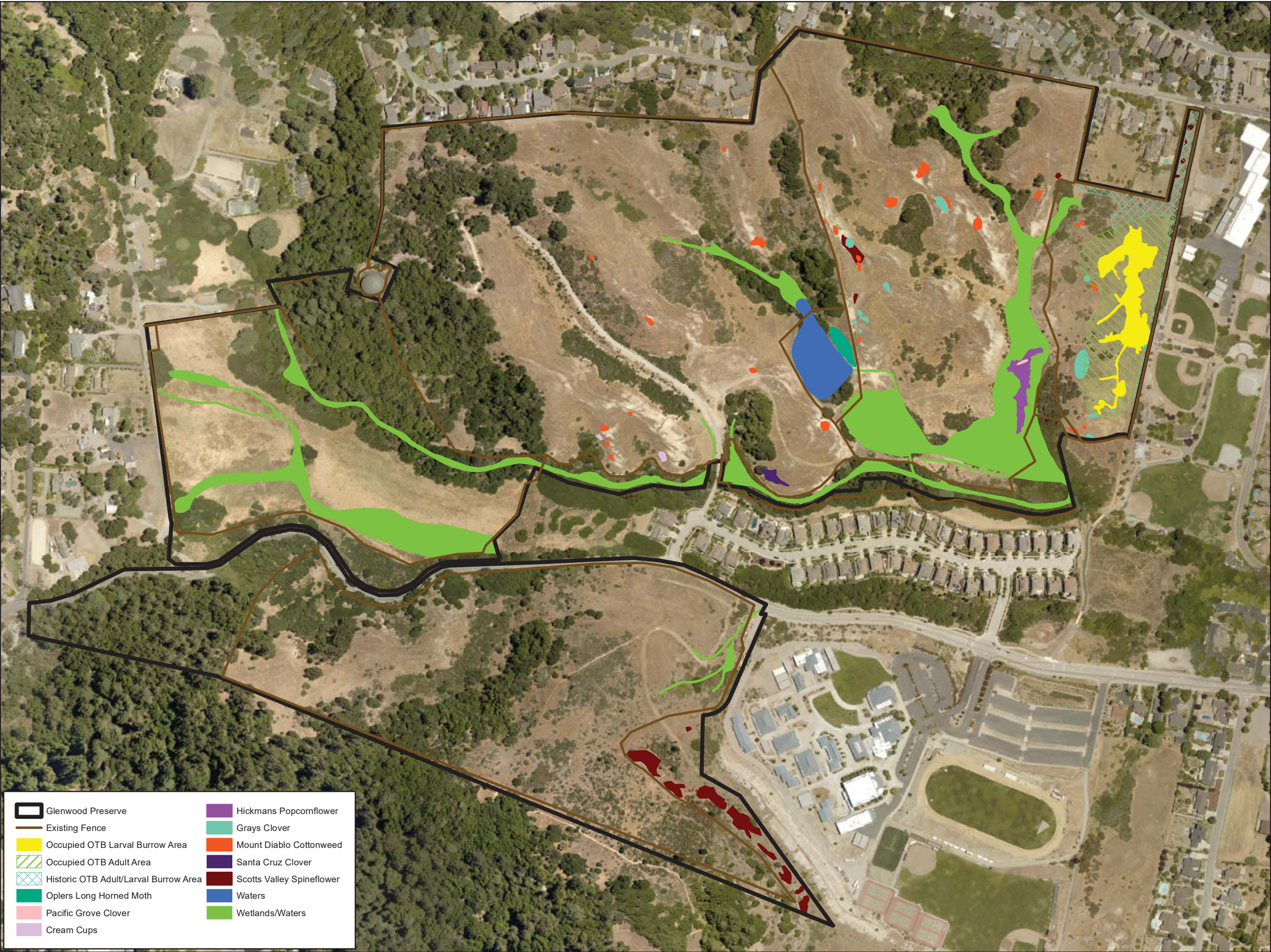
Table 3. Summary of Ohlone Tiger Beetle Larval Burrow Census 2003 – 2017

Larval Survey Year	Observed Numbers by Larval Instar			
	1.5 – 2.3 mm 1 st Instar	2.4 – 3.5 mm 2 nd Instar	3.6 – 6.0 mm 3 rd Instar	Total
2003 (July)	3	21	532	556
2004 (June)	2	57	288	347
2005 (July)	2	23	142	167
2006 (June)	7	38	226	271
2007 (July)	18	58	227	303
2008 (June)	48	90	445	583
2009	34	47	389	470
2010	13	42	356	411
2011	17	38	373	428
2012	60	108	1,061	1,229
2013	27	42	438	507
2014	34	54	858	946
2015	16	34	534	584
2016	11	22	566	599
2017	5	8	162	175

The population sizes of the adult OTB generation in 2016 and 2017 was estimated using a new census technique described by Holmes and Arnold (2015). The transect count data was used in conjunction with the frequencies of observed adult lifespans obtained from a mark-release-recapture (also known as “capture-recapture”) study (Arnold, unpublished) to estimate the number of adults in the OTB generation. Using this new method, estimated OTB population sizes for every year since 2000 are also reported herein for comparison of annual results (Figure 4).

Even though numbers of adult beetles and larval burrows, plus the area occupied by larval burrows, have fluctuated annually, larval burrow densities have remained relatively steady since 2003 (Arnold 2014). Figure 5 of this report contains two graphs that illustrate the number of OTB larval burrows observed annually since 2003 and the densities of larval burrows. Lines illustrating the averages for the period of 2003 through 2017 are also provided. The observed number of OTB larval burrows have exceeded the average of 505/year in six of the 15 years of this monitoring program. During this same period, burrow densities have exceeded the average of 6.26 burrows/100 ft.² in 8 years.

Previously, potential larval burrows were observed on a grassy, sparsely vegetated knoll east of the stock pond; however, no OTBs were observed at this location in either 1996 or 2000. Subsequent to the 2000 report, ground-nesting bees were observed emerging from such burrows (Arnold, personal observation). The National Resource Conservation Service (NRCS) examined soils at this location and found them to be shallow and rocky. The OTBs are known to be restricted to soils that are deeper and in which it is easier to burrow. The limited occurrence of suitable Watsonville loam soil conditions for the OTB to inhabit may explain its restricted distribution within the Glenwood Open Space Preserve.



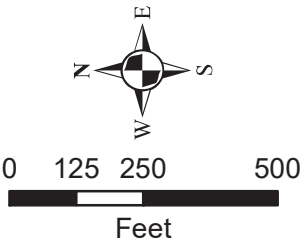
ENVIRONMENTAL CONSULTANTS

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Glenwood Preserve

Scotts Valley,
California

Figure 3.
Special-status Species
Observations



Map Prepared Date: 11/3/2017
Map Prepared By: sgillespie
Base Source: Esri Streaming Imagery
Data Source(s): WRA, Land Trust Santa Cruz County,
Entomological Consulting Services, Ltd.

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Figure 4. Estimated Adult Ohlone Tiger Beetle Population Sizes at Glenwood 2000 – 2017

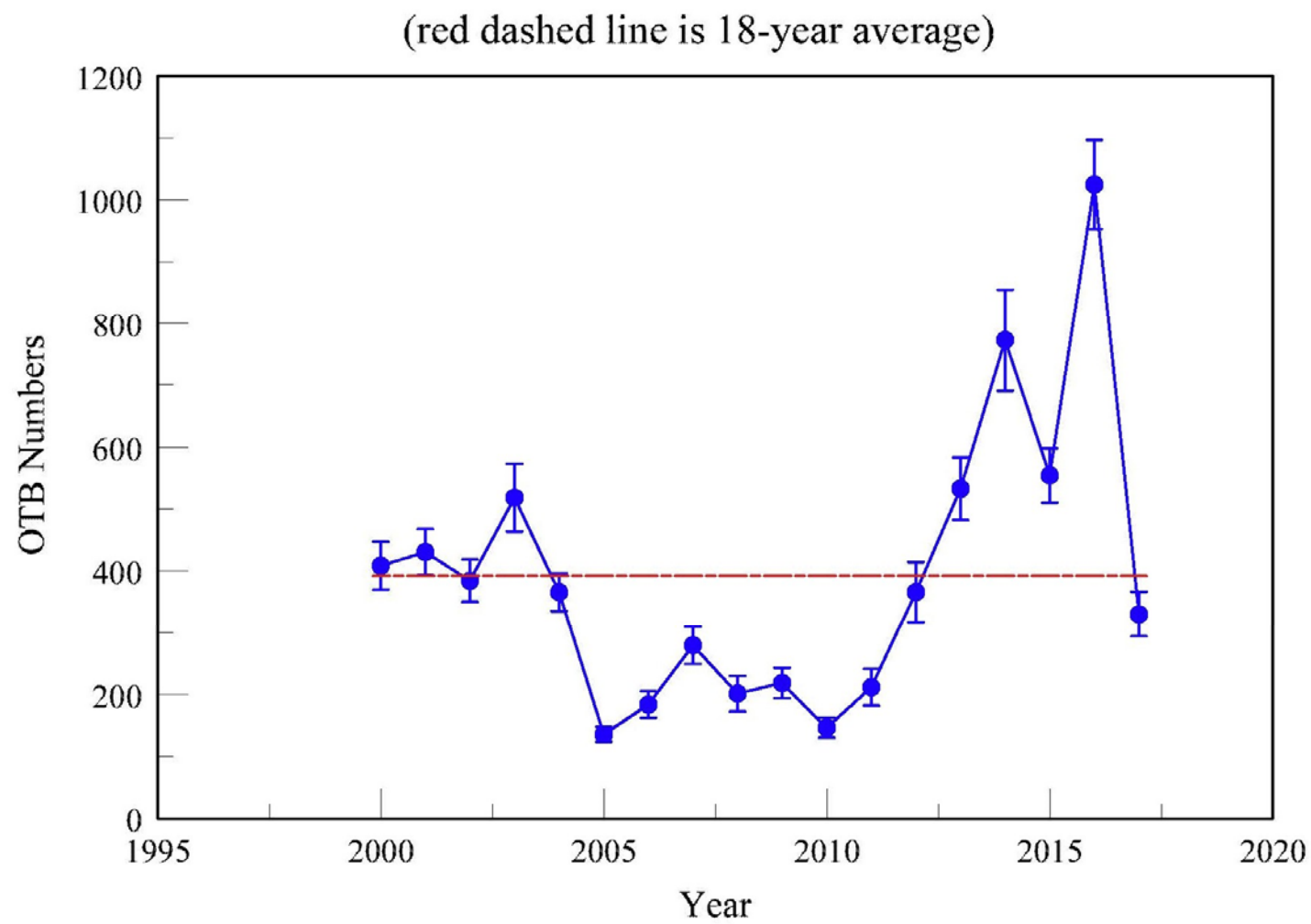
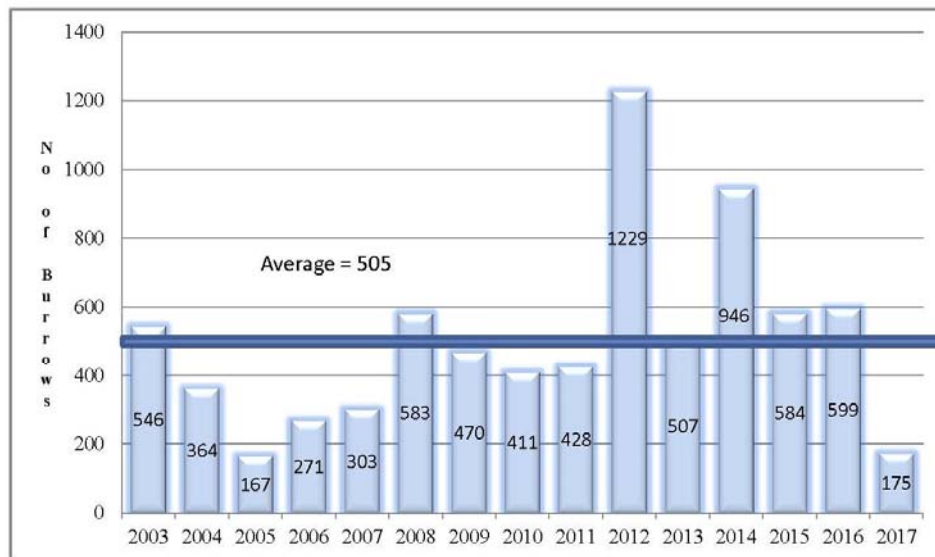
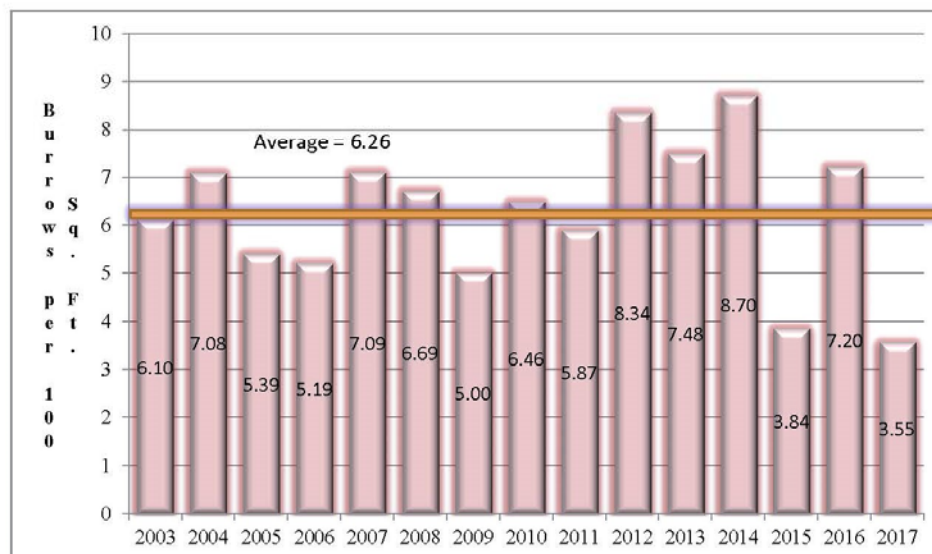


Figure 5. Number and Density of Ohlone Tiger Beetle Burrows from 2003 – 2017

Graph showing the Number of Ohlone Tiger Beetle Burrows Observed 2003 - 2017



Graph showing the Number of Ohlone Tiger Beetle Burrows Observed per 100 Sq. Ft. of Burrow Area On the Scotts Valley - Glenwood Site



2.2.1.5 Habitat Management

Habitat management for OTB is focused on the Beetle Pasture. As the highest priority special management area, the Beetle Pasture is grazed at times that optimize the benefits to OTB and minimize any negative effects on native grasses (refer to “Beetle” column and notes in Table 13). The gates to this pasture are left open during most times of year when grazing is also beneficial in Pond and Tabor Pastures. The cattle may be concentrated in the Beetle Pasture when growth of the herbaceous plants is rapid or its mass significantly exceeds the target levels. Grazing will continue when rainfall and temperatures are sufficient to initiate and maintain fall and winter growth and through the spring. During winter, if heavy rainfall occurs, and the soils are saturated, grazing will be excluded to protect the eggs near the surface. Cattle will graze through late spring or early summer (May, June, or July) until the defined limits of RDM, native grass herbivory, and heterogeneity of herbaceous height are reached. After then, there is no need to graze the Beetle Pasture until the following winter.

We do not know the full distribution of Watsonville loam soils within the Beetle Pasture and it should be a priority to determine this fundamental habitat requirement for the OTB to guide future habitat management efforts. While we anticipate that take of OTB along trails outside of occupied or historically occupied habitat may be unlikely, as the species is very rarely observed in those areas, there is no guarantee that beetles will not occupy future bare ground where it is created. Take of OTB along trails inside of occupied and historically occupied habitat will be minimized by limiting access to periods of the year when vulnerable life stages are not expected to be present above ground. There is a chance of take of OTB in both settings. Monitoring for OTB occurrence will also record any observed take. If take is observed, it will be reported to the Service, which may result in changes to management and trail use.

2.3 Special-Status Plant Species

2.3.1 Scotts Valley Spineflower

2.3.1.1 Status and Distribution

Scotts Valley spineflower is listed as Federal Endangered and CNPS Rank 1B.1, but is not listed under the CESA (USFWS 2002, CNPS 2009). It is limited in its occurrence to rock outcrops and thin soils within grasslands in the Scotts Valley region.

In general, members of the *Chorizanthe* genus are endemic to specific substrate and/or site conditions. They are known from habitats along the coast and inland. However, due to the patchy distribution of these unique soil resources, many species of *Chorizanthe* are highly localized in their distribution. The ranges of many *Chorizanthe* species overlap; however, there is no range overlap between the Scotts Valley spineflower, the related robust spineflower (*C. robusta* var. *robusta*), or the Ben Lomond spineflower (*C. pungens* var. *hartwegiana*).

The Scotts Valley spineflower is known from two sites in the northern end of Scotts Valley, the Glenwood Unit, and the Polo Ranch Unit. The Polo Unit is located east of Highway 17 and north of Navarra Drive. In 2005, Scotts Valley spineflower was recorded at 21 locations and comprised approximately 7,799 individuals. The Glenwood Unit is located north of Casa Way and both east and west of Glenwood Drive. Colonies of Scotts Valley spineflower are scattered throughout the unit, however the largest number of colonies are located west of Glenwood Drive. This unit includes spineflower colonies on properties owned by the Salvation Army, Scotts Valley Unified School District (SVUSD), and the City.

Critical habitat for Scotts Valley Spineflower and Scotts Valley Polygonum has been designated by the U.S. Fish and Wildlife Service (Service) (Figure 6), 287 acres of which occur within the Glenwood Open Space Preserve (USFWS 2002). Critical habitat is defined as specific areas supporting physical or biological features that are essential to the conservation of the species, including areas that may require special management considerations or protection. The primary elements of critical habitat for the Scotts Valley spineflower are:

- Presence of thin soils developed over outcrops of Santa Cruz mudstone or Purisima sandstone;
- Presence of wildflower field habitat (grasslands developing on thin soil areas);
- Presence of a grassland plant community that is stable over time;
- Area to allow each population to survive catastrophic events and re-colonize suitable sites;
- Pollination activity between colonies;
- Seed dispersal between existing colonies, and;
- Sufficient protection of the watershed above spineflower habitat to maintain soil and hydrologic conditions that provide seasonally wet substrate for the species' growth and reproduction.

In addition to these primary constituent elements, the Service also stated that management considerations or protections might be needed for the species (USFWS 2002). The Service found that in some cases, protection of existing habitat and current ecological processes may be sufficient to ensure the maintenance of populations; however, active management may be needed in some areas to preserve the primary elements. The most likely management actions identified by the Service include limiting the application of herbicides, fertilizers and soil amendments, avoid over spray from irrigation, limit habitat fragmentation through construction of roads and fencing that limits movement of pollinators and wildlife dispersal agents, control occurrences of invasive, non-native plant species, and protect sites from heavy disturbances during the species' critical growth and reproduction period.

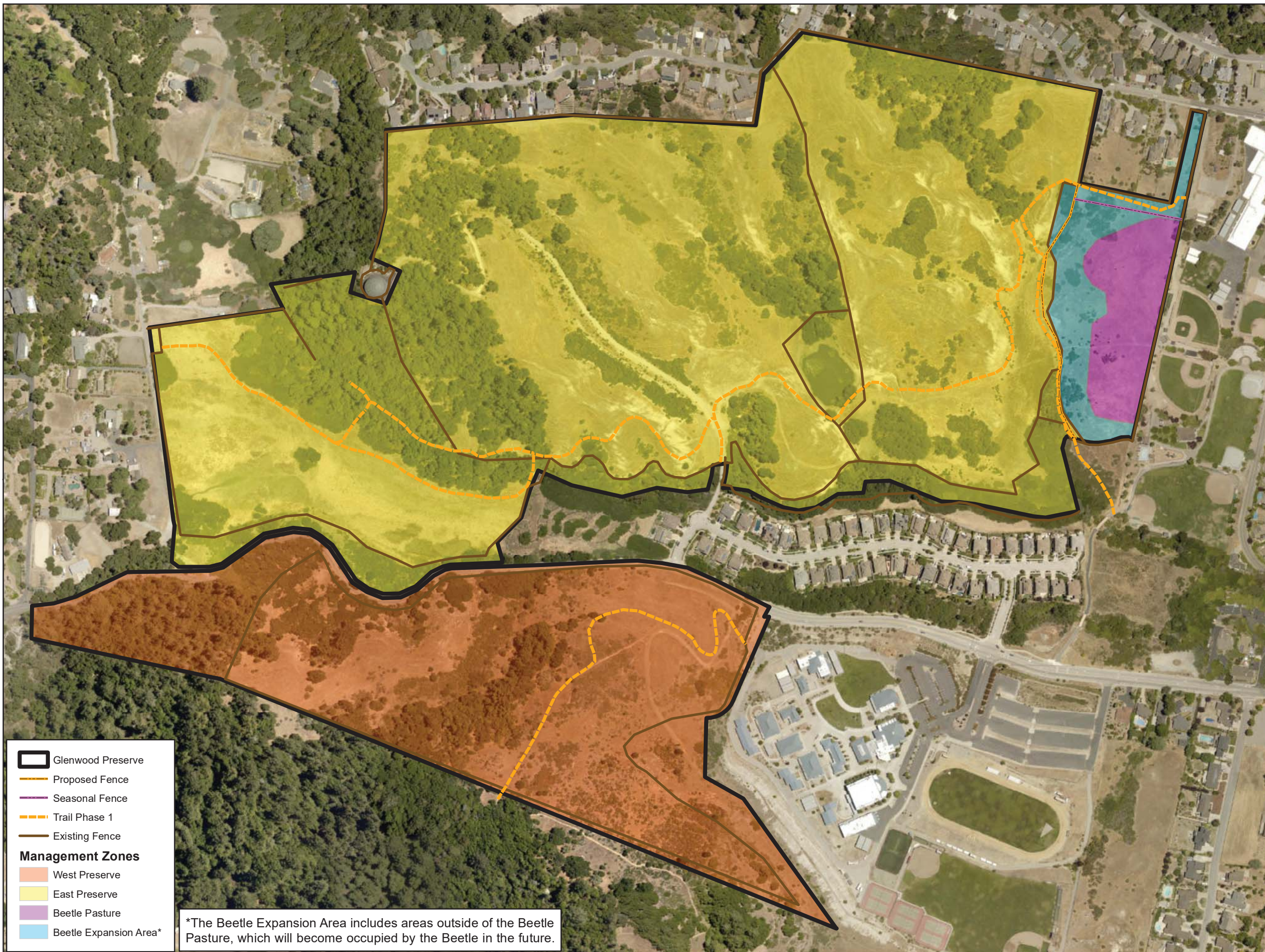
2.3.1.2 Species Description






The spineflower genus, *Chorizanthe*, is in the Polygonaceae (Buckwheat family). The overall appearance of Scotts Valley spineflower is of a low-growing herb that is stiff, hairy, and bright reddish in color. A short-lived annual, the plant is typically branched from the base with a spreading or prostrate habit, with rose-pink modified leaves surrounding a small white-rose flower. Flowers form dense, rounded heads, measuring approximately 0.5 inch in diameter. Each flower produces one seed enclosed in spines lending to the common name, spineflower.

The Scotts Valley spineflower germinates during the winter months and flowers from April through June, with seeds maturing by August. The seed cases shatter from the plant during the late summer and the spiny seed covering may facilitate seed dispersal, as the spiny bracts are expected to easily attach to animals and can therefore be transported. Black-tailed hares (*Lepus californicus*) and California ground squirrels (*Otospermophilus beecheyi*) have been observed to browse on other members of the *Chorizanthe* genus and other animals likely contribute to seed dispersal (USFWS 2002).

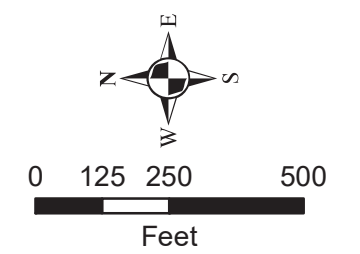
Glenwood Preserve
Scotts Valley,
California

Figure 8.
Management Zones



-  Glenwood Preserve
-  Proposed Fence
-  Seasonal Fence
-  Trail Phase 1
-  Existing Fence
- Management Zones**
-  West Preserve
-  East Preserve
-  Beetle Pasture
-  Beetle Expansion Area*

*The Beetle Expansion Area includes areas outside of the Beetle Pasture, which will become occupied by the Beetle in the future.



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Pollinators for other *Chorizanthe* species are varied and include leaf cutter bees, butterflies, flies and wasps. Where pollinator access is limited, seed production is lowered (USFWS 2002). It is expected that the Scotts Valley spineflower is protandrous, which is a reproductive strategy that facilitates cross-pollination. In species that are protandrous, the anthers (male) mature and shed pollen one to two days before the style (female) matures. This promotes cross-pollination by insects. If, however, cross-pollination does not occur within 1-2 days, self-pollination may occur. The relative importance of insect pollination and self-pollination to seed formation (and viable seed) is not known. However, studies of Monterey spineflower (*Chorizanthe pungens* var. *pungens*) have shown that seed viability was lower in areas with poor pollination access (USFWS 2002).

2.3.1.3 Habitat Characteristics and Use

Scotts Valley spineflower grows on gently sloping to nearly level areas where fine-textured shallow soils of the Bonnydoon series occur over Santa Cruz mudstone or Purisima sandstone outcrops in Scotts Valley. Some of these areas have bedrock intermixed with scree and/or scree intermixed with a thin soil layer (USFWS 2002).

Scotts Valley spineflower habitat is typically isolated rock outcrops or thin soils surrounded by non-native annual grassland on deeper soils. Rock outcrop or thin soil habitat is typically sparsely vegetated and composed of native wildflowers and low-growing grasses. Many of the areas support lichen and mosses, indicating that the areas have high seasonal soil moisture. It is postulated that the Polo Ground and Glenwood Units historically supported native grasslands, wherein the Scotts Valley spineflower (and associated wildflower species) grew on the rock outcrops and in openings amid the perennial bunch grasses (USFWS 2002).

2.3.1.4 Occurrence in the Glenwood Open Space Preserve

The Glenwood Open Space Preserve historically supported 17 colonies of Scotts Valley spineflower (data from 1992). In the surveys from 2004 through 2010), plants were documented from ten of these colonies, and in 2015 survey it had dropped to 8 colonies. Scotts Valley spineflower occurs on south-facing slopes with sparse, low-growing vegetation. Two primary populations persist, one in the eastern portion of the Glenwood Open Space Preserve on thin soils and one in the western portion immediately north of Scotts Valley High School on a rock outcrop. Although additional apparent suitable habitat areas (i.e. areas apparently suitable for the species, yet not occupied) occur in the Glenwood Open Space Preserve, these areas have not been colonized by this species based on focused annual searches 2004 – 2010 and 2015.

As an annual species, the number and location of aboveground plants varies annually. These variations are due to several factors, such as the amount and timing of rainfall, soil and air temperature, soil conditions and the extent and condition of the soil seedbank. Population data for the Glenwood Open Space Preserve have been collected in 1992, 2004 – 2010, and 2015. The largest population is in the western portion of the Glenwood Open Space Preserve. While there are larger areas of suitable soils on the eastern portion, fewer individuals have been observed in this area (Table 4). Refer to Figure 3 for locations of special-status, sensitive and listed species within the Glenwood Open Space Preserve.

Table 4. Scotts Valley Spineflower Population Estimates and Census 1992, 2004 – 2010, and 2015

Preserve	Estimate 1992	Census 2004	Census 2005	Census 2006	Census 2007	Census 2008	Census 2009	Census 2010	Census 2015
East	1,711 – 6,460	1,259	1,019	609	622	248	394	1189	860
West	22,601 – 51,510	23,978	27,099	10,033	10,579	9,203	16,375	28,710	40,030
TOTAL	28,500 – 55,000	25,237	28,118	10,642	11,201	9,451	16,375	29,899	40,890

2.3.1.5 Habitat Management

Grasslands within the Glenwood Open Space Preserve have a history of livestock grazing, dating to the settlement of the valley in the early 1800s. As recently as the late 1960s, the Glenwood Open Space Preserve was a local dairy operation. Since the 1980s, the areas west of Glenwood Drive have not been grazed, while horse grazing has continued on the east side of the Glenwood Drive for the last 20 years with 14 to 28 horses year-round. This grazing regime on the property is believed to have been an amenable management regime (or, at least, not deleterious) to the growth of the spineflower. Concurrent with construction of the Scotts Valley High School in 1999, a mowing management program was implemented for a population in SVUSD Preserve. In 2013, mowing was replaced by year-round grazing with two horses.

Reliable information on palatability and grazing effects on Scotts Valley spineflower was not found. At the Glenwood Open Space Preserve, there is low grazing use of its bare, grassy, or rocky slope habitat. Nonetheless, it is probably benefited by selective reduction of competing non-native annual grasses through grazing herbivory or another similar management method.

2.3.2 Scotts Valley Polygonum

2.3.2.1 Status and Distribution

Scotts Valley polygonum is listed as Federal Endangered, State Endangered, and CNPS Rank 1B.1 (USFWS 2003, CNPS 2009). It is limited in its occurrence to rock outcrops and thin soils within grasslands in the Scotts Valley region and is often associated with Scotts Valley spineflower.

Scotts Valley polygonum is closely associated with Scotts Valley spineflower; however, the polygonum is more restricted in numbers of individuals and colonies. Primary constituent elements and management considerations listed in the critical habitat for Scotts Valley polygonum are the same as those listed for Scotts Valley spineflower (Figure 6).

2.3.2.2 Species Description

The polygonum genus, *Polygonum*, is in the Polygonaceae (Buckwheat family). The overall appearance of Scotts Valley polygonum is of a low-growing herb that is small, erect with either a single stem or branched stems from near the base. A tap-rooted annual, the plant has linear leaves tipped with a singular spine. Flowers are white with two outer and three inner tepals, and are singular in bract axils.

The Scotts Valley polygonum germinates during the late fall or winter months and flowers from May to August. Seeds may range in number from a few dozen to two hundred. Seed predation and subsequent dispersal in other *Polygonum* species include black-tailed hares, pocket mice, ground squirrels, gray squirrels, striped skunks, opossums, and raccoons (USFWS, 2003). Pollinators for Scotts Valley polygonum are not known; however, a single visit by a sphecid wasp has been observed (USFWS 2003).

2.3.2.3 Habitat Characteristics and Use

Similar to Scotts Valley spineflower, Scotts Valley polygonum grows on gently sloping to nearly level areas where fine-textured shallow soils of the Bonnydoon series occur over Santa Cruz mudstone or Purisima sandstone outcrops in Scotts Valley. Some of these areas have bedrock intermixed with scree and/or scree intermixed with a thin soil layer (USFWS 2003).

Scotts Valley polygonum is typically found in the shallowest soils within isolated rock outcrop or thin soil habitat surrounded by non-native annual grassland. Scotts Valley spineflower is closely associated with the Scotts Valley polygonum; however, the spineflower may be found on slightly deeper soils with higher cover of competitive native and non-native herbaceous species (USFWS 2003).

2.3.2.4 Occurrence in the Glenwood Open Space Preserve

Similar to Scotts Valley spineflower, Scotts Valley polygonum is known from two sites in the northern end of Scotts Valley: the Glenwood Unit, and the Polo Ranch Unit. The Glenwood Unit encompasses the Glenwood Open Space Preserve, where the Scotts Valley polygonum has not been observed, and the SVUSD Preserve, which supports the species. In 1998, Scotts Valley polygonum was recorded within six colonies comprised of approximately 3,400 individuals (CDFW 2009).

To date, annual surveys for Scotts Valley polygonum have yielded no observations within the Glenwood Open Space Preserve. Focused surveys have been conducted at the time of census counts for Scotts Valley spineflower, typically in late May or early June. Additional vegetation transect surveys in the Glenwood Open Space Preserve have yielded negative observations for the polygonum. Refer to Figure 3 for details on locations of special-status, sensitive and listed species within the Glenwood Open Space Preserve.

2.3.2.5 Habitat Management

Reliable information on palatability and grazing effects on Scotts Valley polygonum was not found. At the Glenwood Open Space Preserve, there is low grazing use of its potential grassy or rocky slope habitat. Nonetheless, it would probably be benefited by selective reduction of competing non-native annual grasses through grazing herbivory or another similar management method.

2.4 Other Sensitive Species and Habitats

2.4.1 Sensitive Wildlife Species

2.4.1.1 Opler's Longhorn Moth

Status and Distribution

Opler's longhorn moth is a former federal species of concern that was considered but rejected for listing in 1994. It currently is recognized as a special animal species by CDFW (CDFW 2015). The moth is endemic to grasslands where its larval food plant, cream cups (*Platystemon californicus*), grows. The Glenwood Open Space Preserve site supports the only known location of Opler's longhorn moth in Santa Cruz County. Furthermore, the Glenwood Open Space Preserve site is also unique because it is the only known location to support the species not characterized by serpentine grassland habitat.

In recent years Opler's longhorn moth has been recorded from sites extending along the west side of San Francisco Bay, Alameda County, Marin County, Sonoma County, Santa Cruz County, Santa Clara County, and the inner Coast Ranges (A. Launer, pers. comm., 1997, J. Powell, pers. comm., 1997 in USFWS 1998b). Field observations suggest that the dispersal scale for this moth is small, approximately hundreds of meters, thus limiting its ability to colonize new areas easily.

Species Description

Descriptions of the life history and early stages of this moth are incomplete. Opler's longhorn moth completes the active portions of its life cycle during the winter-spring wet season (Powell 1969). Adults fly, mate, and lay their eggs between mid-March and late April, although this timing varies depending on seasonal weather conditions. Eggs are deposited directly into the unopened flowers of the larval food plant, cream cups. A few weeks later, the larvae emerge after they have consumed the developing seeds. Larvae of related longhorn moths, whose life cycles are better understood, enter diapause (a period of suspended development during unfavorable environmental conditions) during the summer and re-emerge after the winter rains to continue feeding until they are large enough to pupate. Presumably, larvae of the Opler's longhorn moth follow a similar procedure. Adults visit the flowers of cream cups.

Habitat Characteristics and Use

Opler's longhorn moth was previously thought to occur only in areas of serpentine soil where its exclusive host plant is found. Areas underlain by serpentine or other low fertility soils often support higher densities of native forbs and grasses including cream cups. Therefore, the moth is found in close association with low fertility soils that support a sufficient density of cream cups.

Occurrence in the Glenwood Open Space Preserve

The Glenwood Open Space Preserve is the only known location of this species that is not associated with serpentine grassland. On the Glenwood Open Space Preserve, cream cups are found on north-facing slopes containing high cover of native perennial grasses and herbs. Surveys conducted in 1996 and 2000 found cream cups at seven locations within the Glenwood Open Space Preserve. Adults were observed only at the cream cup location on the north-facing hillside above the reservoir during both surveys. Between 2004 and 2009, monitoring of the moth has focused on adult counts during the flight season and shows variability between years (Table

5). Refer to Figure 3 for details on locations of special-status, sensitive and listed species within the Glenwood Open Space Preserve.

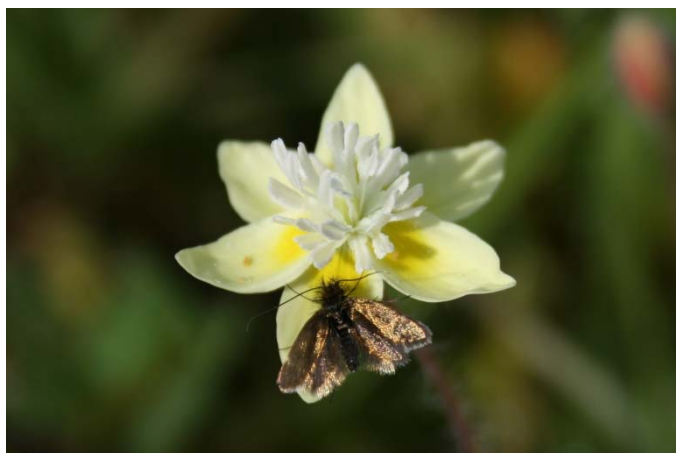
Table 5. Summary of Opler's Longhorn Moth Census for Monitoring Years 2004 – 2009 and 2015

2004	2005	2006	2007	2008	2009	2015
48	37	16	22	35	62	58

Habitat Management

The Opler's longhorn moth is dependent on cream cups. To maintain, and expand, the population of moths, populations of cream cups must be managed. Grazing is a suitable management tool to reduce competition from other plants and accumulated thatch that inhibit cream cup growth. However, grazing must not impact flowers in which moths lay eggs or moth larvae that diapause in leaf duff. In addition, some thatch accumulation is necessary for diapausing larvae to survive the dry season. Thus, grazing will be light or infrequent enough to maintain some thatch (the exact amount required is not known, and should be studied along with other habitat requirements). If grazing is not feasible, then some manual removal of ground cover and accumulated thatch should be done.

Cream cups germinate and grow best in sparse ground cover. Grazing helps reduce competition with cream cups from other herbaceous plants. Cattle are restricted from the area during the periods of larval activity, which begins with the emergence of cream cup flowers (usually March or April) when adult moths lay eggs in the flower buds. When the larvae emerge from eating the developing seeds, they presumably enter diapause in the duff at the base of the plants. Grazing continues to be restricted through the summer due to soil and pond habitat sensitivities, and the need to focus grazing elsewhere. Otherwise, during the time of diapause (all seasons except spring), cattle can graze the Santos Pond region until significant rains occur and saturated soils are vulnerable and until flowering and egg-laying becomes active again. Initial testing to compare fall and winter versus summer grazing found that winter to early spring grazing is preferred to benefit cream cups and minimize effects on soils.



Opler's longhorn moth.
Photo by Land Trust of
Santa Cruz County

2.4.1.2 Western pond turtle

Status and Distribution

Western pond turtle (*Emys marmorata*) has a NatureServe conservation status of G3G4 S3 (vulnerable) and is a CDFW Species of Special Concern. The historical range of the species extended from Washington or British Columbia to northern Baja California; many populations still exist, and human-made reservoirs and ponds now provide habitat throughout much of the range. The species is locally numerous, but distribution and abundance in the northern and southern parts of the range as well as the Central Valley have been reduced as a result of habitat loss and degradation, introduced species, and (locally) disease (NatureServe Explorer site accessed September 6, 2017).

Species Description

Western pond turtle is a small to medium-sized drab dark brown, olive brown or blackish turtle with a low un-keeled carapace. The shell length is 3.5 to 8.5 (8.9 to 21.6 cm) (Stebbins 2003). Hatchlings are approximately 1 inch (2.5 cm) in shell length. Most individuals feature a pattern of lines or spots radiating from the centers of the scutes. The plastron (under-shell) lacks hinges, and has six pairs of shields, which can be cream or yellowish in color with large dark brown markings, or unmarked. The legs have black speckling and may show cream to yellowish coloring. The head usually has a black network or spots and may show cream to yellowish coloring. Males usually have a light throat with no markings, a low-domed carapace (a flatter shell), and a concave plastron. Females usually have a throat with dark markings, a high-domed carapace (a taller shell), and a flat or convex plastron which tends to be more heavily patterned than that of the male (California Herps, accessed 9-5-2017 <http://www.californiaherps.com/turtles/pages/a.marmorata.html#originaldescription>)

Habitat Characteristics and Use

Western pond turtles nest in terrestrial habitats, and are vulnerable to predation or injury while traveling between upland nest sites and aquatic habitat. Hatchlings are particularly vulnerable to predation. In aquatic habitat, individuals often use floating logs and overhanging banks for basking and thermal regulation. As per a Study by Rosenberg (2013), hatchlings detected in water were always within 3.3 ft. (1 m) of shore and in areas with dense submerged vegetation and/or woody debris.

Western pond turtle populations appear to often be limited by predation. Predation by bullfrogs and non-native fishes such as largemouth and smallmouth bass may have significant effects on populations. Competition with non-native red-eared sliders (turtles) for basking sites may also have population effects (Rosenberg et al 2009).

Occurrence at Glenwood Preserve

Western pond turtles are likely to occur at the Glenwood Preserve in Santos Pond, although this is not confirmed. This region of Santa Cruz County is in the overlap zone of the northern western pond turtle and southern western pond turtle populations, which some authorities consider separate species (California Herps 2017).

Abundant terrestrial habitat surrounds the pond. Some of these areas include soft soils or thick duff that may be suitable for turtle nesting. The pond has little vegetation along its margins, and little evidence of submerged woody debris, such as branching tree limbs, that would shelter young

turtles. The pond has no floating logs. Santos Pond also hosts non-native turtle species, including red eared sliders, and abundant populations of aquatic predators, including bass and bullfrogs. Raccoons and coyotes have been observed in the area. As such, western pond turtles present in the area may not be successfully reproducing.

Habitat management

The following measures are recommended to improve habitat quality for western pond turtle:

- Mowing and disking around the pond should be minimized to avoid potential impacts to the species.
- Nearshore vegetation and woody debris should be protected and enhanced to provide shelter for young turtles, but pond margins facing south and west should be left free from tall vegetation to support basking habitat.
- To the extent to which it is consistent with other management priorities, logs that are 8 to 12 inches in diameter should be anchored near the middle of the pond as basking sties.
- Predatory mammals may be attracted to the pond by poor trash management. Wildlife proof trash cans will be necessary if trashcans are provided, to ensure raccoons and coyotes do not become habituated to the site.
- To the extent to which it is consistent with other management priorities, invasive species control of non-native predators and competitors may be performed. Invasive species control shall be performed in a humane manner, preferably following methods that involve permitted relocation if possible, for example, by working with California Turtle & Tortoise Club (Silicon Valley Chapter) or similar agency or facility, to return non-native turtles to captivity. Management of these species by euthanasia should only be initiated if it is part of a comprehensive plan that is highly likely to successfully eradicate the species from the site, sustain the eradication for at least 10 years, and which is supported by a sufficient commitment of resources to ensure long-term success. If euthanasia of wildlife is required, procedures shall adhere to the American Veterinary Medical Association Guidelines for Euthanasia of Animals.

2.4.2 Sensitive Plant Species

2.4.2.1 Santa Cruz Clover

Status and Distribution

Santa Cruz clover (*Trifolium buckwestiorum*) is listed in CNPS's California Rare Plant Rank as 1B.1.

It grows around the Monterey Bay area and at a few locations in western Sonoma and Mendocino counties.

Species Description

According to Calflora, "It is an annual herb growing upright or decumbent in form, with hairless green or reddish herbage. The leaves are made up of finely toothed, oval shaped leaflets up to 1.5 centimeters long and bristle-tipped stipules. The inflorescence is a head of flowers roughly a centimeter wide, the flowers held in a bowl-like involucre of wide, jagged-toothed bracts. Each flower has a calyx of sepals that narrow into fine bristles and a pink corolla under one centimeter long." Flowering occurs from May to June.

Habitat Characteristics and Use

It grows in grassy or disturbed areas below 2,300 feet.

Occurrence in the Glenwood Open Space Preserve

One population was mapped in 2008 (WRA 2009), but there was no population estimate associated with the site. The site was visited in March and April 2015 and through June in 2017, but no plants were detected. This species was not included in the 1992 surveys nor in the Open Space Management Plan (WRA 2003). Local clover expert, Randall Morgan, said that it is unlikely to occur on the property (R. Morgan, pers. comm., 2017). Refer to Figure 3 for details on locations of special-status, sensitive and listed species within the Glenwood Open Space Preserve.

Habitat Management

Although no plants were detected in 2015 or 2017, the site conditions were suitable for the species, which grows in coastal prairie habitat. There may have been plants that were not detected or the survey dates may have missed the optimal period for detection. Current management practices are appropriate for this species, therefore continued grazing is recommended. Annual surveys should be conducted to detect plants.

2.4.2.2 Pacific Grove Clover

Status and Distribution

At one time considered part of the species *Trifolium variegatum*, recent taxonomic evidence and publications recognize *Trifolium polyodon* as a distinct species (Baldwin et al. 2012) listed in CNPS's California Rare Plant Rank as 1B.1. Both species co-occur on Glenwood Open Space Preserve. There is no critical habitat designation for this species as it is not an endangered/threatened species.

The Pacific Grove clover grows on the Monterey Peninsula and in Santa Cruz County.

Species Description

The plants are annuals with spreading stems. The leaflets are 5-20 mm, widely elliptic to obovate with rounded tips. The flowers are in a head-like inflorescence with an involucre that is cut to the middle. The corolla is 8-10 mm, pink to white with a purple tip. It flowers from April to June.

Al Keuter and Randall Morgan collected a type series to describe the local variety as *T. polyodon* var. *oligodon*. This was not done earlier because the species were not well understood taxonomically.

Habitat Characteristics and Use

This species is known from moist meadows, closed-cone coniferous forests, stream sides, and mesic sites in coastal prairie habitat on the coastal side of the Central Coast Ranges below 1000 feet (Calflora 2015, eFlora 2015, Baldwin et al. 2012, Morgan et al. 2005).

Occurrence in the Glenwood Open Space Preserve

In 2017, *T. polyodon* and variegated clover (*Trifolium variegatum*, a common species closely related to *T. polyodon*) were confirmed by Randall Morgan. They both grew along the trail that

crosses the wet meadow in Tabor Pasture. *T. variegatum* flowered earlier than *T. polyodon*, though flowering time overlapped some. Refer to Figure 3 for details on locations of special-status, sensitive and listed species within the Glenwood Open Space Preserve.

Habitat Management

Pennyroyal has spread throughout the wet meadow in southwest Tabor Pasture and is the primary threat to native plants. Clovers are currently only seen in the trail that is disturbed sufficiently to reduce the competition from the pennyroyal. Given the extensive rhizomatous root structure of pennyroyal and its occurrence in the wetland amongst many desirable plants, typical management techniques (grazing, pulling, and herbicide) are ineffective or difficult on a large scale. However, small-scale treatments of pennyroyal in the immediate area of this species may help the rare plant populations persist. Ultimately, the goal should be to investigate or develop management strategies to significantly reduce the pennyroyal population.

2.4.2.3 Choris's Popcornflower and Hickman's Popcornflower

Status and Distribution

Choris's popcornflower (*Plagiobothrys chorisianus* var. *chorisianus*) and Hickman's popcornflower (*P. c.* var. *hickmanii*) are listed in CNPS's California Rare Plant Rank as 1B.2 and 4.2, respectively. These taxa have overlapping distribution, with documented records of both occurring along the central coast from San Francisco to Monterey County.

Species Description

Both of these popcornflowers are fibrous-rooted annuals with several decumbent to prostrate stems. Flowers are white with yellow "pillows" located at the union of the fused tube (lower) and free petals (upper). According to Jepson eFlora, Choris's popcornflower flowers March through June, while Hickman's popcornflower flowers April through July.

Primary diagnostic discrepancies between taxa include frequent erect habit in Choris's popcornflower; lower leaves fused in Choris's popcornflower; stem branching in upper axils in Choris's popcornflower; pedicel length greater than calyx in Choris's popcornflower; and a larger corolla limb (6-10 mm diameter) in Choris's popcornflower.

Habitat Characteristics and Use

Choris's popcornflower grows in grassy, moist places, ephemeral drainages, coastal scrub, and chaparral below 2,000 feet. Hickman's popcornflower is limited in its occurrence in seasonal wetlands, vernal pools, swales, and depressions underlain by heavy clay soils from San Francisco County to Monterey County below 600 feet (Calflora 2012, CCH 2012).

Occurrence in the Glenwood Open Space Preserve

Approximately 560 individuals of Choris's popcornflower were observed in the Glenwood Open Space Preserve during surveys conducted in 2015 (Biotic Resources Group 2015). Within wetland meadow habitat, eight separate patches were observed. This variety was not found in 2017, only var. *hickmanii* was seen.

Within the Glenwood Open Space Preserve, Hickman's popcornflower grows in wetlands in the Tabor Pasture. The *Plagiobothrys chorisianus* was first identified as var. *hickmanii* in 2017. Prior

to this, all surveys associated with the Glenwood project recorded the variety as *chorisianus*. Initially, it was assumed that the previous surveys had misidentified the plant, but photos confirm that var. *chorisianus* was present in earlier surveys. Additionally, specimens collected in 2003 were reviewed by WRA botanists in September 2017 with corollas measuring 5.5-7 mm and elongated pedicels suggesting a trend toward Choris's popcornflower. Evidently, both varieties grow at this site, however no plants were found in 2017 with the characteristics of var. *chorisianus*. Refer to Figure 3 for details on locations of special-status, sensitive and listed species within the Glenwood Open Space Preserve.

Habitat Management

Although the invasive pennyroyal has spread throughout the wet meadow, the populations of *Plagiobothrys chorisianus* numbers were stable at 500 through the 2015 census. Botanists were unaware that both varieties grew at the site, so all *P. chorisianus* were assumed to be var. *chorisianus*. In 2017, there were no Choris's popcornflower found and the Hickman's popcornflower population was probably less than 50 plants, almost entirely within the trail that crosses the wet meadow. Sections of pennyroyal should be removed adjacent to the trail to allow the two varieties to expand.

2.4.2.4 Mount Diablo Cottonweed

Status and Distribution

Mount Diablo cottonweed (*Micropus amphibolus*) has a CNPS California Rare Plant Rank 3.2 (CNPS 2015), but does not have a Federal or State listing. The species occurs in the Coast Ranges from Lake County south to Monterey County (Calflora 2015, CCH 2015). There is no critical habitat designation for this species.

Species Description

The overall appearance of Mount Diablo cottonweed is a very diminutive, low-growing forb typically no taller than 10 cm, with one primary stem. A shallowly tap-rooted annual, this species has short linear to lanceolate leaves, with cobwebby to tomentose hairs throughout the plant. Flowers are diminutive and encased in swollen phyllaries covered in tomentose hairs.

Mount Diablo cottonweed germinates during the winter months, flowers from March to May, and sets seed in late spring to early summer.

Habitat Characteristics and Use

It is limited to relatively bare areas on shallow, rocky soils on ridgelines, hillslopes, trails, and roadsides in foothill grassland, open scrub, and open woodland habitats from 100 – 3,000 feet elevation.

Occurrence in the Glenwood Open Space Preserve

Within the Glenwood Open Space Preserve, Mount Diablo cottonweed is located on several ridgelines underlain by shallow, rocky mudstone soils in the Pond and Tabor Pastures. In the original survey of 1992, 51 populations were found with an estimated total of 100,000 plants. In 2015, 25 colonies were found for a total of 4-5,000 plants (Biotic Resources Group 2015). Refer to Figure 3 for details on locations of special-status, sensitive and listed species within the Glenwood Open Space Preserve.

Habitat Management

Reliable information on palatability and grazing effects on Mount Diablo cottonweed was not found. At Glenwood Open Space Preserve, there is low grazing use of its bare, grassy, or rocky slope habitat. Nonetheless, it is probably benefited by selective reduction of competing non-native annual grasses through grazing herbivory or another similar management method. It is recommended that grazing continue with a goal of keeping competition from herbaceous growth low. In addition to grazing to reduce competition, invasive weeds should be removed where they compete with Mount Diablo cottonweed.

2.4.2.5 Grassland Microseris

Status and Distribution

Grassland microseris (*Stebbinsoseris heterocarpa*) has neither a federal nor state listing, nor a CNPS ranking. The Santa Cruz CNPS Chapter recognizes grassland microseris as locally rare, having few documented occurrences in the county (Morgan et al. 2005). There is no critical habitat designation for this species as it is not a listed species. The plant grows in the coastal mountains from northern Mexico to Marin County.

Species Description

Per Jepson eFlora, the plant is 8-60 cm tall with erect basal leaves 5-35 cm long. The flower ligules are yellow or white. It flowers from April to June.

Habitat Characteristics and Use

This species is known from valley and coastal grasslands underlain by rocky to clay soils (Calflora 2015, Baldwin et al. 2012). It grows below 5,500 feet.

Occurrence in the Glenwood Open Space Preserve

Grassland microseris once occurred on the Glenwood Open Space Preserve, but there are no confirmed occurrences during the baseline studies, monitoring period, or other records (CCH 2015, Calflora 2015). Randall Morgan (R. Morgan, pers. comm., 2017) has seen it in the vicinity of the cream cups near Santos Pond.

The census conducted in 2015 was the first time that the species was included. Prior to this, the botanists were unaware of the local concern for the species. No plants were found in 2015. Refer to Figure 3 for details on locations of special-status, sensitive and listed species within the Glenwood Open Space Preserve.

Habitat Management

This species should benefit from grazing to reduce competition.

2.4.2.6 California Sandwort

Status and Distribution

California sandwort (*Minuartia californica*) does not have a special-status, but is considered locally rare by Santa Cruz CNPS Chapter.

This species grows throughout much of California.

Species Description

California sandwort is a delicate, branching annual 2-12 cm tall. The leaves are small at 2-5 mm long. It has 5-part, white flowers. The plant flowers from February to April.

Per Randall Morgan (pers. comm. 2017), the plants in Scotts Valley are an unpublished new variety that is endemic to Polo Ranch and Scotts Valley High School Preserve and near extinction.

Habitat Characteristics and Use

It grows on gravelly, sandy slopes, grassy ridges, chaparral, serpentine or not, below 4,500 feet.

Occurrence in the Glenwood Open Space Preserve

California sandwort has not been documented on Glenwood Open Space Preserve, but may grow there. Searches in 2017 found its close relative *M. douglasii*, but not the smaller *M. californica*. The plant, furthermore, was not found at its known location at the high school in 2017. Refer to Figure 3 for details on locations of special-status, sensitive and listed species within the Glenwood Open Space Preserve.

Habitat Management

Continue grazing will reduce competition from annual grasses.

2.4.2.7 Gray's Clover

Status and Distribution

Gray's clover (*Trifolium grayi* [*T. barbigerum* var. *andrewsii*]) has no CNPS California Rare Plant Rank, or federal or state listing. This species was considered but rejected by the state CNPS, but is considered sensitive by the Santa Cruz CNPS Chapter.

It grows along the coast from Mendocino to San Luis Obispo counties. There is no critical habitat designation for this species.

Species Description

The overall appearance of Gray's clover is a very low-growing forb with few to several stems. A shallowly tap-rooted annual, this species has compound leaves, with short hairs. Inflorescences are an involucred head with small purple and white-tipped flowers. Gray's clover germinates during the late fall and winter months, flowers from April to June, and sets seed in late spring and early summer. The coastal plants are more robust than inland individuals. In 2017, Al Keuter and Randall Morgan collected a type series to describe the Scotts Valley variety of Gray's clover.

Habitat Characteristics and Use

Gray's clover is limited to mesic sites in wet meadows, foothill slopes, pine woodlands, mixed evergreen forests, and redwood forests in the Coast Ranges and Sierra Foothills from Mendocino County south to San Luis Obispo County (Calflora 2015, Baldwin et al. 2012, CCH 2015).

Occurrence in the Glenwood Open Space Preserve

Within the Glenwood Open Space Preserve, Gray's clover is located on north-facing slopes in the Tabor & Beetle Pastures. Surveys conducted in 1992 found 66 stands of Gray's clover with an overall estimate of 77,000 individuals. Monitoring from 2003 to 2008 mapped between zero and five representative stands; however, monitoring efforts conducted by WRA in this period focused on several sensitive habitats and plants considered rare, statewide. Locally rare plants, such as Gray's clover, were incidentally monitored when time allowed, but there were no focused efforts to monitor the populations of Gray's clover. In 2015, no plants were found (Biotic Resources Group 2015). In 2017, however, the species rebounded with nine stands mapped in the Beetle Pasture and two stands mapped in the Tabor Pasture. More were present, but not mapped. Refer to Figure 3 for details on locations of special-status, sensitive and listed species within the Glenwood Open Space Preserve.

Habitat Management

Reliable information on palatability and grazing effects on Gray's clover was not found. However, another species in its genus, *Trifolium repens*, is highly nutritious to cattle. Therefore, this and other clover species might be vulnerable to livestock herbivory or trampling. The clovers at the Glenwood Open Space Preserve persisted for many years with horse grazing, indicating that the plants can withstand grazing and may benefit from it. At the Glenwood Open Space Preserve, there is low grazing use of its grassy hillside habitat. The grazing, or another similar management method, probably benefits the clover by selective reduction of competing non-native annual grasses.

2.4.2.8 Common Lomatium

Status and Distribution

Common lomatium (*Lomatium utriculatum*) has neither a federal nor state listing, nor a CNPS ranking. It grows throughout most of California. In Santa Cruz County, however, except for a 1935 collection from the Castle Rock State Park area, this species' only known sites are on the Glenwood Open Space Preserve. It is, therefore, important to track these occurrences.

This species is known from coastal sage scrub, sagebrush scrub, yellow pine forest, foothill woodland, chaparral, and valley grassland communities (Calflora 2017). There is no critical habitat designation for this species as it is not an endangered/threatened species.

Species Description

Jepson eFlora describes the plant as 1-5 dm tall with pinnately dissected leaves and a conspicuous cauline leaf petiole that sheaths throughout. The flowers have yellow corollas. Flowering occurs from February to May.

Habitat Characteristics and Use

The species grows in open grassy slopes, meadows, and woodland from 150 to 5,000 feet.

Occurrence in the Glenwood Open Space Preserve

It was known by Randall Morgan to have occurred in the grassland upstream from Santos Pond (R. Morgan, pers. comm., 2017). It was found at a second location in the northern end of the

Pond Pasture in 2017. This species was not included in the 2015 census. Refer to Figure 3 for details on locations of special-status, sensitive and listed species within the Glenwood Open Space Preserve.

Habitat Management

No special management is recommended for this species. The known locations should be visited annually starting in early April to track its persistence.

2.4.2.9 Leptosiphon (formerly Linanthus)

Status and Distribution

There are members of the genus *Leptosiphon* (*Leptosiphon* = *Linthanthus*) that are not well understood taxonomically. *Leptosiphon* does not have a federal or state listing, or CNPS ranking, however the Santa Cruz CNPS chapter considers this genus locally rare. Because baseline studies did not distinguish between small-flowered (*L. parviflorus*) and others of the genus, in the future all members of this genus should be confirmed as to their species. Randall Morgan (outlined by Aaron Schusteff on CalPhotos 2015) discovered that the *L. parviflorus* on the Glenwood Open Space Preserve should be called *L. longitubus* ssp. *longitubus*. There is no critical habitat designation for these species as they are not endangered/threatened species.

Species Description

According to Jepson eFlora, *L. parviflorus* is a hairy annual 4 – 40 cm tall. The inflorescence is a head of flowers that close at night. The corolla forms a long tube opening at the top to lobes that are 4-8mm long. The corollas vary greatly in color, thereby giving the plant its common name of variegated leptosiphon.

The species that is likely to be identified for Glenwood Open Space Preserve is *L. longitubus* ssp. *longitubus*, which differs in the following characteristics:

- the corolla tube is relatively long and uniform in diameter (not tapering above),
- the throat is entirely yellow,
- there is a pair of red spots at the base of each lobe, and
- stamens are closely grouped (attached deeper in the throat and less spreading).

Additionally, *L. longitubus* ssp. *longitubus* grows in the relatively northern and coastal region in grassland habitat.

Habitat Characteristics and Use

Leptosiphon species are known from openings or partial shade of oak woodlands, chaparral, and valley and coastal grasslands throughout cismontane California except for most the Central Valley (CCH 2015, eFlora 2015, Calflora 2015, Baldwin et al. 2012).

Occurrence in the Glenwood Open Space Preserve

Variable linanthus (*L. parviflorus*) was historically and has recently been reported in the Glenwood Open Space Preserve (CCH 2015, EIR plant list). In 2017, three populations were mapped east of Glenwood Drive, north of the water district road. Refer to Figure 3 for details on locations of special-status, sensitive and listed species within the Glenwood Open Space Preserve.

Habitat Management

Concerted efforts to map members of the *Leptosiphon* have not been conducted within the Glenwood Open Space Preserve because these species were not well understood taxonomically at the time of surveys/monitoring and all were considered common at the statewide level. The Glenwood Open Space Preserve has habitat that supports *Leptosiphon* species. The current management with grazing should be beneficial for this species.

2.4.2.10 Purple Owl's Clover

Status and Distribution

Purple owl's clover (*Castilleja exserta* ssp. *exserta*) does not have a special-status listing but is considered locally rare by the Santa Cruz CNPS Chapter.

It grows in coastal California, primarily from San Diego to Sonoma counties, and in the Central Valley.

Randall Morgan (pers. comm. 2017) reported that this species is has only been found at Glenwood and Sandhills within the County. Calflora does show records outside that area.

Species Description

Purple owl's clover is an annual that grows 10-45 cm tall. The leaves have 509 lobes that are threadlike. The inflorescence is 2-20 cm tall and 2-4 cm wide of bracts and flowers with colors of white, pale yellow, rose, and purple. Flowering occurs from March to May.

Habitat Characteristics and Use

It grows in open fields and grasslands below 4,800 feet.

Occurrence in the Glenwood Open Space Preserve

This species was not included in the regular surveys, but Randall Morgan (pers. comm. 2017) was aware of a population of this species in the northeast area of Tabor Pasture. That population was confirmed in 2017. Refer to Figure 3 for details on locations of special-status, sensitive and listed species within the Glenwood Open Space Preserve.

Habitat Management

Current management practices are appropriate for this species, therefore continued grazing is recommended. Annual surveys should be conducted to detect plants.

2.4.2.11 Indian Clover

Status and Distribution

Indian clover (*Trifolium albopurpureum*) does not have a special-status listing, but is considered locally rare by the Santa Cruz CNPS Chapter.

It grows in California's coastal counties from Mendocino south and in the Central Valley.

Species Description

This is a hairy, annual with a stem that can be decumbent to erect. The inflorescence is a spike that is 5-20 mm wide with purple and white flowers. Flowering occurs from March to June.

Habitat Characteristics and Use

It grows in coastal dunes, grassland, wet meadows, open slopes, oak chaparral, Pine woodland, roadsides and disturbed areas below 6,300 feet.

Occurrence in the Glenwood Open Space Preserve

This species was not known to occur on Glenwood Open Space Preserve until it was noticed in 2017. It was found on the edge of grassland north of the water district road. Refer to Figure 3 for details on locations of special-status, sensitive and listed species within the Glenwood Open Space Preserve.

Habitat Management

This grassland species does not need any special management.

2.4.2.12 Dwarf Sack Clover

Status and Distribution

Dwarf sack clover (*Trifolium depauperatum* var. *depauperatum*) does not have a special-status listing but is considered locally rare by the Santa Cruz CNPS Chapter. Thomas flora calls this rare in Santa Cruz Mountains region.

It grows in northern California in the Central Valley and the Coast Ranges.

Species Description

Dwarf sack clover is a small, glabrous annual. The leaflets are generally truncate with occasional notches at the tips. The inflorescence is a head of three to many flowers that are pink to purple with white tips. The banner inflates when it matures in to a fruit. Flowering occurs from March to May.

Habitat Characteristics and Use

This taxa is known from wet meadows, grassland, roadsides, and open vernal mesic areas underlain by heavy soils, at elevations below 1,800 feet.

Occurrence in the Glenwood Open Space Preserve

Randall Morgan (pers. comm. 2017) never saw it in more than a couple of sites at Glenwood Open Space Preserve. In 2017, however, it was common. Refer to Figure 3 for details on locations of special-status, sensitive and listed species within the Glenwood Open Space Preserve.

Habitat Management

Current management practices are appropriate for this species, therefore continued grazing is recommended. Annual surveys should be conducted to detect populations.

2.4.2.13 Cream Cups

Status and Distribution

Cream cups (*Platystemon californicus*) do not have any rare plant status. It is, however, the host plant for the Opler's longhorn moth and for this reason, it is surveyed on the Glenwood Open Space Preserve.

This species grows in most of California.

Species Description

Jepson eFlora describes the plant as a 3-30 cm tall hairy annual. It has basal leaves. Each stalk leads to a single nodding bud that blooms as a cream/yellow-colored flower. Flowering occurs from March to May.

Habitat Characteristics and Use

The species grows in open grassland, sandy soil and burns below 3,000 feet.

Occurrence in the Glenwood Open Space Preserve

Six colonies of this species were observed in grasslands east of Glenwood Drive in 2015 (Biotic Resources Group 2015). The populations range from a couple plants to about 100. Refer to Figure 3 for details on locations of special-status, sensitive and listed species within the Glenwood Open Space Preserve.

The south bank of Santos Pond hosts the largest population of cream cups on the property. In 2017, the combination of grazing that reduced the thatch and a very wet year produced the largest number seen in years. Opler's longhorn moth has only been seen at this pond location.

Habitat Management

Management of cream cups is described above under Opler's longhorn moth (Section 2.4.1.1).

2.4.3 Sensitive Habitats and Natural Communities

The Glenwood Open Space Preserve contains several vegetation types identified by CDFW as sensitive natural communities. Native grasslands and wildflower fields are general structural vegetation types that encompass many specific floristic vegetation types (alliances) that occur throughout California, particularly in the Coast Ranges and Sierra Foothills. Native grasslands have diminished in extent by upwards of 90 percent, largely due to over-grazing, development, type conversion, and the spread of non-native species, particularly annual grasses. Grazing management is frequently utilized to reduce competitive pressure from non-native annual grass species. Remnant stands are often located in isolated terrain or unique soil types (e.g. mudstone, serpentine) that limit the growth and expansion of non-native grasses. Native species diversity and density are typically high in these habitats; however, non-native grasses are usually a characteristic, sometimes dominant, component of these landscapes. Within the Glenwood Open

Space Preserve, native grasslands primarily composed of purple needlegrass grasslands (*Stipa pulchra* Herbaceous Alliance, (Sawyer et al. 2009)) and California oat grass (*Danthonia californica* Herbaceous Alliance, (Sawyer et al. 2009)) occur on south- and west-facing slopes and ridgelines underlain by shallow, rocky soils derived from mudstone. Substantial cover of non-native annual grasses persists within these communities; however, native grasses comprise a characteristic to subdominant component, with a relative cover of 25 percent or greater.

At Glenwood Open Space Preserve, herbaceous plant communities that are dominated by sensitive and/or common native forb (broadleaf) species can be classified as wildflower fields under the Holland classification system (1986). Wildflower fields are located on ridgelines, slopes and some flats where thin soils over shallow sandstone or mudstone bedrock reduce competition from non-native annual grasses. This generalized community is typically dominated or characterized by one or more native forbs, which shift annually dependent on climatic conditions (e.g. lupines dominate in years of sustained early winter drought followed by moderate to heavy rainfall in the late winter/early spring [Knops and Barthel 1996]). Common native forb species include rusty popcornflower, sky lupine, miniature lupine, purple owl's clover, dense flower owl's clover, cream cups, and California goldfields. Sensitive species include Scotts Valley spineflower, Choris's popcornflower, Gray's clover, Mount Diablo cottonweed, Pacific Grove clover, leptosiphon, and grassland microseris.

2.4.3.1 Habitat Management

Native grasslands respond positively to grazing that is directed to reduce competition from non-native grasses and forbs. This is achieved by adjusting the number of animals and the timing of their grazing. The Rangeland Ecologist would monitor the grazing closely and provide direction to the Grazing Operator to achieve these goals.

Rare species (not including OTB, and Scotts Valley spineflower, spineflower or Scotts Valley polygonum) are ranked in Table 6 below in order of legal status and local importance. Information is also included on the species' required conditions, research needs, and management recommendations.

Table 6. Rare Species Information

Common Name	Latin Name	Status	Local Importance	Most Recent Status on Glenwood	Required Conditions	Research Needs	Management Recommendation	Comments
Santa Cruz clover	<i>Trifolium buckwestiorum</i>	CNPS Rank 1B.1	Most records are in Santa Cruz County	None found	Coastal prairie	Determine if population is extant	Graze to reduce herbaceous plant competition.	Population mapped in 2008, but no size estimated. Randy Morgan is doubtful that it grows at Glenwood (R. Morgan, pers. comm., 2017)
Pacific Grove clover	<i>Trifolium polyodon</i> var. <i>oligodon</i>	CNPS Rank 1B.1	The swale at Glenwood was designated the type locality, and first discovery site, of this rare northern variety	2015: Not surveyed 2017: <i>T. variegatum</i> and <i>T. polyodon</i> var. <i>oligodon</i> confirmed.	Usually wetland, but occasionally in non-wetland. Also coastal prairie.	What control measures for pennyroyal are feasible and will not harm TRPO	Graze to reduce competition Census to document species and populations	<i>T. variegatum</i> and <i>T. polyodon</i> . grow at this site, with the former blooming first. 1996 record of <i>T. polyodon</i> from N. Tabor Pasture (Morgan, R.)
Choris' popcornflower Hickman's popcornflower	<i>Plagiobothrys chorisianus</i> var. <i>chorisianus</i> <i>Plagiobothrys chorisianus</i> var. <i>hickmanii</i>	CNPS Rank 1B.2 CNPS Rank 4.2		2015: 560 individuals (Choris's) 2017: ~10 plants (Hickman's)	Wetland	What control measures for pennyroyal are feasible and will not harm PLCH	Reduce pennyroyal cover	Hickman variety known by Randall Morgan to exist, but first identified in plan in 2017. Plants were almost completely restricted to the trail zone.
Mt. Diablo cottonweed	<i>Micropus amphibolus</i>	CNPS Rank 3.2		2015: 25 populations, 4-5,000 plants	Sparsely vegetated slopes of mudstone soils	None	Graze to reduce competition	The OSMP recommends closing grazing periodically to allow plants to grow and reproduce
Grassland microseris (aka grassland silverpuffs)	<i>Stebbinsoseris heterocarpa</i>	None	Santa Cruz CNPS: locally rare	2015: Not reported	Grasslands with underlain rocky to clay soils	None	Census to document species and populations	Not surveyed prior to 2015. The species' range is from Marin County to northern Mexico, but there are few occurrences in Santa Cruz County.

Common Name	Latin Name	Status	Local Importance	Most Recent Status on Glenwood	Required Conditions	Research Needs	Management Recommendation	Comments
California sandwort (endemic variety)	<i>Minuartia californica</i>	None	Santa Cruz CNPS: Rare	2015: Not surveyed 2017: Surveyed, not found	Sparsely vegetated soil	None	Graze to reduce competition Watch for species during April	Per Randall Morgan (pers. comm. 2017), this unpublished new variety is endemic to Polo Ranch and SVHS Preserve and near extinction. Not found at SVHS in 2017.
Gray's clover	<i>Trifolium grayi</i>	None	Santa Cruz CNPS Sensitive	2015: None found 2017: Many pops seen.	Grassland, especially north-facing.	None	Graze to reduce competition	Populations of this plant crashed from 77,000 (66 populations) in 1992 to no plants in 2015. Surveys from 2003-8 found between 0 and 5 populations. It rebounded in 2017, not all populations were documented, but it was seen frequently, including 9 populations in the Beetle Pasture. A type series was taken in 2017 to describe the Scotts Valley race.
Common lomatium	<i>Lomatium utriculatum</i>	None	Santa Cruz CNPS: Rare	2015: Not surveyed 2017: 1 site documented	Grassland	None	Graze to reduce competition	Currently, the only known sites for this species in the county are at Glenwood Preserve and a 1935 collection from Castle Rock

Common Name	Latin Name	Status	Local Importance	Most Recent Status on Glenwood	Required Conditions	Research Needs	Management Recommendation	Comments
Variable linanthus	<i>Leptosiphon (Linanthus) parviflorus</i> (new name will be <i>L. longitubus</i>)	None	Santa Cruz CNPS: Rare	2015: Not surveyed 2017: 3 populations recorded	Grassland	<i>Leptosiphon parviflorus</i> at Glenwood may be renamed <i>L. longitubus</i>	Graze to reduce competition	This species was not mapped before 2017 because the plants were considered common. New taxonomic info shows it is a different species. (Randall Morgan, pers. comm. 2017) Santa Cruz CNPS believes them to be rare.
Purple owl's clover	<i>Castilleja exserta</i>	None	Santa Cruz CNPS: Rare	2015: Not surveyed 2017: Found at one site	Grassland	None	Graze to reduce competition	Randall Morgan (pers. comm. 2017) says that this species is only found at Glenwood and sandhills for the county. Calflora does show records outside that area.
Indian clover	<i>Trifolium albopurpureum</i>	None	Santa Cruz CNPS: Rare	2015: Not surveyed 2017: Discovered from one site	Grassland	None	Graze to reduce competition	The 2017 occurrence was the first record for Glenwood Preserve. It occurs in a few sites in the county.
Dwarf sack clover	<i>Trifolium depauperatum</i> var. <i>depauperatum</i>	None	Santa Cruz CNPS: Rare	2015: Not surveyed 2017: Many populations. Some documented	Grassland	None	Graze to reduce competition	Thomas flora calls this rare in Santa Cruz Mountains region. Randall Morgan (pers. comm. 2017) never saw it in more than a couple of sites at Glenwood. In 2017 it was common at Glenwood.

Common Name	Latin Name	Status	Local Importance	Most Recent Status on Glenwood	Required Conditions	Research Needs	Management Recommendation	Comments
Cream cups	<i>Platystemon californicus</i>	None	Host plant for Opler's longhorned moth	<p>2015: 240 at pond. 5 other pops some less than 20 plants</p> <p>2017: No count, but larger footprint than 2015 at pond. 1 other pop found.</p>	Minimal competition from other herbaceous plants	Optimal timing of grazing	<p>Graze to reduce thatch and competition from other herbaceous plants. Grazing must not harm flowers, which is where adult moths lay eggs. Grazing must not trample moth larvae which likely go through diapause in leaf duff.</p> <p>Survey annually for cream cups</p>	This species has an affinity for serpentine soil, though serpentine doesn't occur at Glenwood. This site is an anomaly.

Table 7 below is a calendar of monitoring and management actions related to certain rare species (not including Ohlone tiger beetle, Scotts Valley spineflower or Scotts Valley polygonum)

Table 7. Monitoring and Management Actions

ACTION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Graze Beetle Pasture												
Graze Tabor Pasture												
Graze Pond Pasture												
Graze Canham Pasture												
Graze Moth Zone												
Monitor for Opler's longhorn moth adults												
Monitor for cream cups, Mt. Diablo cottonweed, Gray's clover, common lomatium, Indian clover, dwarf sack clover and variable linanthus												
Monitor for Santa Cruz clover, Choris's popcornflower, Hickman's popcornflower, Pacific Grove clover												
Monitor for grassland microseris												
Identify and remove weeds that threaten rare species												

Figure 7. Photos of Rare Plants



*Santa Cruz clover.
Photo used with
permission from
Kerry Heise*



*Pacific Grove
clover, previously
considered
variegated clover.
Note it is more pink.
Photo by Land
Trust of Santa Cruz
County*



*Variegated clover.
Note it is more
purple than Pacific
Grove clover. Photo
by Land Trust of
Santa Cruz County*



Choris's popcornflower.
Note the pedicel is longer than the calyx. Photo by Phil Greer, WRA.



Mt. Diablo cottonweed. Photo used with permission.
©Dylan Neubauer

Hickman's popcornflower.
Note pedicels are shorter than calyx. Photo by Land Trust of Santa Cruz County.





Grassland microseris.
Photo by Debra Cook



California sandwort.
Photo by
© 2007 Carol
W. Witham



Gray's clover.
Photo by Land
Trust of Santa
Cruz County



*Common
lomatium.
Photo by
Land Trust
of Santa
Cruz County*



*Variable
linanthus.
Photo by Land
Trust of Santa
Cruz County.*



*Purple owl's clover.
Photo by
© Keir Morse 2009*



*Indian clover.
Photo by Land
Trust of Santa
Cruz County*



*Dwarf sack clover.
Photo by Land
Trust of Santa
Cruz County*



*Cream cups. Photo
by Land Trust of
Santa Cruz County*

3.0 MONITORING AND MANAGEMENT GUIDELINES

3.1 Glenwood Open Space Preserve Management Goals and Objectives

The goals and objectives for this LTMP were developed based on the biology of sensitive species, threats to sensitive species, and potential effects of habitat management and public access on sensitive species. Below are descriptions of the goals and objectives developed for this LTMP.

Goal 1: Manage for the benefit of special-status, sensitive and listed species

Objective 1.1: Prohibit trail-building and prohibit public recreational access to OTB habitat occupied at the time of this plan (2017), while allowing seasonally restricted educational access along an existing trail in historically occupied OTB habitat.

Objective 1.2: Coordinate vegetation management (i.e. grazing and invasive plant management) within OTB habitat to achieve optimum habitat conditions (i.e. bare ground) with minimum adverse effects.

Objective 1.3: Avoid use of pesticides that would directly negatively affect OTB and other rare plants and animals.

Objective 1.4: Prohibit trail building and restrict public access to existing livestock paths within documented Scotts Valley spineflower populations (potential Scotts Valley polygonum habitat).

Objective 1.5: Coordinate vegetation management (i.e. grazing, control of woody succession into grassland, and invasive plant management) in spineflower and polygonum habitat to achieve optimum habitat conditions (i.e. reduce non-native annual grass cover) with minimum effects (i.e. erosion).

Objective 1.6: Avoid use of pesticides that would directly negatively affect spineflower and polygonum or negatively affect potential pollinators of spineflower and Polygonum.

Objective 1.7: Implement / continue vegetation management (i.e. grazing, control of woody succession into grassland, and weed whacking of designated trail habitat) to maintain bare ground and control competitive non-native annual herbaceous species.

Objective 1.8: Conduct / continue monitoring, of OTB, Scotts Valley spineflower, and Scotts Valley polygonum habitat to guide future management plans and to adapt those plans and management actions for improved results. To the extent possible, monitor sensitive plant and animal species that are not federally listed.

Goal 2: Manage risk of wildfire.

Objective 2.1: Prohibit discing and mowing in or near sensitive habitat. Consultation with the Land Trust should be conducted prior to any discing or mowing to ensure protection of sensitive species and habitat. In November 2015, City of Scotts Valley Public Works wrote that discing and vegetation management for fire protection was feasible while avoiding the Scotts Valley spineflower habitat above the high school.

Objective 2.2: Conduct regular livestock grazing to help reduce fire hazards. Fuel breaks should be maintained in strategically important grassland areas with grazing

by placing mineral/molasses licks to attract greater grazing there or other means as specified by the Scotts Valley Fire Protection District. The City and the Land Trust will continue to cooperate with local fire management authorities to develop and refine fire management plans for the Glenwood Open Space Preserve.

Goal 3: Use cattle grazing to meet vegetation management targets.

Objective 3.1: Allow horse or cattle grazing year-round, as prescribed by a certified rangeland manager and overseen by the Glenwood Open Space Preserve Manager, within the OTB, Opler's longhorn moth, and wetland habitat areas. Grazing is designed to achieve specified objectives while minimizing impacts and maintaining a healthy rangeland ecosystem.

Goal 4: Provide public access consistent with Goals 1 and 3.

Objective 4.1: Provide restricted access through signage for designated trails, designated entry points, and seasonal limitations / restrictions; however no such access will be provided through occupied OTB habitat (Objective 1.1).

Objective 4.2: Allow public access using existing livestock paths within the Glenwood Open Space Preserve to the extent feasible. New trails to provide Glenwood Open Space Preserve access in areas where existing livestock paths are absent, to avoid wetlands, and to connect to access and staging areas should meet the following objective:

Objective 4.3: Constructed trails should avoid occupied federal and state listed species habitat and minimize impacts to other sensitive species habitats and natural communities; designation of public access trails that follow existing livestock paths (and are not constructed) should also avoid such habitat.

3.2 Roles and Responsibilities

The roles and responsibilities outlined in Table 8 will help guide the long-term management of the Glenwood Open Space Preserve. A new MOU will provide guidance on these roles and responsibilities based on the 2003 MOU.

Table 8. Roles and Responsibilities

Responsible Party	Roles and Responsibilities
City	<ul style="list-style-type: none"> • Leading the management of public access. • Engaging the public for planning on specifics related to public access. • Providing environmental review of plan and component projects. • Overseeing infrastructure associated primarily with public access such as parking, rules and regulations signage, waste management (including wildlife-proof receptacles), benches and picnic tables, trail brushing, graffiti management, etc. • Overseeing public safety and emergency response. • Providing rules enforcement, particularly those that support grazing, such as no dogs and no bicycles on the east side of the Glenwood Open Space Preserve, and preventing the intentional or accidental release of cattle by visitors. • Holding ultimate responsibility for land management, but may delegate responsibility to the Land Trust or other party. • Reviewing and approving expenditures under the endowment. • Fulfilling obligations of the MOU between the LTSCC and the City in order to provide clear guidance on the roles and responsibilities of the City and the LTSCC.
Land Trust	<ul style="list-style-type: none"> • Acting as the Glenwood Open Space Preserve Manager. • Overseeing overall ecosystem management. • Coordinating with the City on recreation management to ensure recreation and ecosystem management are compatible. • Managing contractors, in consultation with the City, including, but not limited to: <ul style="list-style-type: none"> ○ Grazing Operator ○ Rangeland Ecologist ○ Entomologist ○ Botanist • Acting as easement holder <ul style="list-style-type: none"> ○ Monitoring and enforcing the conservation easement • Managing the endowment <ul style="list-style-type: none"> ○ Investing according to the Land Trust investment policy (approximately \$1.5 million as of May 2017). Reimbursement for spending from the endowment must be approved by the City.
Preserve Manager (Land Trust Staff)	<ul style="list-style-type: none"> • Coordinating with the Scotts Valley Fire District on fire protection planning. Collaborating with the Scotts Valley Fire District on their plan for the Glenwood Open Space Preserve. • Patrolling the Glenwood Open Space Preserve on a weekly or more frequent basis. Assisting in the prevention of additional vandalism that could result in cattle escapes. • Receiving training from the project Entomologist to perform monitoring of the OTB, and obtain appropriate state and federal permits for this monitoring. The Land Trust applied for a Section 10(a)(1)(A) recovery permit in 2017. • Analyzing, or supporting the analysis of, OTB data to understand the relationship between management and population trends. • Preparing an annual monitoring report per standards outlined in this LTMP in order to maintain compliance with the terms and conditions of this LTMP, and submit the report to the Service. • Conducting weed-whacking activities in the Beetle Pasture Management Zone in order to provide optimal bare ground conditions for OTB. • Conducting reconnaissance monitoring on a quarterly basis, in collaboration with the Rangeland Ecologist, to inform grazing and other land management actions.

Table 8. Roles and Responsibilities

Responsible Party	Roles and Responsibilities
	<ul style="list-style-type: none"> • Fulfilling obligations of the MOU between the LTSCC and the City in order to provide clear guidance on the roles and responsibilities of the City and the LTSCC. • Monitoring weeds and treating those that threaten special-status, sensitive, and/or listed species or sensitive habitat. • Developing and implementing an erosion control plan. Erosion projects should be prioritized for design and implementation. • Monitoring fences and gates for cattle containment. • Assessing water trough locations and design to ensure they will be efficient and effective. • Maintaining the property GIS. • Establish and maintain interpretive and wayfinding signage, in collaboration with the City • Coordinate with Vine Hill School for educational access through the Beetle Pasture
Grazing Operator	<ul style="list-style-type: none"> • Rotating cattle in coordination with the Rangeland Ecologist and Glenwood Open Space Preserve Manager. • Coordinating with the Glenwood Open Space Preserve Manager and City staff to facilitate interface between cattle and recreational use. • Keeping cattle on the property. Ensuring cattle do not cause property damage or escape through broken fences from the Glenwood Open Space Preserve. • Monitoring and repairing gates and fences to ensure cattle do not escape. • Removing thatch from Opler's longhorn moth habitat to improve habitat conditions for this species. • Maintaining water troughs for cattle to ensure they have a reliable water source at all times.
Rangeland Ecologist	<ul style="list-style-type: none"> • Monitoring the condition of forage and soil. • Making recommendations regarding grazing locations, frequency, and intensity to achieve desired ecological outcomes. • Providing a grazing assessment report to the Grazing Operator and Preserve Manager by the end of October each year. Review the management objectives related to grazing, mowing, and other vegetation management. Provide clear guidance to the Grazing Operator as needed. • Closely manage cattle grazing in the Beetle Pasture Management Zone in order to ensure optimal bare ground conditions are maintained for OTB. • Quantitatively monitor grassland conditions in the fall and spring of each year in order to ensure optimal vegetation height is achieved for special-status, sensitive, and listed species.
Entomologist	<ul style="list-style-type: none"> • Performing monitoring of the OTB and Opler's longhorn moth in order to maintain compliance with this LTMP. Survey results will inform management objectives for the following year and recovery actions for OTB. • Training Land Trust staff or others in monitoring of OTB and Opler's longhorn moth. • Analyzing, or supporting the analysis of, OTB data to understand the relationship between management and population trends. • Recommending management activities to sustain and enhance the OTB population.
Botanist	<ul style="list-style-type: none"> • Conducting periodic monitoring for special-status, sensitive and listed plants. • Coordinating with the Glenwood Open Space Preserve Manager to leverage botanists in the community to make surveys efficient.

3.3 Endowment Use and Management

The endowment will be used for the management and restoration of biotic resources, including, to a limited extent, facilities, or activities that enable biotic resource enhancement concurrent with public access. For example, relocating cattle fencing to accommodate trails, adding gates in cattle fences, providing receptacles for waste fishing line, and installing signage for implementation and resource protection.

The endowment will also be responsible for management planning to ensure biotic resources are protected as future uses are contemplated, including public access.

The endowment will not be responsible for the maintenance of facilities such as parking areas, restrooms, and trail construction.

Budget management under this LTMP is assigned to the Land Trust, subject to review and approval by the City. Review and approval of the annual budget will be conducted by the City. Spending authority will be consistent with the budget will be the responsibility of the Land Trust. Deviations from the budget will require approval by the City.

The endowment may be used for biotic resource management activities outlined in this LTMP. Other, presently unanticipated, biotic resource management activities may also be eligible. An annual work plan overview, along with the budget, will be shared with the City. Deviations from the LTMP will require approval by the City.

3.3.1 *Costs of Plan Implementation*

Costs to implement the conservation strategy described in this LTMP are listed in Table 9. Operational costs estimated for the Land Trust habitat management capital costs for pasture infrastructure was estimated, amortized over 20 years, and included in the annual cost. Total estimated annual operational cost was rated as a multiple of the minimum cost. To allow all potential habitat management options to be evaluated in the LTMP, no threshold of acceptability or rejection was established for operational cost. For long-term financial sustainability, costs will be cut below present levels by increasing efficiency, bringing consulting expenses in-house, and reducing the frequency of certain activities, such as mapping.

An endowment established as a condition of approval for the Glenwood Open Space Preserve is the primary source of funding for the conservation activities and management of biological resources covered in this LTMP. Under an agreement with the City as landowner of the Glenwood Open Space Preserve, the Land Trust will hold the endowment and conduct or oversee all biological management and monitoring activities. The Land Trust holds the endowment of approximately \$1,125,000 with a projected increase of 3 percent after inflation annually based on conservative estimates of annual interest earned. Costs related to public access management, infrastructure, maintenance, and public safety will be the responsibility of the City.

Table 9. Estimated LTMP Operational Costs

Glenwood Open Space Preserve Financial Analysis Land Trust of Santa Cruz County April 2017		
<u>Endowment Cash Flow</u>		Notes
Account value	\$1,500,000	1
Anticipated loss in next bear market	25%	2
Account value after next bear market	\$1,125,000	3
Safe yield	3.0%	4
Sustainable annual budget	\$33,750	

<u>Future Management Costs</u>		
Monitoring (cattle, beetle, plants)	\$10,000	5
Field work (patrols, vegetation management)	\$7,000	6
Management (contracts and coordination)	\$3,000	7
Projects	\$6,500	8
Contingency	\$5,000	9
Total	\$31,500	10

<u>Reference Management Costs (2010-2014)</u>		
Beetle monitoring	\$5,680	
Grazing monitoring and coordination	\$11,400	11
Plant mapping and weed control	\$9,600	12
Land Trust field work and management	\$15,700	13
Total	\$42,380	

Notes	
1 75%/25% invested in stocks and bonds	
2 Average of various scenarios	
3 Reduced by anticipated bear market loss. Provides emergency buffer.	
4 Assumes annual returns of 6% and inflation of 3%	
5 Division among beetle, habitat condition and spineflower TBD	
6 Land Trust field staff at 12 hours/month, plus expenses	
7 Land Trust manager at 5 hours/month	
8 E.g. fencing, invasives and erosion management, habitat enhancement	
9 For short term, intensive monitoring, field work, management, projects	
10 Future management costs are assumed to increase with inflation	
11 Included one-time cost related to transition to cattle	
12 Included one-time cost related to invasive plant mapping	
13 Included one-time cost related to transition to cattle	

3.4 Habitat Management

3.4.1 Management Zones

Four management zones will be created as a part of this LTMP. These four zones include the following:

- Beetle Pasture – Bounded by the fencing around the Beetle Pasture and encompassing all known OTB habitat.
- Beetle Expansion Area – Includes areas outside of the Beetle Pasture, which become occupied by the OTB. There is no land in this management zone at present.
- East Side Preserve – Includes areas on the east side of Glenwood Drive that are not part of the Beetle Pasture or the Beetle Expansion area.
- West Side Preserve – Includes areas on the west side of Glenwood Drive.

Additional details regarding each zone are outlined below and shown in Figure 8.

3.4.1.1 Beetle Pasture Management Zone

The Beetle Pasture Management Zone is bounded by the present alignment of the Beetle Pasture fence, the area of habitat occupied and historically occupied by the OTB, and adjacent areas inside the Beetle Pasture, including:

- Occupied breeding area where burrows are present
- Occupied areas where adults have been observed
- Areas that were historically occupied by OTB
- Adjacent areas where no OTB or burrows have been observed
- A 100-foot buffer around occupied and historically occupied habitat (a portion of that buffer extends outside the Beetle Pasture at the northeast part of the Beetle Pasture)

The buffer provides some physical separation between the OTB and visitors, but OTB may move into the buffer or through it into other areas. There are planned restoration activities in the buffer area and in other parts of the Beetle Pasture Management Zone, such as the removal of brush and other woody vegetation, and the establishment of a trail on the far eastern side of the Beetle Pasture. If management is successful, those areas will become occupied, and the ‘buffer’ will not be a buffer anymore; it will become occupied habitat. Whether buffer or habitat, the areas inside the Beetle Pasture will be subject to the same management approach.

Goals

The goals for management of this area are to:

- Sustain and increase populations of OTB
- Enhance and expand OTB habitat
- Conduct ongoing grazing to sustain and expand habitat
- Conduct monitoring to track the efficacy of management
 - the planned trail to the East Preserve from Vine Hill School will be monitored for burrow activity to determine if the species becomes re-established in area
 - take observed in the area will be recorded and reported to the Service
 - if range expansion is observed, there would likely be a net benefit to the species, and such take may be added to the recovery permit at that time

- Avoid take of the OTB while accomplishing other objectives

Management Practices

Management activities that may be performed throughout the year, when authorized by a qualified biologist with expertise in OTB biology, include

- Grazing and maintenance of grazing infrastructure necessary to support grazing, including perimeter fencing, gates, and signage as well as water troughs
- Weed-whacking and other vegetation management that minimizes soil disturbance and is necessary to enhance OTB habitat (Appendix A)
- No discing for fire protection, grazing only

Certain activities may be conducted between September 1 and December 15 to avoid the adult activity period and sensitive juvenile life stages of OTB. These activities include:

- Vegetation management that may result in soil disturbance such as brush removal
 - Perform habitat management activities to create open grassland and bare soil conditions, including shrub and tree removal
- Installation of interior signage and seasonal fencing along the segment of trail from Vine Hill school into the preserve
- Establishment and visitor use of trails

Trails

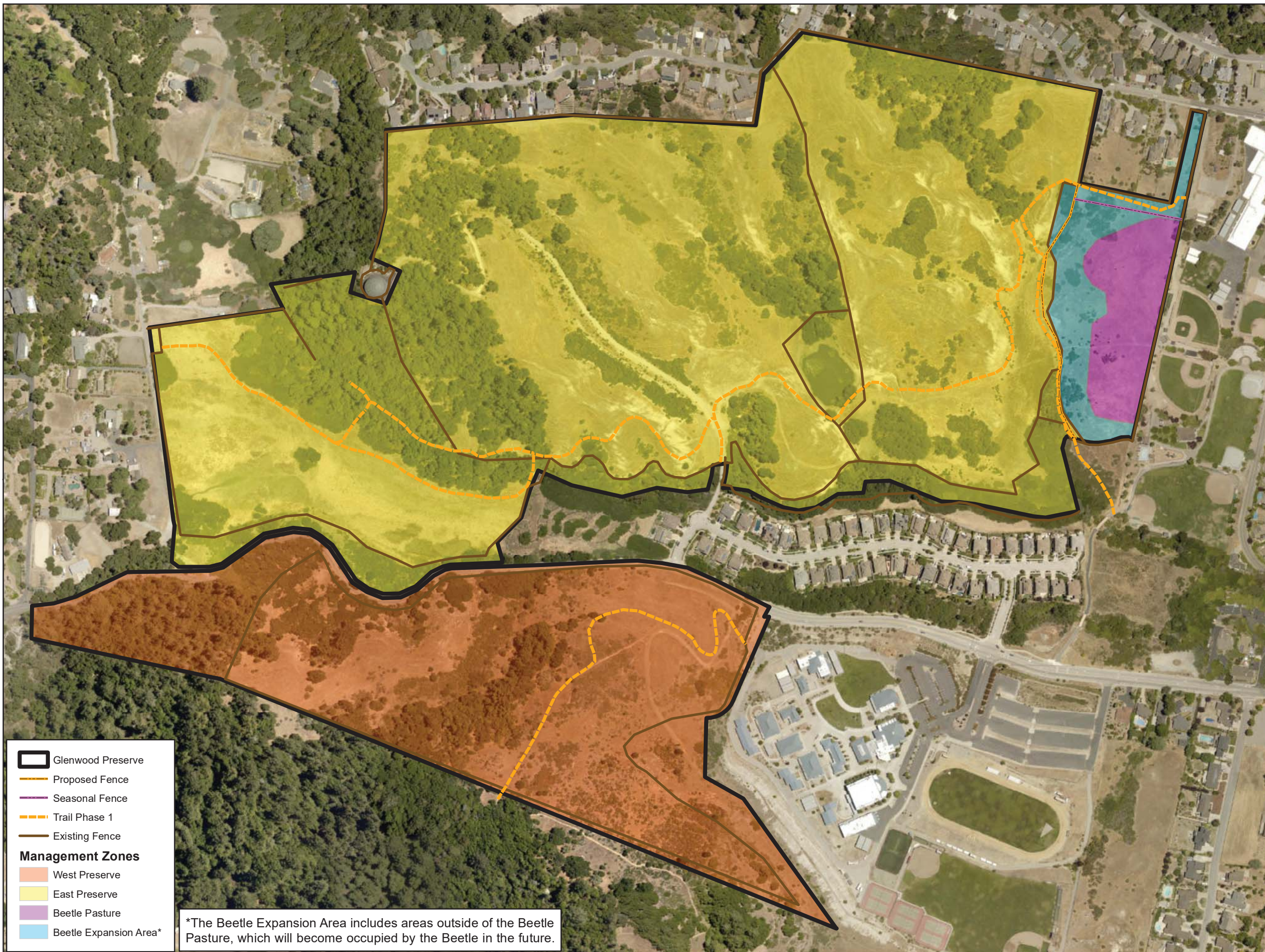
A single trail along the eastern side of the Beetle Pasture Management Zone may be provided as an interpretive trail and access intended primarily for students and teachers of Vine Hill School. The trail must avoid occupied habitat, and only pass through historically occupied or unoccupied habitat. Allow the trail to form through use, scraping and/or constructing a trail is prohibited. Only existing soil surface trails are allowed, no imported soil material will be used.





Trail management will follow the guidelines outlined below:

- Prohibit visitor access generally from December 15 through September 1, but subject to provisions below
- Prohibit visitor access unless monitoring demonstrates that no life stages of the beetle are present along the trail, and that the soil is dry and firm
- Prohibit visitor access once the rains soften the soil if vulnerable life stages are present
- Prohibit visitor access when cattle are in the pasture
- No bicycles
- No dogs
- At the entrance to this trail, signage will direct the public to the primary trailhead at or near the footbridge
- The Land Manager will coordinate with staff of Vine Hill School for access, and not broadly advertise access

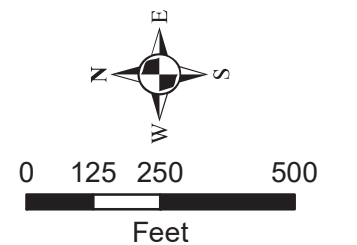
Glenwood Preserve
Scotts Valley,
California

Figure 8.
Management Zones



-  Glenwood Preserve
-  Proposed Fence
-  Seasonal Fence
-  Trail Phase 1
-  Existing Fence
- Management Zones**
-  West Preserve
-  East Preserve
-  Beetle Pasture
-  Beetle Expansion Area*

*The Beetle Expansion Area includes areas outside of the Beetle Pasture, which will become occupied by the Beetle in the future.



Map Prepared Date: 11/3/2017
Map Prepared By: sgillespie
Base Source: Esri Streaming Imagery
Data Source(s): WRA, Land Trust Santa Cruz County,
Entomological Consulting Services, Ltd.

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A seasonal fence system will be installed in the eastern Beetle Pasture along the boundary between currently occupied and historic OTB habitat will add a visual barrier that will help to divert visitors away from occupied OTB habitat (Figure 11). The installation of the fence should minimize ground disturbance, e.g. blocks and posts resting on the ground with wooden rails between them. The fence will be installed during a period when schools may access the property. The fence will be removed when cattle are in the pasture.

An unofficial existing trail through the center of the Beetle Pasture will be allowed and abide by the following guidelines:

- Leave existing informal climb-over structure in the boundary fence to discourage trespass that damages the fence
- At this structure, replace the "No Trespassing" sign with signage directing people to official entrance and stating that this area is closed to protect special-status, sensitive and listed species
- Assess the fence and gate along the north side of the pasture, and make changes to discourage entry to the closed area and discourage vandalism, while prioritizing actions that keep the cattle management facilities intact, even if that means some trespass occurs
- Respond quickly to monitoring showing heavy adult OTB use in this area with additional effort to exclude unauthorized persons from the area between December 15 through September 1.

Vegetation management will include the following:

- Weed-whacking of designated trail habitat to maintain bare ground and control competitive non-native annual herbaceous species (Appendix A)
- Brush should be removed periodically

The Vine Hill School trail and all unofficial trails in the Beetle Pasture Management Zone, both inside and outside of occupied and historically occupied OTB habitat, will be monitored for adult and burrow activity.

3.4.1.2 Beetle Expansion Management Zone

Goals

One goal for management of OTB is to expand the extent of the habitat occupied by this species. If this occurs, then areas outside the Beetle Pasture Management Zone may become occupied habitat. The species has a strong affinity for Watsonville Loam series soils, and those soils are not mapped in detail in the area. As management proceeds, these and other areas may become occupied habitat.

In the future, if OTB are observed outside the Beetle Pasture Management Zone, then this newly occupied area, and a 100-foot buffer around it, will be designated the Beetle Expansion Management Zone. The designation will occur within three months of when the annual monitoring report delineates the extent of newly occupied habitat.

Management Practices

Ground disturbing activities in this area will be limited to the period between September 1 and December 15. No artificial soil or imported fill will be placed in these areas.

Each of the management practices employed in the Beetle Pasture Management Zone will be considered for this Beetle Expansion Area Management Zone and either adopted or rejected based on the likely benefit to OTB. The Land Trust will lead this process in coordination with the City, the Service and qualified biologists approved for monitoring OTB.

The goal will be to determine whether management of this newly occupied area should continue unchanged, as it may have contributed to the expansion of OTB into the area, or be changed to be consistent with the management of the Beetle Pasture Management Zone, for example, by excluding visitors between December 15 and September 1. There may be different management strategies that benefit OTB, which can also be trialed. Considerations will include the status of occupied burrows, weather, grazing activity, visitor use patterns and both potential and observed impacts.

Trails

A single trail along the eastern side of the Beetle Pasture Management Zone may be provided as an interpretive trail and access intended for students and teachers of Vine Hill School. The trail must avoid occupied habitat, and only pass through historically occupied or unoccupied habitat. Allow the trail to form through use; scraping and/or constructing a trail is prohibited. Only existing soil surface trails are allowed, no imported soil material will be used.

Trail management will follow the guidelines outlined below:

- Prohibit visitor access generally from December 15 through September 1, but subject to provisions below
- Prohibit visitor access unless monitoring demonstrates that both no life stages of the beetle are present along the trail, and that the soil is dry and firm.
- Prohibit visitor access once the rains soften the soil if vulnerable life stages are present
- Prohibit visitor access when cattle are in the pasture
- No bicycles
- No dogs
- At the entrance to this trail, signage will direct the public and all visitors during the closed period to the primary trailhead at or near the footbridge
- The Land Manager will coordinate with staff of Vine Hill School for access, and not broadly advertise access

3.4.1.3 East Preserve Management Zone

The East Preserve Management Zone is the area outside the Beetle Pasture on the east side of Glenwood Drive.

Goals

This area will be managed to support the grazing management program. Successful OTB management requires that the property support a grazing herd of cattle, which require extensive pastures distinct from the Beetle Pasture.

The primary objectives of this area are to

- Support the herd of cattle that sustains the OTB habitat in the Beetle Pasture
- Support native plant and insect habitat in the East Preserve
- Support a healthy watershed
- Provide for public access for the quiet enjoyment of nature

Management Practices

All fences, gates, and stiles must ensure adequate containment of cattle. The East Preserve Management Zone will be managed for public access. Any use that conflicts with the cattle operation will be discouraged or prohibited. Dogs and bicycles are prohibited.

Existing cattle trails may be used, however, all trails, including cattle trails, should be modified to conform to the trail standards below.

Interpretive signage will be installed at official entrances and will provide strategic locations to direct people to official entrances.

Various gullies and erosion features occur in the East Preserve. Many of the gullies are associated with altered hydrology, while bare soil conditions are associated with historic grazing practices. This erosion damages habitat, soil structure, and downstream aquatic resources. These erosion features will be assessed and addressed over time through individual projects.

Fire protection includes the following guidelines:

- Mow areas as needed for fire protection
- Limit discing to non-sensitive areas that have been disced previously and only where it is necessary for fire protection and mowing is infeasible
- Prohibit discing or vehicle mowing in sensitive habitats
- String trimming is permitted in OTB habitat, if deemed necessary. Person should follow protocols in Appendix A regarding weather conditions that minimize the chance of take of OTB.
- Management for fire protection is the responsibility of the Scotts Valley Fire Protection District

Trails

Trails may be built that conform to the following design standards:

- Trails should be no steeper than 15%. Trails should be no steeper than 10% for distances greater than 50 feet
- Trails should be oriented across the slope such that the gradient of the trail is less than half the gradient of the hillslope to facilitate drainage (for example, if the hillslope is 10% the trail gradient should be less than 5%)
- Areas with hillslope less than 10% should be avoided where possible as trails in such areas are prone to ponding
- Trails should have grade reversals at least every 100 feet and ideally every 50 feet to ensure adequate drainage
- Trail tread should use native soil material rather than imported material
- Maximum width of constructed trail tread should be three feet; maximum width of graded area should be five feet
- Constructed trails must avoid habitat occupied by federally protected species
- Constructed trails should avoid habitat occupied by rare plants and potential habitat for federally protected species
- Existing cattle paths may be used as trails temporarily, but, where cattle paths do not conform to the standards above, visitor use should be diverted onto constructed trails
- No bicycles
- No dogs

Trail building and fence management may occur any time, consistent with local, state, and federal regulations.

Appropriate erosion control measures should be taken during winter season trail construction, such as completing trails in short segments with drainage features rather than opening extensive segments of rough grade without drainage features.

3.4.1.4 West Preserve Management Zone

The West Preserve Management Zone is located on the west side of Glenwood Drive.

Goals

It is to be managed as per the East Preserve, with the primary exception that it will not be grazed (at least initially). Scotts Valley spineflower occupies habitat in this area. However, the spineflower habitat is in steep areas, such that visitor impacts are unlikely to be significant.

Management Practices

The West Preserve Management Zone will be managed to protect Scotts Valley spineflower with signage and, if necessary, fencing. Hiking, dogs, and bicycles will be allowed near the plants; however, trails, fencing, and signage will be used to keep visitors out of occupied habitat.

This area will not be grazed initially, but it may be grazed in the future, as this would be beneficial to native plants. However, this would require the exclusion of dogs. No grazing is planned for at least 5 years after implementation of this LTMP. Disturbance is not expected to be necessary to sustain the spineflower habitat because of the rocky and low-nutrient status of the soils.

Discing would be limited for fire protection. Discing for fire protection is the only management activity identified as a threat to special-status, sensitive and listed species. Discing should not be performed on the Glenwood Open Space Preserve near occupied Scotts Valley spineflower habitat. Discing should be performed only on the adjacent property of the Scotts Valley High School. Mowing will also be conducted for fire protection and habitat enhancement to the extent feasible.

Trails

Trails may be built so long as they conform to the same standards as the East Preserve Management Zone. Dogs and bicycles may be allowed. If bicycles are allowed, additional care must be taken in trail design and maintenance to ensure excessive erosion does not occur. Existing trails that do not conform to these standards should be decommissioned and replaced with re-designed trails.

3.4.2 Grazing

The grazing and related management strategy described here aims to maximize the conservation benefits and minimize the impacts of such management at the Glenwood Open Space Preserve, particularly focusing on the special-status, sensitive and listed plants and wildlife and other special resources. All resources with the potential to be affected by grazing in rangelands were assessed.

This strategy includes the goals, objectives, and performance standards for grazing and related management. It recommends the use of yearlong horse or cattle grazing, with carefully timed deferments and distribution incentives within the OTB, Opler's longhorn moth, and wetland habitat areas, as the primary vegetation management tool throughout the Glenwood Open Space Preserve. Grazing is further designed to reduce fire hazards and to optimize ecological conditions for the special-status, sensitive and listed plants, riparian woodlands, wetlands, native grasses, and other special resources dependent on such management. It recommends the use of grazing and non-grazing management tools, to achieve other goals at areas designated for special management. The grazing prescription is designed to achieve specified objectives while minimizing impacts, maintaining a healthy rangeland ecosystem, and providing the conditions for a cooperative and productive relationship between the Glenwood Open Space Preserve Manager and Grazing Lessee. The grazing capacity assessment provides the baseline for expected herbaceous forage available to graze and the appropriate initial stocking rates for each Management Zone depending upon annual weather. The strategy relies on the cooperation and tactical decision making by the Glenwood Open Space Preserve Manager and Grazing Lessee within a framework they can understand and appreciate, and flexibility to achieve the performance standards. It describes the circumstances to sustain the horse or cattle grazing operations, which in turn enable the use of grazing as an effective and flexible conservation management tool. It also defines monitoring and adaptive management measures to assure the goals are achieved over the long-term.

3.4.2.1 Summary of Current Conditions Affected by Grazing

Habitat of Special-Status and Other Sensitive Plants

Fourteen special-status plants were either observed or could occur at Glenwood Open Space Preserve. The habitats of the plants with at least potential occurrence warrant special management where they might be vulnerable to or benefit from planned livestock grazing, in particular, planned winter and spring grazing. High stocking rates (of horse or cattle) could

damage these special-status, sensitive and listed plants due to soil compaction, erosion, and higher grazing herbivory pressure (Arthur, pers. comm. 2010). However, the prescription to graze at low stocking density is expected to avoid harm to these plants due to the relatively higher palatability (and thus selective preference by livestock) of the green growing grasses, thus reducing the chance that such forbs will be grazed even if they are palatable. In addition, exclusion from grazing could cause more harm than benefit. No negative impacts to any of the plants are expected because of the grazing prescription, and conditions for their conservation are expected to improve.

No science-based information on grazing effects or palatability was found for Gray's clover or Pacific Grove clover. However, another species in the same genus, *Trifolium repens*, is considered fair to good forage for both horses and cattle (Coladonato 1993). Therefore, these species might be vulnerable to herbivory or trampling. It is possible that exclosure from grazing would be detrimental to these populations because they persisted while the site was grazed with horses and dairy cattle. These and the other special-status, sensitive and listed species are likely to be harmed more by the exclusion of grazing and the resulting negative effects of competition from the non-native annual grasses, than by continued grazing.

Habitat of Special Status and Other Sensitive Wildlife Affected by Grazing

Historic grazing apparently was the main management factor that maintained the required grassland habitat qualities for persistence of special-status OTB, Opler's longhorn moth, and special-status, sensitive and listed plants within the Glenwood Open Space Preserve. Little evidence is available to determine the prehistoric range and habitat characteristics for these species. However, inferences can be suggested based on the ecological conditions where these species persist. Occupied habitat is mainly where the soils are shallow or where relatively heavy grazing by cattle or horses or some other means of creating and maintaining bare soil surfaces (such as lightly-used bicycle or human foot trails, dirt vehicle roads, scraping, and burning) has occurred. These site conditions and management activities result in reduced height and density of the dominant non-native grassland plants (and thus reduced competition for space, sunlight, moisture, and nutrients with the species), and reduced encroachment of scrub and woodlands into the grasslands.

Recent studies of OTB habitat and its management by Arnold, Bartolome, Ford, and Rao (2012a and 2012b) explained that continuing management with either extensive grazing by cattle or horses or moderate-frequency hiking and bicycling use on trails was critical to maintain suitable conditions for OTB in the remaining occupied sites. These studies also defined the habitat features that land managers should focus upon and monitor to increase the amount of suitable habitat. The amount of sunlit, bare soil should be maintained at 50% or more on road and trail habitat sites and at 12% or more in grassland habitat areas. Although the amount of bare soil in grassland sites is more dependent on fluctuations in cover due to weather (which varies between years) rather than management, the effects of livestock grazing, livestock trailing, weed whacking, scraping, and other management treatments are likely to be most important during years with normal and above-normal precipitation. These studies also recommended avoiding traffic by livestock and bicycles when the soils are saturated. In addition, heavy usage of recreational trails is considered detrimental.

Open Grassland Habitat Maintained by Grazing

Coyote brush scrub is expanding into and replacing the grassland areas some of which may be suitable habitat for special-status and sensitive species. This loss of open grassland habitat is evident when comparing aerial photos from 1993 to present day. Natural succession from

grassland to northern coastal scrub to mixed woodland is typical of the central California sites influenced by the coastal maritime climate (Ford and Hayes 2007). Northern coastal scrub is found invading the grasslands of the Glenwood Open Space Preserve, which indicates succession to scrub habitat. Favorable conditions for conversion to scrub would include above-normal precipitation extended into the summer, and absence of livestock grazing during the dry months. In general, livestock grazing limited to the winter and spring seasons avoids the trampling and herbivory impacts of livestock on scrub and oak seedlings and saplings when they are most vulnerable in the summer and fall (McBride 1974), and thus could allow potential colonization by those woody species into adjacent grasslands. Willows and coyote brush generally provide fair quality browse for cattle, and their browsing often creates a hedged browse-line (Sampson and Jespersen 1981). Willows and coyote brush generally provide less valuable browse for horses, and horses are less likely to browse near dense shrubs or willow woodlands due to the perceived threat of predators. Despite this difference in palatability, both horses and cattle hoof action would reduce scrub encroachment. Thus, the expansion of scrub and especially willow woodland into grasslands might be partly associated with the change from cattle to horses around 1982.

Under favorable conditions and within a few decades, even more of the Glenwood Open Space Preserve's grasslands could be encroached upon by woody vegetation unless management action is taken. The best single measure would be to extend the grazing period (best with cattle if available) into early summer on a trial basis. However, this would only affect invading woody plants, not the existing scrub or woodlands. The special-status, sensitive and listed annual herbs of the Glenwood Open Space Preserve could be damaged by summer grazing. This is because, in the summer, cattle and horses begin to graze forbs and cattle begin to graze succulent woody foliage when their preferred forage (grass) has senesced.

Therefore, manual or mechanical scrub control or periodic summer grazing by cattle will be required to prevent further expansion. Clearing of existing scrub and willow woodland should be conducted gradually and experimentally to assure the increase of benefits and reduction of risk to special-status, sensitive and listed plants. The Grazing Lessee might be willing to assist in scrub clearing because it will increase the availability of forage. If so, a plan will be needed that outlines where to clear scrub, where not to clear scrub, how to clear scrub, and how to dispose of it.

Invasive Species Affected by Grazing

Five non-native invasive plants are currently considered to be of primary conservation concern and potentially affected by grazing in the grazed grasslands of the Glenwood Open Space Preserve:

- Stinkwort (*Dittrichia graveolens*)
- Pennyroyal (*Mentha pulegium*)
- Italian thistle (*Carduus pycnocephalus*)
- Bull thistle (*Cirsium vulgare*)
- Milk thistle (*Silybum marianum*)

Because of the substantial limitations of grazing to control these invasive plants, most control will be performed using herbicides.

Some of these plants might be partially controlled (but not eliminated) using grazing management in the grasslands, including the targeting of specific invasive plant stands with short-duration high-

intensity grazing encompassed temporarily by portable electric fencing at the time of greatest vulnerability. As an example, Italian thistle might be controlled by short-duration high-intensity grazing. However, control of Italian thistle is generally regarded as uneconomical and impractical (Bossard, Randall, and Hoshovsky 2000). The high stocking densities necessary to achieve the desired impact on target weeds is normally not feasible on landscapes larger than a few hundred acres. However, the Glenwood Open Space Preserve is small and the use of targeted grazing within small temporary enclosures to control some pest plants is feasible. Livestock grazing might not effectively control bull thistle. The most effective control of bull thistle involves the use of herbicide, mowing, and in coastal areas possibly the biological control insect *Urophora stylatai*. Specific grazing management practices to control invasive plants noted above are described in Table 10.

Table 10. Grazing Management Practices for Invasive Plant Species at the Glenwood Open Space Preserve

Species	Grazing Management Considerations
Stinkwort (<i>Dittrichia graveolens</i>)	(Timing). Stinkwort is poisonous to sheep, and is generally avoided by cattle and horses. There are no known guidelines for using grazing as a control method. The seeds are sticky, and grazing of infested fields when seeds are present (generally autumn and early winter) may facilitate the spread of this species. Aminopyralid/triclopyr blended application when plants are young is recommended (Brownsey et al. 2013).
Pennyroyal (<i>Mentha pulegium</i>)	The plant is poisonous to livestock and grazing is not expected to be an effective control method.
Italian thistle (<i>Carduus pycnocephalus</i>)	(Timing/Intensity). Targeted grazing by goats or sheep has been effective when the infested area is excluded from the time of germination until plants reach a height of four to six inches, and then grazed with a high stocking rate for several weeks. Cattle generally avoid grazing thistles, but will sometimes eat the flowers. (DiTomaso et al. 2013). Aminopyralid (Milestone) can be effective.
Bull thistle (<i>Cirsium vulgare</i>)	(Timing/Intensity). Cattle will not consume bull thistle due to long, stiff spines at the end of the leaves and subtending the flowers. However, bull thistle tends to colonize in disturbed areas and under oaks. Aminopyralid (Milestone) can be effective.
Milk thistle (<i>Silybum marianum</i>)	(Intensity). Accumulated nitrates in milk thistle leaves are toxic to cattle (Fuller and McClintock 1986; Bean 1985). Thorny spines on the leaf margins and flower heads will cause selective avoidance by cattle although goats may consume it. Residual dry matter (RDM) in the late summer and fall is an important inhibiting factor in the germination of milk thistle seed. Thus, the level of grazing in areas supporting this plant should be carefully managed for appropriate levels of RDM (Bartolome et al. 1980). Avoid soil disturbance due to cattle concentration (Bean 1985). Aminopyralid (Milestone) can be effective.

Surface Water Drainage and Water Quality Affected by Grazing

The Glenwood Open Space Preserve is located in the San Lorenzo River watershed. The West Branch of Carbonera Creek and the smaller tributary along Glenwood Drive to the west run from north to south through the Glenwood Open Space Preserve. Carbonera Creek is a seasonal to perennial flowing stream with dense willow and oak-bay riparian stands along most reaches. A perennial stock pond sits in the central portion of the Glenwood Open Space Preserve (on the west side of the Pond Pasture), with a spillway that drains into the east branch of Carbonera

Creek. This spillway has a natural bedrock and soil bottom without armoring. Several ephemeral drainages take surface flows from the ridges and slopes within the Glenwood Open Space Preserve into either branch of Carbonera Creek.

A Sediment total maximum daily load (TMDL) for the San Lorenzo River (including Carbonera Creek) was approved by the U.S. Environmental Protection Agency on February 19, 2004. A Pathogen TMDL was approved for the San Lorenzo River Watershed (including Carbonera Creek) by the Central Coast Regional Water Quality Control Board (RWQCB) on March 21, 2008. A Nitrate TMDL for San Lorenzo River was approved by the US EPA on January 14, 2003 (CCRWQCB 2008). These TMDLs prohibit sediments, pathogens, and nutrients from entering the Creek (McNeil pers. comm. 2009). Carbonera Creek has been identified as supporting recreation and municipal uses, including drinking water, as beneficial uses (SWRCB 1994). This means that Carbonera Creek has been used or has the potential to be used for and must be managed for these purposes. Best Management Practices (BMPs), including exclusion of horses/cattle from the Creek could be used to comply with the TMDLs.

The Sediment TMDL requires that livestock operators, “promote improved livestock management practices to reduce discharge of sediment” and “improve riparian corridor protection, maintain channel integrity, implement alternatives to hard bank protection, and retain woody material” (CCRWQCB 2002). Listed treatment measures that can be used to comply with sediment reduction regulations include: dispersing runoff by directing water to grass filter strips; stabilizing soil by planting vegetation on bare areas; and reducing sedimentation of waterways by installing vegetated filter strips. Other practices to minimize pollution associated with livestock are to maintain service areas (such as corrals and watering troughs) away from drainages, proper maintenance of drainage on roads and trails, and maintaining grassland herbaceous mass above the recommended minimums of RDM.

McNeill (pers. comm. 2009) recommended that the grazing management plan include measures referred to as “Key Elements of an NPS Pollution Control Implementation Program,” which are identified in the Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program (SWRCB 2004). The four key elements are: 1) explicitly state that the plan purpose is to address pollution and maintain water quality, 2) describe how BMPs will be used, how BMPs were selected, and how BMP implementation will be verified, 3) if RWQCB states it is necessary, include a timeline to achieve water quality targets, and 4) include a method to determine whether water quality objectives are being achieved and whether additional BMPs are needed. This grazing strategy employs the appropriate practices to prevent or minimize pollution associated with livestock grazing.

Fire Hazard

Reduction of fire hazards associated with fuel loads in the grasslands at the Glenwood Open Space Preserve is an important goal that can be influenced by grazing. Accumulations of highly flammable herbaceous fuels in annual grasslands are a well-known problem during the dry seasons. In this case, livestock grazing is the preferred alternative, among the common methods of fuel reduction. Mowing is expensive and impractical in uneven terrain. Prescribed fire causes smoke pollution and can escape to cause severe damage to property and human health. It is also impractical to burn large areas every year.

Most grassland managers find the benefit of fire hazard reduction to be one of the primary incentives to employ grazing on their lands. However, it is important to note that grazing of annual grasslands at conventional levels has been shown to reduce the hazard of fuel loads and to alter the behavior of wildfires, but not to significantly reduce the risk of fire ignition and spread

(Stechman 1983). An increase in the intensity of grazing is often required to achieve fire hazard reduction objectives.

The herbaceous fuel loads of the grasslands fluctuate from year to year associated with weather conditions, the risks posed by these fuels can be reduced by grazing or other means. Regular livestock grazing at the Glenwood Open Space Preserve at stocking rates and times prescribed to utilize most of the available forage by the start of summer will help greatly reduce fire hazards. As a further precaution, fuel breaks should be maintained in strategically important grassland areas (such as adjacent to homes) with grazing by placing mineral/molasses licks to attract greater grazing there or other means as specified by the Scotts Valley Fire Protection District. The City and the LTSCC will continue to cooperate with local fire management authorities to develop and refine fire management plans for the Glenwood Open Space Preserve.

3.4.2.2 Grazing Capacity

Grazing capacity is a term equivalent to “carrying capacity,” and is used by rangeland ecologists and managers to estimate the maximum number of livestock and months to be grazed during a given year to avoid damage and to sustain vegetation and related resources.

The estimates of the Glenwood Open Space Preserve’s grazing capacity were based on the mapping of vegetation and soils. The estimates of forage available for livestock utilization were extrapolated from the NRCS soil descriptions (NRCS 2010) based on sampling conducted in 2000; NRCS production estimates from the Soil Survey of Santa Cruz County (NRCS 1980); and from field clippings and visual estimates made in 2008 in ungrazed grasslands at a nearby property with the same soils.

Grazing is managed by dividing the eastern portion of the Glenwood Open Space Preserve into several pastures, as shown in Figure 8. Rotating grazing between these pastures allows the ecologic goals to be met as well as the forage needs of the animals.

The stocking rate recommendations shown below are conservative and must be applied with flexibility due to the variable and unpredictable nature of California’s weather, which affects plant growth patterns dramatically. Thus, it will be necessary to make adjustments to the stocking rates each year to meet the Glenwood Open Space Preserve’s objectives and performance standards based on the experience of the Glenwood Open Space Preserve Manager and the Grazing Lessee and on weather predictions. The following stocking rates should be used as conservative initial guidelines (Tables 11 and 12) to determine the appropriate stocking rate each year and any adjustments. Table 110 shows the expected forage production in the grassland areas of the Glenwood Open Space Preserve.

Table 11. Grazable Acres and Expected Rangeland Forage Production by Weather Year², the Glenwood Open Space Preserve.

Pasture:	Grassland / Wetland Grassland						
	Beetle (D)	Tabor (C)	Pond (B)	Pond Exclosure	Canham (A)	West Preserve	Total
Potentially Grazable Acres	23	51	53	1	60	38	226
Wetter (Favorable) Weather Year (Lbs./acre)	39,000	104,000	109,000	2,100	99,000	78,000	432,000
Normal Weather Year (Lbs./acre)	26,000	69,000	72,000	1,400	66,000	52,000	288,000
Drier (Unfavorable) Weather Year (Lbs./acre)	17,000	46,000	49,000	950	44,000	35,000	192,000

Estimates of future forage production and forage available for grazing during normal, wetter, and drier years at the Glenwood Open Space Preserve's grasslands are shown in Table 12. These estimates represent the expected forage production minus the minimum RDM³ to be left ungrazed, predicted summer decomposition,⁴ potential wildlife utilization, and livestock trampling losses.

The recommended initial stocking rates were based on the amount of forage available for grazing (after deduction of the sum of the recommended RDM, summer decomposition, wildlife utilization, and livestock trampling loss), and calculated from the number of pounds of forage to be consumed by the horses or cattle per month. The number of Animal Units (AUs) to be grazed for a given grazing period can be calculated by dividing the Animal Unit Months (AUMs) by the number of months in the grazing period. That number should be calculated on a per animal basis for each kind and class of livestock, and adjusted with experience to achieve the objectives and performance standards.

The horse stocking rate for twelve months of grazing during normal weather years in the East Preserve would be 10 horses (avg. 1200 lbs.) for the 5 pastures, and 2 horses (avg. 1200 lbs.) in

² "Weather years" are terms used by the NRCS and rangeland managers to describe the variation in the combination of precipitation and temperatures experienced by grassland plants during the growing season that affect germination and the production of biomass. A normal weather year corresponds to the average precipitation and temperatures; unfavorable weather years are significantly drier and colder; favorable weather years are significantly wetter and warmer.

³ RDM refers to the dry mass (and height) of plant matter left on the ground from previous growth before the start of the next winter growing season (September/October). The amount and species of forage that is produced in a growing season is largely dependent on the environment of soil and RDM during the previous late autumn. This affects seed germination and seedling growth, and will be optimized under the indicated range of herbaceous mass and height. The RDM standards are based on Table 11 in Bartolome et al. (2006). We used the RDM standard for dry annual grassland on 10-20% slope with 0-25% woody cover.

⁴ Refer to Frost, Bartolome, and Churches (2005); Decomposition of dry herbaceous biomass during the summer and fall occurs at the rate of about 7% per month. Compounding that decomposition rate plus 1% (total 8%) for the other factors (potential wildlife utilization and livestock trampling losses) for four months (June through September) would result in about 36% additional herbaceous biomass. Therefore, those percentages more of residual biomass should be added to the recommended RDM level at the end of the grazing period.

the West Preserve. The cattle stocking rate for 6 months of grazing during normal weather years would be 32 cattle (avg. 1000 lbs.) for the 5 pastures in the East Preserve, and 6 cattle (avg. 1000 lbs.) in the West Preserve. These are conservative estimates and must be adjusted based on experience. We also recognize that in some unfavorable years a reduced number of animals will be required to achieve conservation goals. However, even these reduced numbers should be sufficient for a viable horse or cattle operation, and flexibility will likely allow the operation to persist until better conditions return. Monitoring results will indicate any needed adjustments.

Table 12. Forage Available by Weather Year, the Glenwood Open Space Preserve

Pasture: Weather Year:	Grassland / Wetland Grassland						
	Beetle (D)	Tabor (C)	Pond (B)	Pond Exclosure	Canham (A)	West Preserve	Total
RDM Standard (Lbs./acre)	300	600	600	600	300	600	
Deduction for Autumn RDM, Summer Decomposition, Wildlife Utilization, and Trampling (36% of RDM--Total Lbs.)	108	216	216	216	108	216	
Forage Available (Lbs. / AUMs⁵):							
Wetter (Favorable) Weather Year	36,000 / 36	86,000 / 86	90,000 / 90	1800 / 2	94,000 / 94	65,000 / 65	372,000 / 373
Normal Weather Year	23,000 / 23	51,000 / 51	53,000 / 53	1000 / 1	60,000 / 60	38,000 / 38	227,000 / 226
Drier (Unfavorable) Weather Year	14,000/ 14	28,000 / 28	29,000 / 29	569 / 1	38,000 / 38	21,000 / 21	131,000 / 131

Estimates of the potential maximum stocking rates for horses and cattle to achieve the desired degree of forage utilization from the forage available during wetter, normal, and drier years at the Glenwood Open Space Preserve's grasslands are shown in Table 13.⁶

⁵ An Animal Unit Month (AUM) refers to the standard of 1000 lbs. of forage, which is the expected amount of forage normally consumed by a 1000 lbs. cow, with or without her unweaned calf, in one month; thus the AUM standard for such a cow is 1.0. Horses have a higher rate of forage demand than cattle due to a different digestive system (daily intake as % of body weight--cattle 2.5%, horses 3%). Horses have a higher rate of forage demand than cattle due to a different digestive system (daily intake as % of body weight--cattle 2.5%, horses 3%). Thus the expected standard amount of forage normally consumed by a 1200 lbs. horse in one month is 1440 lbs., and the equivalent AUM = 1.4.

⁶ Stocking rates were calculated in the following fashion: forage production in dry, normal, and wet weather years was determined (see discussion above); amount of RDM to be left standing at the end of the grazing season was subtracted from forage production values to get total available forage; total available forage was converted to AUMs; AUMs were then converted to the number of horses to be grazed for 12 months and cattle to be grazed for 6 months.

Table 13. Initial Stocking Rate Estimates (numbers of 1,200lbs. horses grazing for 12 months and 1,000lbs. cattle grazing for 6 months) by Weather Year, the Glenwood Open Space Preserve

Pasture:	Grassland / Wetland Grassland						
	Beetle (D)	Tabor (C)	Pond (B)	Pond Exclosure	Canham (A)	West Preserve	Total
Weather Year:							
Number of 1200 lb. horses grazing for 12 months:							
Wetter (Favorable) Weather Year	2	5	5	0.1	5	4	21
Normal Weather Year	1	3	3	0.1	3	2	12
Drier (Unfavorable) Weather Year	1	2	2	0	2	1	8
Number of 1000 lb. cattle grazing for 6 months:							
Wetter (Favorable) Weather Year	6	14	15	0.3	16	11	62
Normal Weather Year	4	9	9	0.2	10	6	38
Drier (Unfavorable) Weather Year	2	5	5	0.1	6	3	21

The pasture labeled “Pond Exclosure” in the tables above encompasses the currently occupied habitat area for the Opler’s longhorn moth. This area is small, and contributes only a small amount of forage. Its grazing prescription allows for grazing only when needed, and may be excluded from grazing when not beneficial or for purposes related to pond management. Thus, it adds little to the grazing capacity of the Glenwood Open Space Preserve, and may be entirely ungrazed some years.

3.4.2.3 Grazing and Adaptive Management Prescriptions

Grazing is one of the primary tools available to reduce the competing cover of non-native annual grasses and native shrubs of this habitat (Arnold et al. 2012, Cornelisse et al 2013, Knisley and Arnold 2013). The grazing prescriptions and practices to utilize grazing as a tool to manage OTB and special-status, sensitive and listed plant habitats at the Glenwood Open Space Preserve (Table 14) will include the practical testing of hypotheses to maintain and enhance habitat quality, and then adapting those prescriptions based on the results of monitoring. In addition, means to expose patches of bare soil, such as flaming and scraping, may supplement tests of scraping elsewhere (Knisely and Arnold 2004).

Preliminary Grazing Prescription

Table 14. Preliminary Calendar for Grazing of Pastures (Recommended for Years of Normal Precipitation, adjust as needed), updated July 2017.

Access to Pasture	Beetle D	Tabor C	Pond B	Pond Exclosure E	Canham A	Rationale
Jan	Open? / weed-whacking	Open	Open	Open? / weed-whacking	Excluded	Canham excluded due to risks of damage to wetland plants and soils and gully erosion with associated lowering water table; Pond & Tabor open to allow grazing, especially of uplands; Beetle & Moth open to maintain trails and control growth (ahead of rapid spring growth); exclude Beetle & Moth temporarily if soils saturated or moist enough for ovi-positing; confine cattle in Beetle if excess growth when feasible; terminate Beetle trail weed-whacking 1/15
Feb	Open?	Open	Open	Open?	Excluded	Canham excluded due to risks of damage to wetland plants and soils and gully erosion with associated lowering water table; Pond & Tabor open to allow grazing, especially of uplands; Beetle & Moth open unless insufficient forage or grazing not needed to reduce excess growth; exclude Beetle & Moth temporarily if soils saturated or moist enough for ovi-positing; confine cattle in Beetle if excess growth when feasible
Mar	Open?	Open	Open	Open?	Excluded	Canham excluded due to risks of damage to wetland plants and soils and gully erosion with associated lowering water table; Pond & Tabor open to allow grazing, and to control growth; Beetle open unless insufficient forage or grazing not needed to reduce excess growth, and to allow growth that will lead to more heterogeneity; Moth excluded due to emerging cream cups; exclude Beetle & Moth temporarily only if soils very saturated; confine cattle in Beetle if excess growth when feasible
Apr	Open	Open	Open	Excluded	Excluded?	Canham excluded due to risks of damage to wetland plants and soils and gully erosion with associated lowering water table; Canham open to temporary grazing if needed and to reduce excess growth; Pond & Tabor open to allow grazing, and to control growth, especially fire fuels; Beetle open to control rapid spring growth and maintain trails; Moth excluded due to cream cups; exclude Beetle temporarily only if soils very saturated; confine cattle in Beetle and if excess growth when feasible

Access to Pasture	Beetle D	Tabor C	Pond B	Pond Exclosure E	Canham A	Rationale
May	Open?	Open	Open	Excluded	Open?	Canham open to control growth if dry enough; Pond & Tabor open to allow grazing, and to control growth, especially fire fuels; Beetle open to control rapid spring growth and maintain trails; Beetle terminate grazing when RDM, native grass grazing, and heterogeneity limits reached; Moth excluded
Jun	Excluded?	Open	Open	Excluded	Open?	Canham open to control growth if dry enough; Pond & Tabor open to allow grazing, and to control growth, especially fire fuels; Beetle open unless insufficient forage, or grazing is no longer needed to reduce excess growth; Beetle terminate grazing when RDM, native grass grazing, and heterogeneity limits reached; Moth excluded
Jul	Excluded?	Open	Open	Excluded?	Open	Canham open to control growth and shrub encroachment, and to provide better forage; Pond & Tabor open to allow grazing, and to control growth, especially fire fuels; Beetle and Moth excluded
Aug	Excluded	Open	Open	Excluded?	Open	Canham open to control growth and shrub encroachment, and to provide better forage; Pond & Tabor open to allow grazing, and to control growth, especially fire fuels; Beetle & Moth excluded due to insufficient forage, grazing not needed, and extra risk of impact to soils and native grasses
Sep	Excluded	Open	Open	Excluded?	Open	Same as August
Oct	Excluded / weed-whacking ?	Open	Open	Excluded?	Open	Canham open to allow grazing, control growth and shrub encroachment, and to provide better forage; Pond & Tabor open to allow grazing, and to control growth; Beetle & Moth excluded; Beetle trail weed-whacking begins after germinating rains to prevent establishment and keep trail tread cleared
Nov	Excluded / weed-whacking ?	Open	Open	Open?	Open	Canham open to allow grazing, control growth and shrub encroachment, and to provide better forage until water table rises and wetlands are saturated; Pond & Tabor open to allow grazing; Beetle & Moth excluded due to insufficient forage, grazing not needed, and extra risk of impact to soils and native grasses; Beetle trail weed-whacking to keep trail tread cleared; monitor closely for increased utilization and hoof impacts, and thus erosion risk due to drought

Access to Pasture	Beetle D	Tabor C	Pond B	Pond Enclosure E	Canham A	Rationale
Dec	Excluded / weed-whacking	Open	Open	Open?	Excluded?	Assuming normal rainfall this month, Canham excluded due to risks of damage to wetland plants and soils and gully erosion with associated lowering water table; Pond & Tabor open to allow grazing, especially of uplands; Beetle & Moth grazed if sufficient forage and grazing needed to control growth; Beetle trail weed-whacking to keep trail tread cleared

3.4.3 Invasive Species

Invasive plant species shall continue to be managed by grazing, mechanical, and chemical methods. Non-native annual grasses will continue to be managed primarily by grazing. Large scale mowing is impractical due to the terrain and presence of sensitive species in the Glenwood Open Space Preserve.

To minimize impacts to pollinators, herbicide formulations reported as “non-toxic”, “practically non-toxic” or “relatively non-toxic” to insects, such as bees, on the Extension Toxicology Network (EXTOXNET) or similar university database, may be used, according to the label. Such herbicides may be used as needed for invasive plant species control in areas outside habitat occupied by listed plant species. Such herbicides that are also post-emergent and non-persistent may be used in habitat occupied by listed species provided that the listed species in that habitat are dormant. Target forbs shall include those species listed as “High” or “Moderate” by the California Invasive Plant Council (Cal-IPC 2012).

Recent invasive species control efforts focus on those areas and species with the greatest potential to threaten sensitive habitats (i.e. wetlands, Scotts Valley spineflower populations). Immediately following the monitoring period (typically spring), a landscape contractor will collect data to conduct control methods on a habitat- and species-specific basis. Targeted species included pennyroyal (*Mentha pulegium*), stinkwort (*Dittrichia graveolens*), mayweed (*Anthemis cotula*), acacia species (*Acacia spp.*), bull thistle (*Cirsium vulgare*), Italian thistle (*Carduus pycnocephalus*), teasel (*Dipsacus fullonum*), French broom (*Genista monspessulana*), Scotch broom (*Cytisus scoparius*), jubata grass (*Cortaderia jubata*), johnsongrass (*Sorghum halepense*), velvet grass (*Holcus lanatus*), and eucalyptus (*Eucalyptus sp.*).

Invasive plant species shall continue to be monitored annually.

The following recommendations will guide invasive plant species management:

- All plant species categorized as “High” or “Moderate” on the Cal-IPC list (2006) shall be managed with appropriate controls.
- Non-native grasses shall be managed through grazing; the extensive distribution, site topography, and presence of sensitive species make other methods (e.g. mowing) impracticable. Some perennial grass species, such as velvet grass, jubata grass, Johnsongrass and Harding grass may be managed with herbicides.
- Mature eucalyptus trees shall generally remain in place unless otherwise considered a hazard or significantly impacting habitat; eucalyptus seedlings shall be removed on a regular basis to prevent a decline in available grazing forage and conversion from grassland habitat to eucalyptus grove.
- Mature and seedling acacia trees shall be removed by mechanical methods (i.e. cutting) followed by a topical herbicide; all mature acacia trees have been removed along Carbonera Creek, but young trees will be removed mechanically and/or treated with herbicide as necessary.
- French broom, Scotch broom, and pampas grass were removed in 2009; however should these species emerge in the Glenwood Open Space Preserve again, they shall be managed mechanically (hand pulling) or chemically with seed bearing material moved off site.

- Pennyroyal may be controlled by chemical methods, according to label, or by hand-digging or hand removal of rhizomes in the late spring when the soil moisture is still high, but management during saturated or inundated conditions should be avoided.
- Italian thistle, bull thistle, and teasel that is likely to adversely impact sensitive habitats shall be controlled using chemical methods, or weed-whacked annually in late spring prior to bloom; Italian thistle and bull thistle are known throughout the Glenwood Open Space Preserve and Glenwood Open Space Preserve-wide management of these species is likely impracticable, therefore targeted locations within or near sensitive habitats should be of the highest priority.
- New invasive plants will be managed on a case by case basis, based on their potential impact to listed species and the efficacy of management at eradicating or containing the plant. For example, stinkwort (*Dittrichia graveolens*) is a newly arrived, fast expanding weed that will be aggressively treated with herbicide and hand-pulling. Effectiveness of the effort will be evaluated in the first year to determine if the weed is manageable or if management efforts are ineffective and should be abandoned.

3.4.4 Open Grassland Habitat Maintenance

The area of grassland that provides habitat for sensitive plant and wildlife species within the Glenwood Open Space Preserve has likely decreased as shrubs, such as coyote brush, and willows have become established. The current cattle-grazing regime that focuses on winter and spring effects is unlikely to be effective in restoring open grassland habitat. Therefore, manual or mechanical scrub control or periodic summer grazing by cattle will be required to prevent further expansion. Clearing of existing scrub and willow woodland should be conducted gradually and experimentally to assure the increase of benefits and reduction of risk to special-status, sensitive and listed plants.

Scrub clearing is likely to result in a net benefit to the special-status, sensitive and listed plants at the Glenwood Open Space Preserve since scrub invasion has probably already covered several former grassland sites where special-status, sensitive and listed plants were located before the invasion, but have since disappeared. Thus, scrub invasion might be suppressing the growth of special-status, sensitive and listed plants. Re-conversion from scrub to grassland might expand the current habitat for all of the special-status grassland plants, and should be investigated.

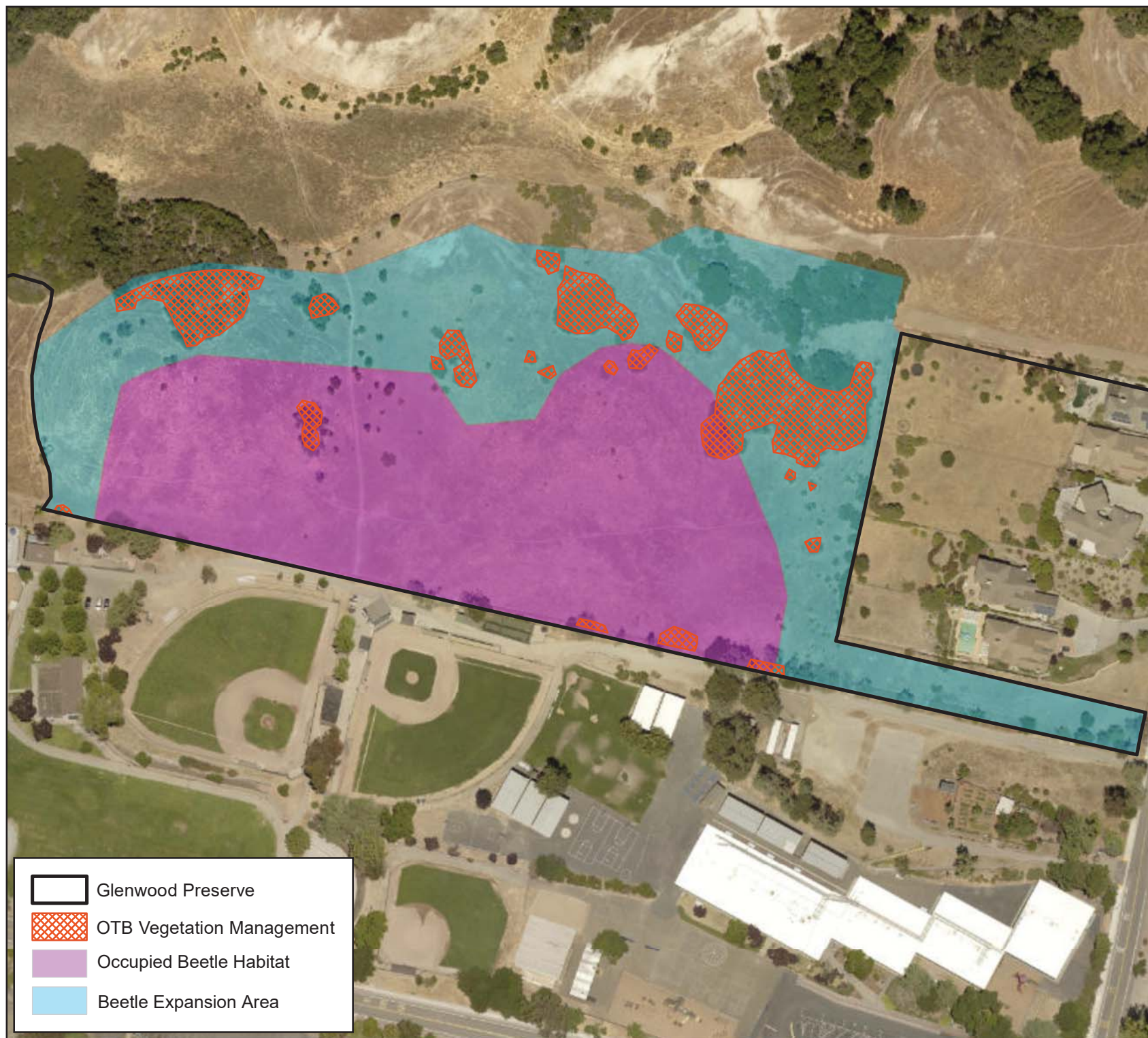
No negative impacts to special-status, sensitive and listed plant species are expected to occur due to scrub removal as long as special-status, sensitive and listed plants have temporary protection from removal and damage as the scrub is cleared, and the resulting debris is hauled off-site or pile-burned on-site. An appropriate path, avoiding the known areas of special-status, sensitive and listed plants, should be established for removal of scrub debris from the site. The special-status, sensitive and listed plants are annuals. In order to prevent damage to these species, manual scrub removal should be conducted after the flowers of the special-status, sensitive and listed plants have gone to seed (fall). During scrub removal, care should be taken minimize removal of soil containing the special-status, sensitive and listed plant seed bank.





Shrub and tree removal will be conducted within the Beetle Pasture Management Zone to mitigate for potential negative impacts from trail construction to areas historically occupied but currently unoccupied by OTB. The proposed removal includes 2,857 square meters of coyote brush and trees and 563 square meters of Monterey cypress (*Hesperocyparis macrocarpa* [*Cupressus macrocarpa*]) (Figure 9).

Glenwood Preserve

Scott's Valley,
California

Figure 9. Proposed
Shrub and Tree
Removal within
Beetle Pasture



-  Glenwood Preserve
-  OTB Vegetation Management
-  Occupied Beetle Habitat
-  Beetle Expansion Area



0 50 100 200
Feet

Map Prepared Date: 7/19/2017
Map Prepared By: SGillespie
Base Source: Esri Streaming Imagery
Data Source(s): WRA, Land Trust Santa Cruz
County, Entomological Consulting Services, Ltd.

Scrub removal may be conducted in other portions of the preserve at the discretion of the Preserve Manager and with advice from the Rangeland Ecologist, who should consider ecologic, aesthetic and privacy issues when determining scrub to remove.

3.5 Public Access

Public access into the Glenwood Open Space Preserve is a shared goal between the City and the Land Trust. Public access outside of currently occupied OTB habitat has the potential to provide beneficial effects to OTB. Resulting trails can be considered a recovery action due to the suitable habitat they may create through increased bare ground. Bare ground is essential for both OTB adults and larvae because of their visual hunting and mate finding natural history characteristics and creation of bare ground has been shown to augment OTB colonization within patch habitat (Cornelisse et al. 2013). A moderate to high level of soil compaction, a sign of disturbance, has also been shown to indicate high quality oviposition habitat for some tiger beetle species (Knisley 2011, Cornelisse 2013). Pedestrian traffic of no more than moderate frequency has been shown to be effective in maintaining compacted soils and bare ground for OTB burrows (Arnold et al, 2012). Higher levels of pedestrian or bicycle traffic have also been observed to be detrimental to OTB and its habitat (Arnold et al 2012; Cornelisse and Duane 2013), but the threshold between moderate and high levels has yet to be accurately determined. However, it is also well known that recreational usage in areas that support OTB or its relatives can result in trampling of life stages, disruption of their normal behaviors, impacts to prey items, and damage to their habitats (Cornelisse and Hafernik 2009; Cornelisse and Duane 2013; Knisley and Hill 1992; Pearson and Vogler 2001; and Rivers-Moore and Samways 1996).

The intensity of public use of the Glenwood Open Space Preserve is difficult to forecast, and exclusion of the un-escorted public from occupied OTB habitat is infeasible. Thus, to meet the biological goals and provide public access to the Glenwood Open Space Preserve, a number of management measures will be implemented. Gated access, educational signage, and appropriate trail infrastructure will be designed and installed to avoid and minimize impacts to sensitive habitats. OTB use of trails outside existing occupied habitat would require adaptive management of the intensity of trail use by the public. Monitoring and adaptive management will be performed to verify that special-status, sensitive and listed species are not impacted by recreational usage at the Glenwood Open Space Preserve.

3.5.1 Allowable Public Uses

The location and timing of public access to various portions of the Glenwood Open Space Preserve will be limited based on the sensitive habitats present, the time of year, and the kind and class of grazing animals present. Use of the Glenwood Open Space Preserve by the public will be limited to pedestrians during daylight hours. Use may be restricted to designated trails in certain Management Zones. Use may also be prohibited or restricted seasonally in special-status species habitat as well as during periods of potential conflict with livestock occupying defined pastures as determined by the Glenwood Open Space Preserve Manager.

Because the Glenwood Open Space Preserve contains special-status species and habitats, certain uses will not be allowed. Allowable public uses will include hiking, fishing, and wildlife viewing. Non-allowable uses will include but will not be limited to dumping, littering, camping, campfires, overnight use, consumption of alcohol, collecting live animals or plants, collecting wood, and unauthorized motorized vehicles. Dogs, if allowed in the future, will be prohibited from areas that are grazed to avoid conflict between dogs and livestock. Bicycles, if allowed in the future, will be prohibited from areas occupied by OTB, Opler's longhorn moth, Scotts Valley

spineflower, erosion-prone areas, or certain Management Zones, as well as defined areas of potential conflict with pedestrians.

To reduce impacts to the aquatic environment, signage will be installed to discourage the use of live bait, chemical bait, and lead weights. In addition, facilities to collect waste fishing gear will be provided.

Fire protection will remain the responsibility of the Scotts Valley Fire District. Maintenance of the Scotts Valley Water District facilities, road, and easement shall remain the responsibility of the Scotts Valley Water District. Vehicular access shall remain restricted to the Scotts Valley Fire District, Scotts Valley Water District, emergency services, City, Land Trust, grazing managers, Glenwood Open Space Preserve Managers, and any others permitted by the Glenwood Open Space Preserve Manager.

3.5.1.1 Public Access to Sensitive Habitats

To provide recreational access and protect species habitat in the Glenwood Open Space Preserve, a trail system will be designed to avoid direct and indirect impacts to the species covered in this LTMP and their habitats. Trail construction will be prohibited in the Beetle Pasture Management Zone, which encompasses all occupied habitat of that species. Constructed trails should be located to provide 50-foot buffers to occupied Scotts Valley spineflower habitat. Constructed trails should avoid or minimize impacts to the maximum extent feasible to sensitive habitats including wetlands, riparian areas, streams, and grassland areas dominated by native plants. In some instances, low to moderate intensity hiking may be allowed and encouraged on existing livestock paths to maintain bare ground for OTB and other disturbance dependent species. Access through occupied special-status, sensitive and listed species habitat will be restricted to existing animal paths. Trail building will not occur in these areas. If monitoring indicates that off-trail hiking is becoming a problem for listed species, it will be discouraged through signage at all entry points. If problems persist, the issue will be addressed through increased patrol and visitor engagement, followed by additional measures such as closure of one or more trails. If the issue is not resolved, the property will be closed to public access. This approach will also be taken if public access in other parts of the property jeopardizes successful management of the OTB habitat. For example, if public access makes grazing or similarly effective management of the beetle pasture infeasible, then public access would be removed. New trails and trail heads, especially those in proximity to occupied OTB areas, are likely to attract OTB adults and potentially provide burrow habitat. Monitoring in these areas will be conducted to ensure trails are a benefit to the species.

3.5.1.2 Public Access and Livestock Interactions

The need for grazing management of sensitive habitats necessitates care in the interaction between public use and grazing animals. All entry points to the East Preserve and the West Preserve (if grazing is introduced there), will have signage detailing the potential dangers of grazing animals, and provide precautions for the public when encountering these animals. Dogs will not be allowed in portions of the Glenwood Open Space Preserve where grazing animals are present.

Trail use in areas with active cattle or horse grazing would pose some risk of injury to the public. Compared to horse grazing, cattle grazing on public lands is more commonplace, and the risks with cattle can be managed more efficiently. Only grazing operators with experience managing cattle herds where public access is provided should be selected as lessees. The City of Santa Cruz and the University of California, Santa Cruz presently allow public access to areas where

cattle are present. Thirteen San Francisco Bay area agencies, including the East Bay Regional Park District and Point Reyes National Seashore (National Park Service) host public access on over 130,000 acres of actively grazed lands (Barry and Amme 2009). The pastures occupied by OTB and Opler's longhorn moth are small compared to other currently defined pastures, and thus confining livestock in these pastures may pose higher risk of conflict with the public. Therefore, confined grazing by cattle or other livestock will require periodic closure of these areas to the public.

The risk of injury to Glenwood Open Space Preserve users in pastures grazed by horses is much greater than with cattle. As a result, the public will not be allowed in pastures actively grazed by horses and the authorization of grazing by horses compared to cattle would necessarily result in more limited public access or more expensive infrastructure. The horse grazing operation historically used at the Glenwood Open Space Preserve can be characterized as extensive grazing where the horses had no stables or separated paddocks and grazed on natural grass with little supplemental feed. Under these conditions, grazing horses normally develop a hierarchical social structure and behavior when interacting with people can be aggressive and unpredictable. Given this potential danger and that horses are sensitive to some common human foods, feeding of horses by the public can pose a danger for horses and humans alike. If horses are used for grazing management and extensive public access is desired, additional public access infrastructure will be necessary. However, because use by horses and people will not be allowed concurrently in the same pasture, use of horse grazing at the Glenwood Open Space Preserve would require periodic closure of pastures to the public.

3.5.2 Public Access Infrastructure

Public access infrastructure should be designed to avoid occupied species habitats and minimize impacts to wetlands, waters, native grasslands, rock outcrops, and other special-status or sensitive species.

Public access to the Glenwood Open Space Preserve and between pasture units will be controlled using pedestrian gates. The gates should be lockable to allow the public to be excluded from pastures occupied by livestock if necessary. Perimeter gates and interior pasture gates should be designed with a spring hinge and latch or other design to ensure that livestock cannot escape. Access points may be added next to existing internal gates designed to allow or prevent the movement of grazing animals between pastures. Likewise, gates allowing access to sensitive species habitat (i.e. OTB habitat) will be lockable to control public access to the area during critical life history functions of special-status species.

Information signs should be posted at all entrance points. The signs should include the following information:

- Ownership / partnership and a brief history of the Glenwood Open Space Preserve
- The acreage of the Glenwood Open Space Preserve and general location within Santa Cruz County
- Public safety notice detailing the dangers and liabilities for those entering the Glenwood Open Space Preserve
 - Special attention regarding grazing animals including safety of both hikers and grazing animals
 - No dogs or bicycles shall be allowed in the Eastern Preserve because of routine use of these areas by grazing livestock
- The purpose of grazing animals and grazing management

- The sensitive habitats and species supported by the Glenwood Open Space Preserve and steps visitors can take to protect them and contact information to report violations.
- Limits on access (i.e. daily hours, seasonal exclusions) and allowable uses
- Images of habitats / species (photographs / line drawings)

Additionally, interpretive signs could be posted at selected trailside locations within the Glenwood Open Space Preserve that should be worded to avoid identifying specific locations of habitat areas to avoid investigation and potential collection by visitors. All signage should be periodically monitored for maintenance and replacement.

Trail building will take all prudent and available measures to minimize unnecessary vegetation removal, and limit erosion. Typical trail width will be three feet with a full-bench cut and up to a maximum of five feet with a half-bench cut. Trail beds should be comprised of native soil unless gravel or other natural substrate is necessary for erosion control. Wherever possible, trail grades should not exceed 10 percent with 5 percent being most desirable. Switchbacks may need to be installed in areas exceeding 10 percent slope. To route surface water runoff and reduce erosion, grade reversals may be constructed. In areas where side slopes are greater than 10 percent, it may be necessary to either cut in a stable back slope or reinforce the downslope for public safety and erosion control. Prior to construction, a biologist familiar with the habitats and species present in the Glenwood Open Space Preserve will survey the trail alignment in areas mapped as hosting or historically hosting special-status, sensitive and listed special-status organisms.

3.5.3 Public Access Conceptual Design

A conceptual design for initial public access infrastructure (Figure 10) has been prepared to demonstrate avoidance and minimization of impacts to sensitive areas described above. Future trail construction would also utilize similar design to avoid and minimize potential impacts to sensitive areas. The relationship between infrastructure design, recreational access experience, and grazing management is described below.

The trail layout in the initial design provides a continuous route from Vine Hill School and Siltanen Park in the south of the Glenwood Open Space Preserve to Canham Road in the north. To avoid trail construction impacts to wetlands and streams, existing trails are used as dry season crossings in several locations. During wet weather, alternate routes are provided with bridge crossings of wetlands and streams.

Newly constructed and passively formed trails would allow for access from Siltanen Park on the west and Vine Hill School on the east. They would be separated from occupied OTB habitat. On the eastern boundary of the Beetle Pasture, a trail formed through passive use (rather than scraping or other active construction) would be allowed within the historic OTB habitat. A seasonal fence system will be installed without ground penetrating posts to create a visual barrier that will help to divert visitors away from the adjacent occupied OTB habitat. This configuration would allow for through-access to bypass occupied OTB habitat. No trails will pass through occupied OTB habitat, and occupied OTB habitat will be kept closed to the public. Most public access is intended to use the western entrance at Siltanen Park and access the Glenwood Open Space Preserve without passing through the historic OTB habitat. Trails in most the Glenwood Open Space Preserve will be open year-round, although temporary closures may be conducted for wet weather or extreme fire risk. An exception is made for the eastern access trail.

The eastern access trail, which passes through historic OTB habitat, will have gates allowing it to be closed during the active OTB season, wet weather, or intensive grazing. This area will be open for public access during the period of September 1 through December 15. Lockable pedestrian gates would allow controlled access into the Beetle Pasture Management Zone where signage would restrict pedestrians to existing trails during periods of dry weather/soils. The intention for this trail is for use by teachers and students from Vine Hill Elementary School. Teachers would coordinate with the Preserve Manager for access. The new eastern trail and fenced corridor would be constructed in an area that was historically but is currently unoccupied by OTB. This trail would be closed during the period from December 15 through August 31 to allow for high-intensity grazing, wet soil conditions, and adult OTB activity. If the OTB re-occupies the area, management may be adjusted to manage the risk of impacts to the species and enhance the restoration of the population in this area. (Foot traffic may restore the formerly occupied habitat in that area).

The western trail outside the relocated western and northern Beetle Pasture Management Zone fence is in areas with soil, slope, and aspect conditions unlikely to support OTB. OTB have occasionally been observed outside of the area of occupied habitat. A conceptual design for initial public access infrastructure (Figure 11) has been prepared to demonstrate avoidance and minimization of impacts the beetle pasture management zone.

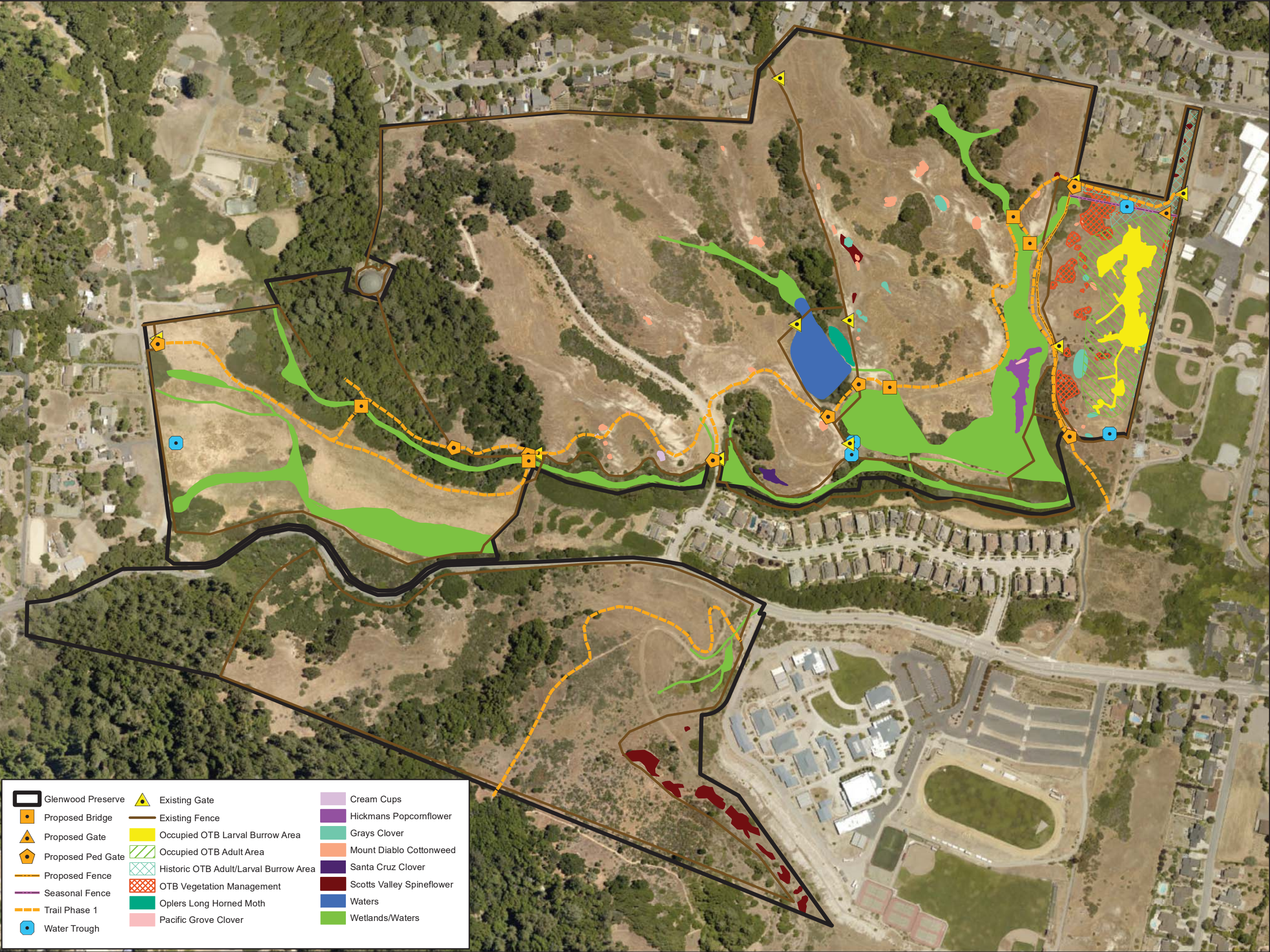
Designated trails in other pastures will similarly be designed for occupied Scott Valley spineflower and Opler's longhorn moth habitat. Trails will be designed to avoid occupied and potential habitat areas of other special-status plant species, except where no reasonable alternative outside of that habitat is available. Such trails will be designed to follow an existing livestock trail and traverse the habitat area only across its narrowest dimension. Monitoring will determine whether these public access plans are successful. If impacts to special-status, sensitive and listed species habitats, soil erosion effectiveness livestock grazing, or other special management concern are found, then plans will be adapted to reduce impacts.

3.6 Public Safety and Security

Public safety within the Glenwood Open Space Preserve will be the responsibility of the Scotts Valley Fire District. The public, the Land Trust staff, its consultants and grazing operators will contact the City of Scotts Valley Police Department and Fire District as appropriate in the event of a potential violation of Glenwood Open Space Preserve rules, criminal activity, or other public safety concern. To maintain public safety, all external access gates shall remain accessible to emergency service vehicles. The endowment for the Glenwood Open Space Preserve will cover the capital cost of maintaining perimeter Glenwood Open Space Preserve fencing in a condition necessary to prevent escape of grazing animals.

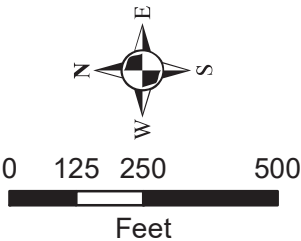
3.6.1 Fire Hazard Management

At the direction of the Scotts Valley Fire Protection District, the City will perform mowing and/or disking of fire fuel breaks within the Glenwood Open Space Preserve. The City will coordinate with Scotts Valley Fire District and the Glenwood Open Space Preserve Manager to avoid impacts to special-status, sensitive and listed species habitat to the maximum extent feasible while meeting fire hazard management objectives. Reduction of fuel loads in the grasslands can be influenced by grazing, however fire hazard reduction is not a goal of grazing and other habitat management activities at the Glenwood Open Space Preserve.



Glenwood Preserve
Scotts Valley,
California

Figure 10.
Conceptual Design
for Initial Public
Access Infrastructure

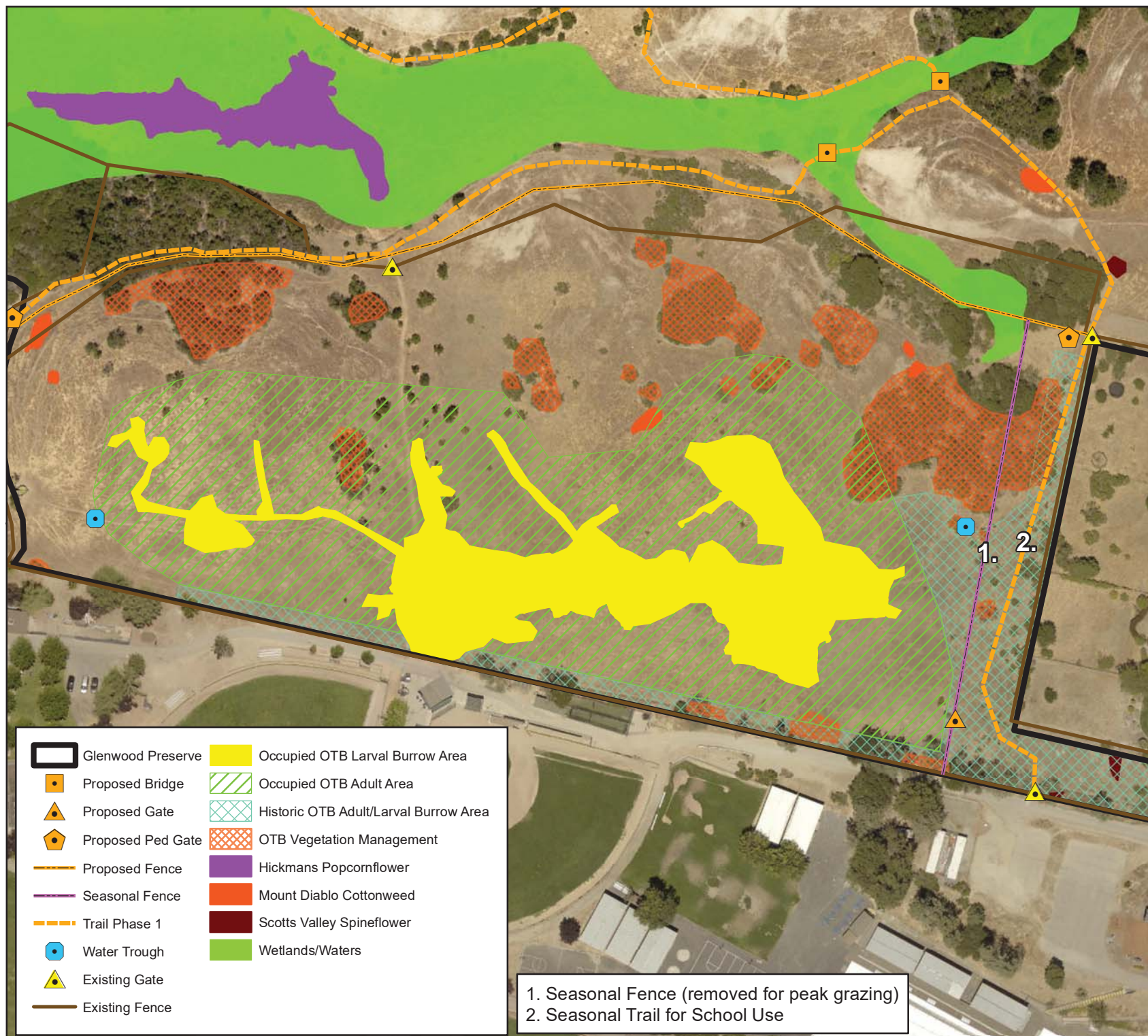




















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Glenwood Preserve

Scott's Valley,
California

Figure 11.
Conceptual Design
for Initial Public
Access
Infrastructure for
Beetle Pasture
Management Zone



- | | | | |
|--|-------------------|---|---------------------------------------|
|  | Glenwood Preserve |  | Occupied OTB Larval Burrow Area |
|  | Proposed Bridge |  | Occupied OTB Adult Area |
|  | Proposed Gate |  | Historic OTB Adult/Larval Burrow Area |
|  | Proposed Ped Gate |  | OTB Vegetation Management |
|  | Proposed Fence |  | Hickmans Popcornflower |
|  | Seasonal Fence |  | Mount Diablo Cottonweed |
|  | Trail Phase 1 |  | Scotts Valley Spineflower |
|  | Water Trough |  | Wetlands/Waters |
|  | Existing Gate | | |
|  | Existing Fence | | |



0 25 50 100
Feet

Map Prepared Date: 11/3/2017
Map Prepared By: sgillespie
Base Source: Esri Streaming Imagery
Data Source(s): WRA

3.7 Long-Term Monitoring and Reporting

Monitoring will collect data and interpret results on grazing management, recreational usage, and potential effects to sensitive species, invasive species control, infrastructure, OTB populations, Scotts Valley spineflower populations, and Scotts Valley polygonum populations (not previously observed within the Glenwood Open Space Preserve). Monitoring reports will include recommendations for future management. Baseline data for the OTB has been collected from 2000 to 2017. Baseline data for Scotts Valley spineflower was collected in 1992, from 2004 through 2010 and in 2015. To assess the continued effectiveness of management activities, existing data collected during the previous baseline period will be supplemented with ongoing data collection. Monitoring of the OTB during at least a three-year additional baseline period will be conducted using relatively intensive quantitative methods. Monitoring for the OTB will be continued indefinitely, and intensive quantitative methods will be sustained, unless it becomes cost prohibitive to do so. After the three-year additional baseline period, and obtaining required permits from the state and federal regulatory agencies, the Land Trust will perform such monitoring in-house to contain costs. Monitoring for special-status plants will be performed every two years as described below in the section Long-Term Monitoring and Reporting. As detailed in the Adaptive Management Strategy section below, following the additional baseline period, quantitative monitoring may be reduced. Qualitative monitoring of special-status, sensitive and listed species, grazing, and invasive plants monitoring will be conducted annually. Monitoring for special-status, sensitive and listed species will be conducted by qualified biologists. The report will be provided to the City, the Land Trust, and the Service (Ventura Office).

3.7.1 *Grazing Monitoring*

Monitoring related to livestock grazing at the Glenwood Open Space Preserve will be focused on the effectiveness of the grazing management strategy and tactics used during the previous period to achieve their intended purposes, informing the managers whether adjustments to strategy are needed, and cooperating with the Grazing Operators to identify and address issues important to achieve both conservation objectives and a sustainable livestock operation. Quantitative monitoring will be performed by the Rangeland Ecologist at least twice per year, and measure the following items: habitat conditions (mainly in the Beetle Pasture and Pond Exclosure); biomass and height of herbaceous vegetation; native grasses; grazing infrastructure; and locations and movements of the livestock.

Qualitative monitoring will be performed by the Rangeland Ecologist during several additional short visits and through phone conversations with the Grazing Operators and Glenwood Open Space Preserve Managers to evaluate conditions between the quantitative monitoring visits, and discuss issues that arise. The qualitative monitoring will focus on habitat conditions affected by weather and grazing in the Beetle Pasture and Pond Exclosure, and assess conditions for providing guidance during droughts or storms and general supervision of the livestock grazing operation. Detailed monitoring and reporting methods are listed below in Table 15.

Table 15. Monitoring Variables, Methods, and Schedule

VARIABLE	METHODS	SCHEDULE	METRICS
Herbaceous Mass and Residual Dry Matter (RDM)	Clip and weigh samples to “calibrate” observer’s judgment (air-dry spring samples then adjust data for %dry); visually estimate mass (spring) / RDM (fall) in 5-10 representative places per pasture	Late spring and early fall	Record mass/RDM on maps of pastures; compute range and averages
Herbaceous Height	Use a Robel pole to “calibrate” observer’s judgment; visually estimate obstruction height in 5-10 representative places per pasture	Late spring and early fall	Record height on maps of pastures; compute range and averages
Native Bunchgrass Frequency and Percent Flowering	Measure 1x30m belt transects within two different established patches of the native grasses for each pasture of concern	Late spring and mid-summer	Record numbers and average % flowering per transect; notes on herbivory
Livestock Use Records	Interview Grazing Operator	Monthly	Record numbers of each kind and class of livestock present throughout the year
Infrastructure Maintenance Records	Inspect infrastructure as needed; Interview Grazing Operator	Monthly	Record when and what maintenance activities were performed during the year
Qualitative Monitoring	Interview Grazing Operator. Visits to monitoring sites.	Quarterly	Inspect habitat conditions (i.e., erosion, movement of livestock, etc.)

3.7.1.1 Grazing Management Monitoring and Performance Standards

The following table (Table 16) describes grazing management objectives and associated performance standards related to livestock grazing.

Table 16. Grazing Management Objectives and Performance Standards

OBJECTIVE (O)	PERFORMANCE STANDARD (PS)
SPECIAL STATUS SPECIES HABITAT. O.1. Provide short grass and desired percent cover of herbaceous plants and bare ground generally and in the designated special management areas for special-status species habitat, and limit shrub encroachment into such habitat.	PS.1. Herbaceous mass and RDM are no less than the RDM standard and up to 300% of the RDM standard at the end of the growing season and in fall. The herbaceous height maximum roughly translates to 12 inches (measured as obstruction). This height may be up to 18 inches temporarily in the spring due to rapid growth. Ranges of desired percent cover of forbs may be 75% to 95% and bare ground 5% to 25%; no significant increase of shrub cover over time.
EROSION. O.2. Provide adequate ground cover to minimize soil erosion and avoid accelerated erosion and sedimentation of lowlands and streambeds.	PS.2. Herbaceous mass and RDM minima (use RDM standard for both) and percent bare ground (less than 25%) maxima; no visible signs of active erosion attributed to livestock management.

OBJECTIVE (O)	PERFORMANCE STANDARD (PS)
HERBACEOUS DIVERSITY	
O.3.a. HERBACEOUS BIODIVERSITY. Provide the level of RDM associated with increased herbaceous biodiversity and productivity and reduced levels of non-desired species.	PS.3.a. Desired range of RDM as defined in PS.1 and PS.2.
O.3.b. NATIVE GRASSES. Maintain or increase the current frequency of native bunchgrasses; allow bunchgrasses to set seed.	PS.3.b. Bunchgrass frequency (no less than 50% of baseline frequency) and percent setting seed (no less than 20% of plants setting seed) in stands of native grasses of grasslands.
COMPLIANCE AND SUSTAINABILITY O.4. Ensure that the number of livestock and timing of grazing use and maintenance of infrastructure corresponds with the grazing lease, annual operations plans, and agreed-to adjustments.	PS.4. Livestock animal unit months (AUMs) and on/off dates and maintenance activities correspond with annual plans and agreed-to adjustments. Requests for livestock movements have reasonably prompt responses by the Livestock Operator.

Herbaceous Mass / Residual Dry Matter

The mass of herbaceous plants in California annual grassland is called RDM in the fall and residual phytomass (mass) in the spring. RDM is used as a minimum standard (measured in the fall only) for its protection of the soil from erosion and nutrient loss, and conditions to favor desirable species composition and production during the following growing season. The accepted method to measure RDM in California annual grassland is described by Bartolome et al. (2006). The appropriate table of standards for the Glenwood Open Space Preserve is "Dry Annual Grassland." The RDM measurements exclude summer annuals as well as detached woody stems and leaves because these are considered to be non-forage. Summer annuals typically provide little soil protection from rain during fall and winter, and there can be a lot of bare ground between plants. In cases where invasive plant stands are significantly large, a note should be made on the data form, and marked on the field map.

If necessary to "calibrate" the observer's visual measurements, measure and record herbaceous mass using the method described by Bartolome et al. (2006) at several reference sites each day. All herbaceous matter should be clipped as low to the ground as can be done without removing dirt. Non-RDM material should be removed and the remaining herbaceous matter placed in an empty nylon bag. The amount of RDM material that remains on the ground, or that blows away in strong winds during clipping, should be estimated, and an equivalent amount of RDM material should be added to the sample bag before weighing. The scale should be tared to the weight of the bag before weighing (the taring should be periodically rechecked throughout monitoring).

Green Samples

If the herbaceous matter being measured is still live and green (e.g. spring residual mass), then apply the NRCS estimates of percent air-dry matter for the various phenological stages of grasses to convert the green weights to dry weights (NRCS 2006).

Wet Samples

To the extent feasible, sampling should be timed to avoid wet conditions. Wet conditions require additional experienced work to determine the dry weight of the clipped wet samples or to make

adjustments to the dry weights. If there has been recent rain, and the samples are moist beyond just surface wetting, then collect sub-samples for drying in an oven. In such cases, be sure to mark all details of the subsample on the paper sub-sample bag and on the data form while in the field. At the end of the field day, take these sub-samples to a drying oven and dry at very low temperature (115-125°F) for 24 hours or until no more weight can be extracted. Prevent causing a fire in the oven by avoiding the drying of too many sample bags at one time, and keeping the flammable material away from the heating elements. Once dried, record the dry/wet weight ratio on the sample bag and on the data form. Then apply that ratio to the field/wet weight data to get the dry weights. A different method for samples that are wet on the surface only may be used without sub-sample drying when there has been no rain for many days before the fieldwork, and the grassland is generally dry during the day. These circumstances may occur when clipping in the morning when the herbaceous vegetation is still wet on the surface from dew, or on a foggy day. In such cases, reduce the dry weight by an additional 20%. As the herbaceous vegetation dries out during the day, decrease that reduction from 20% to 0% from the dry weights, based on the judgment of relative humidity.

Herbaceous Height

To “calibrate” the observer’s visual measurements, use a Robel pole or tape measure to determine the average and range of herbaceous height as needed--height above the ground surface of all herbaceous material (including standing/bent foliage and non-woody litter), from within a 20-foot radius around the center point. Include any non-woody summer annuals and pest plants. This is “obstruction height”, which refers to the height of the main mass of herbaceous foliage through which the monitor’s sight is generally obstructed (this usually excludes grass inflorescences that extend above the grass blades). This is more relevant to the habitat qualities required by the special-status, sensitive and listed wildlife present than other measures of height. The monitor usually must get down on his/her knees so that the view through the herbaceous matter is parallel to the ground surface.

3.7.1.2 Reporting and Adaptation of Management Actions

Monitoring reports will summarize the results of measurements and observations that were made in the field. The report should be prepared soon after fieldwork, and be made available to the Glenwood Open Space Preserve Manager and the Grazing Operator, so they can do the following:

- Determine whether the amounts of herbaceous mass/RDM present and heights met or did not meet standards, and any reliable interpretations of cause.
- Identify locations that might need more or less grazing pressure in the future - including the remainder of the grazing season; re-evaluate and adjust planned stocking rates, movement, enclosure, exclosure, or rotation plans; re-evaluate and adjust cattle distribution methods; and other operational considerations.
- Communicate more clearly and precisely with each other and the public about resource management; demonstrate that grazing-related conditions were monitored; and prepare education and outreach information using the monitoring records.
- Make any appropriate adjustments to the range of results for each monitoring variable that are recognized as achieving the standards for future monitoring; identify additional variables that should be included in future monitoring; and adjust the grazing management plans and practices.

3.7.2 Invasive Species

3.7.2.1 Monitoring

Reconnaissance surveys will be conducted by the Preserve Manager in early spring when target species are beginning to bolt. If the locations of the populations have changed, a new map will be generated highlighting the densest populations of target species with a focus on encroachment into sensitive habitats (i.e. OTB, wetlands).

3.7.2. Reporting and Adaptive Management

If the locations of invasive species populations have changed from last year's survey results, a new map will be generated highlighting the densest populations of target species with a focus on encroachment into sensitive habitats (i.e. OTB, wetlands). Management actions will be documented in the report.

3.7.3 Infrastructure

3.7.3.1 Monitoring

Fencing, gate, and sign infrastructure will be monitored routinely by the City and the Preserve Manager to ensure proper functioning and recommendations regarding repair or upgrades will be made. Trails should be monitored to assess erosion, fallen logs, over growth, or other hazards. Recommendations for necessary maintenance should take into consideration safety to the public, local maintenance ordinances, sensitive species and habitats, deleterious effects to soil compaction and erosion, etc.

4.7.3.2 Reporting and Adaptive Management

The Preserve Manager will develop a summary report of fencing, gates and other infrastructure, and share it with the City, Grazing Operator, and Rangeland Ecologist to coordinate management and maintenance. An urgent response will be warranted when the condition of infrastructure results in an increased likelihood of cattle escaping from the property or injury to the public.

3.7.4 Recreational Usage

3.7.4.1 Management Objectives

In order to make more informed decisions regarding potential positive or negative impacts of trail use on sensitive species, trail use will be monitored by the City and the Preserve Manager. Cleared vegetation and erosion along trails will be recorded. During the initial three-year additional baseline period trail use monitors will be installed to count the number of users over a given period of time. Visual monitoring of constructed and existing trails in the vicinity of sensitive species habitats will also be conducted to gather qualitative data for use in conjunction with the trail counts to assess potential effects. Conflicts between habitat management and visitor use should be documented.

3.7.4.2 Reporting and Adaptive Management

Quarterly reports of trail condition and annual reports of visitation will be shared between the City and the Land Trust. The City will maintain vegetation along the trails at a cleared width of 4 feet and height of 8 feet. Annual visitation counts will be summarized in the annual report for the

Service. Remedies to conflicts should be proposed, and, in subsequent years, evaluated for success.

3.7.5 Ohlone Tiger Beetle Monitoring

Existing baseline data on OTB consist of adult and larval burrow census collected 2003 – 2017. Additionally, vegetation cover and RDM data were collected in OTB habitat during the baseline monitoring period. Both adult and larval counts declined sharply between 2004 and 2005, but have risen since with large fluctuations between some consecutive years. It is postulated that removing grazing in 2004 combined with high rainfall in 2004 and 2005 resulted in a substantial increase in vegetation cover and decline in OTB habitat. The return of horse grazing and reduced rainfall (2007 – 2008) enhanced OTB habitat by reducing vegetation cover and increasing bare ground within which OTB larvae create and maintain their burrows. Each year during the monitoring period, the number and timing of livestock were adjusted to achieve desired management thresholds. The drought of 2012-2015 may be associated with increased abundance during this period. The population of OTB at the Glenwood Preserve is the healthiest of any population of the species, most likely as a result of successful management.

3.7.5.1 Monitoring and Performance Standards

Monitoring for OTB will be performed in a manner consistent with the methods used by Richard Arnold during the years prior to the development of this LTMP. Monitoring will be performed by a qualified biologist, or an individual following the instructions and guidance of a person approved by the Service to monitor OTB.

OTB monitoring will include inspection of trails in the Beetle Pasture and the Beetle Expansion Management Zones. Monitoring will be used to characterize the net benefit and impacts of management, and will be used to guide future management. For example, metrics such as the aerial extent of habitat occupied by burrows and the number of burrows per unit area will continue to be used to evaluate the influence of suitable habitat on the population, and the effect of management on the extent of suitable habitat.

Current OTB monitoring activities include:

- Transect counts (approximately weekly from January through May) of adults which provide estimates of generation population size;
- Larval burrow census by GPS mapping – June or July;
- Routine visual assessments of grazing and habitat conditions in OTB habitat and working with the Rangeland Ecologist, Lawrence Ford, to make adjustments based on vegetation growth, weather conditions, OTB vulnerability, etc.; and
- Grazing and habitat monitoring (RDM, etc.) by Lawrence Ford.

Monitoring at a lower frequency will also be conducted along trails in the East Preserve Management Zone within 1,000 feet of those areas for the presence of OTB adults and larval burrows, and for killed adults and damaged burrows. If OTB are found outside of the Beetle Pasture and Beetle Expansion Management Zones, the Beetle Expansion Management Zone will be extended accordingly. If take is observed in any Management Zone, the Service will be notified and consulted regarding potential changes in management to avoid take in the future.

Roles and responsibilities regarding monitoring include:

- Richard Arnold, in coordination with the Land Trust, will submit a summary report for at least two years following the opening of the site to public access that will incorporate the following:
 - OTB activity within established trails inside and outside of historic habitat;
 - any observed take that may have occurred due to recreational use of the site; and,
 - any pertinent recommendations.
- Land Trust staff, specifically Lynn Overtree, is a qualified biologist with experience monitoring the OTB and will conduct adult surveys under the supervision of Richard Arnold (and his staff), in addition to conducting habitat and burrow surveys independently (and under Richard Arnold's supervision when available) as applicable.
- The Land Trust is currently applying for a Section 10(a)(1)(A) permit (recovery permit) from the Service in order to independently conduct recovery related activities that may result in take of the species at the site.
- A Certified Rangeland Manager will provide rangeland management services.

Potential Additional Monitoring Activities

The Land Trust will work with staff, consultants and other researchers to increase our understanding of the drivers behind OTB population and its response to management.

To the extent feasible this monitoring, in the Beetle Pasture and Beetle Expansion Management Zones, will, at least:

- a) Monitor fixed plots (typically a square meter each) to follow individual OTB burrows (egg & larvae) over time
 - a. Document life span and timing of individual life stages
 - b. Identify and quantify impact/mortality factors
 - c. Measure soil moisture content throughout the year and correlate timing/changes with OTB life history/ecology
 - d. Measure changes/timing of vegetative cover (in subsets of species or groups) and bare ground and correlate with timing/changes in OTB life history/ecology
- b) Formally describe immature life stages of the OTB (egg, larva, pupa)
- c) Measure general vegetative cover/bare ground in OTB pasture and correlate with OTB occupancy/abundance (The amount of sunlit, bare soil should be maintained at 50% or more on trail habitat sites and at 12% or more in grassland habitat areas [Arnold, Bartolome, Ford, and Rao 2012a, 2012b])
- d) Establish long term vegetation monitoring transects across trails to capture vegetation and other ecologic data and corresponding OTB data
- e) Monitor visitor usage and type(s) of recreation activities and where they occur, especially within OTB pasture. Consider automated photography to assess visitor numbers while respecting visitors' privacy by only using distant camera positions.
- f) Conduct additional soil testing to identify other areas of Watsonville Loam and manage those soils for conditions conducive to OTB utilization.

3.7.6 *Scotts Valley Spineflower and Scotts Valley Polygonum*

Existing baseline data on the Scotts Valley spineflower consists of population data collected in 1992, 2004 – 2009, and 2015. Baseline data include population census, vegetation cover, grazing pressure, and qualitative habitat assessment (e.g. erosion, litter). These data have shown that

several Scotts Valley spineflower sites in the East Preserve Management Zone which had small numbers of individuals in 1992 did not support the species in 2004 to 2009. It is not known what grazing or other management was in effect in 1992 and how that may affect changes in numbers of this species. Population counts from 2004 through 2009 and 2015 are relatively stable with counts generally within an order of magnitude.

3.7.6.1 Monitoring and Performance Standards

Baseline and long-term monitoring shall be conducted. The number of flowering plants observed within the managed portion of the Glenwood Open Space Preserve (currently only the Eastern Preserve Management Zone is actively managed by grazing) will be assessed against the range of counts observed during the baseline period. Following the three-year baseline monitoring period, monitoring will be conducted every two years as long as the total annual count within the managed portion of the Glenwood Open Space Preserve remains within the range observed during the complete baseline period. The baseline period will include 1992, 2004-2009, 2015, and the additional baseline period (2018-2020) counts and may be expanded to include subsequent years as long as they are deemed to reflect suitable management conditions. If counts are below the observed baseline range, surveys will be conducted annually until they are again within the baseline range.

In late spring of each monitoring year, the population size of Scotts Valley spineflower will be determined. Each previously known occupied site, as well as previously documented suitable habitat sites, will be surveyed for spineflower plants. At each site, species density data will be collected using a visual count of individuals and/or spatial estimates to determine total population size. The current data form will be used to record plant density information and a GPS will be used to record the positional coordinates of each occupied colony. Each site will be visited twice during the flowering period to achieve an accurate population count. The distribution of the Scotts Valley spineflower will be portrayed on a base map.

Data on pertinent habitat features will be collected as part of the vegetation monitoring. Associate plant species at each occupied and suitable habitat site will be recorded. Any obvious signs of plant damage will also be recorded, including any potential impacts from management and/or unauthorized activities within the Glenwood Open Space Preserve.

Although Scotts Valley polygonum has not been observed in the Glenwood Open Space Preserve, continued searches for this species will be conducted following the same timing and protocol as for Scotts Valley spineflower. Should Scotts Valley polygonum be observed, all avoidance and minimization measures and habitat management strategy included herein for the Scotts Valley spineflower will be applied for Scotts Valley polygonum.

3.7.6.2 Reporting and Adaptive Management

The abundance and distribution of Scotts Valley spineflower and other rare plants will be summarized in a report by the project Botanist, which will be shared by the Preserve Manager with the City and Service. If populations decline below the range observed during the complete baseline period, then the Preserve Manager and Botanist will develop additional management actions. Subsequent reports will evaluate the efficacy of those actions and revise the approach as needed until the population is brought back into the observed range.

3.8 Adaptive Management Strategy

Habitat management shall be guided by the principles of adaptive management. An adaptive management approach will allow Glenwood Open Space Preserve management to evolve as habitat or regulatory conditions change, and as monitoring provides new information. An annual report will recommend appropriate changes in habitat management practices based on the monitoring results, revision of preliminary baselines, and refinement of thresholds.

Adaptive management includes four general principles:

1. Monitoring of species and habitat
2. Continued development of baseline data and management thresholds
3. Coordination and application of management activities to maintain species habitat
4. Reassessment of management thresholds and activities based on the monitoring results and management goals

A considerable amount of information has been gathered regarding the biology, habitat, and management of the species present in the Glenwood Open Space Preserve during the baseline monitoring period (2004 – 2017). However, continued intensive monitoring including species counts will continue for an additional three years following initiation of public access to add to and refine the existing baseline data. At the end of the three-year additional baseline monitoring period, long-term monitoring, except for OTB monitoring, will be conducted that will include qualitative monitoring annually and quantitative monitoring of covered species at two-year intervals. OTB will continue to be quantitatively monitored annually. The flexibility of an adaptive management approach will allow adjustments to be made to preserve and enhance species habitat and meet the requirements of this LTMP.

Evaluation of management activities will involve examining monitoring data relative to thresholds while considering long-term habitat and population data trends, as well as influence of climatic and other natural environmental fluctuations. The analysis of monitoring data and thresholds will identify where management efforts are successful and where additional measures need to be implemented to improve success. If continued monitoring shows that the management efforts are unsuccessful, the Glenwood Open Space Preserve Manager will seek advice from species experts, range managers, and federal and state resource agencies to adopt alternative management methods.

During the long-term monitoring period, quantitative monitoring for special-status, sensitive and listed species will be based on OTB adult and larval burrow counts and Scotts Valley spineflower and Scotts Valley polygonum flowering plant counts. The OTB monitoring will be conducted every year. The plant monitoring will be conducted every second year unless the last years' annual total count falls below the range observed during the baseline period. If at any time a monitoring report demonstrates that an annual species count has declined below the baseline range, monitoring will be conducted annually until counts fall back within the baseline range. The baseline period will include 1992, 2004-2017, and the additional baseline period (2018-2020) counts and may be expanded to include subsequent years as long as they are deemed to reflect suitable management conditions. If a decline in adult plant numbers during the long-term monitoring period indicates a negative effect of public access on a special-status, sensitive or listed species population, then annual intensive monitoring will continue until adaptive management measures are effective in maintaining numbers within the baseline range.

For example, if this LTMP were approved in 2017, additional baseline monitoring would be conducted in 2018, 2019, and 2020. If the species count in 2020 were within the range for the

total baseline period (including all data collected 2018 to 2020 and prior to 2018), then the interval would increase to two years for species other than OTB. Monitoring would next be conducted in 2022. If the species counts in 2022 were within the range of the baseline period, monitoring would continue at the two-year interval. If, however, the species count in 2022 were below the range of the baseline period, then monitoring would return to an annual basis.

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