SADDLE MOUNTAIN OPEN SPACE PRESERVE MANAGEMENT PLAN

AG + OPEN SPACE
SONOMA COUNTY

LAND FOR LIFE

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SADDLE MOUNTAIN OPEN SPACE PRESERVE MANAGEMENT PLAN

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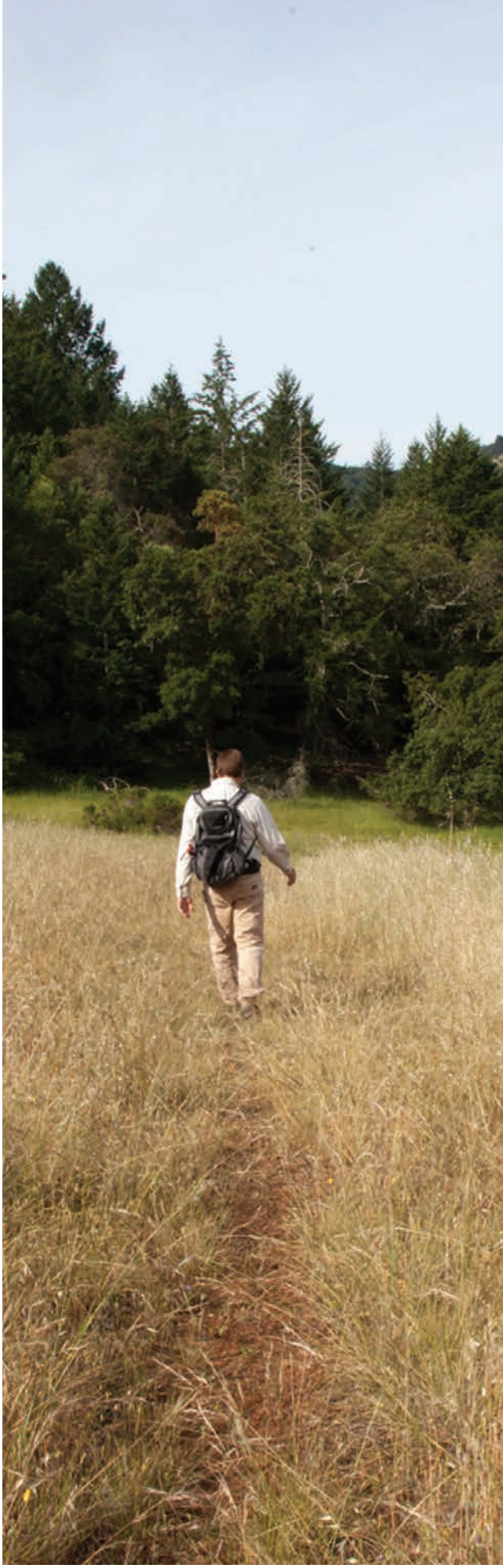

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LIST OF ACRONYMS

AGS: Annual Grassland
BAAQMD: Bay Area Air Quality Management District
BLM: Bureau of Land Management
BMP: Best Management Practice
CAL-IPC: California Invasive Plant Council
CDFW: California Department of Fish and Wildlife
CEQA: California Environmental Quality Act
CNDDB: California Natural Diversity Database
CNPS: California Native Plant Society
COW: Coastal Oak Woodland
CPC: Closed-Cone Pine-Cypress
DFR: Douglas Fir
EPA: Environmental Protection Agency
FEW: Fresh Emergent Wetland
FMP: Forest Management Plan
FMWW: Friends of the Mark West Watershed
GP 2020: Sonoma County General Plan 2020
LAC: Lacustrine
MCH: Mixed Chaparral
MHC: Montane Hardwood-Conifer
MRI: Montane Riparian
NPDES: National Pollutant Discharge Elimination System
NSO: Northern Spotted Owl
NTU: Nephelometric Turbidity Unit
PWA: Pacific Watershed Associates
RRD: Resources and Rural Development
SER: Society for Ecological Restoration
SMPMP: Saddle Mountain Open Space Preserve Management Plan
SOD: Sudden Oak Death
TMDLs: Total Maximum Daily Loads
TREX: Prescribed Fire Training Exchange
USFS: US Forest Service
VMP: Vegetation Management Program
VTP: Vegetation Treatment Program
WTM: Wet Meadow

ACKNOWLEDGEMENTS

Special thanks and appreciation to the California Coastal Conservancy for their financial support. Ag + Open Space would also like to thank the Saddle Mountain Open Space Preserve Volunteer Patrol members who have vigilantly monitored the Preserve since its acquisition in 2006 and provided countless hours towards the conservation and enhancement of the Preserve.

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Board of Directors

Ag + Open Space is governed by a Board of Directors, which consists of the five elected County Supervisors, one representing each Supervisorial District. The current Ag + Open Space Board of Directors includes:

Susan Gorin, 1st district
David Rabbitt, 2nd district (current chair)
Shirlee Zane, 3rd district
James Gore, 4th district
Lynda Hopkins, 5th district

1. INTRODUCTION

1.1 Regional Setting

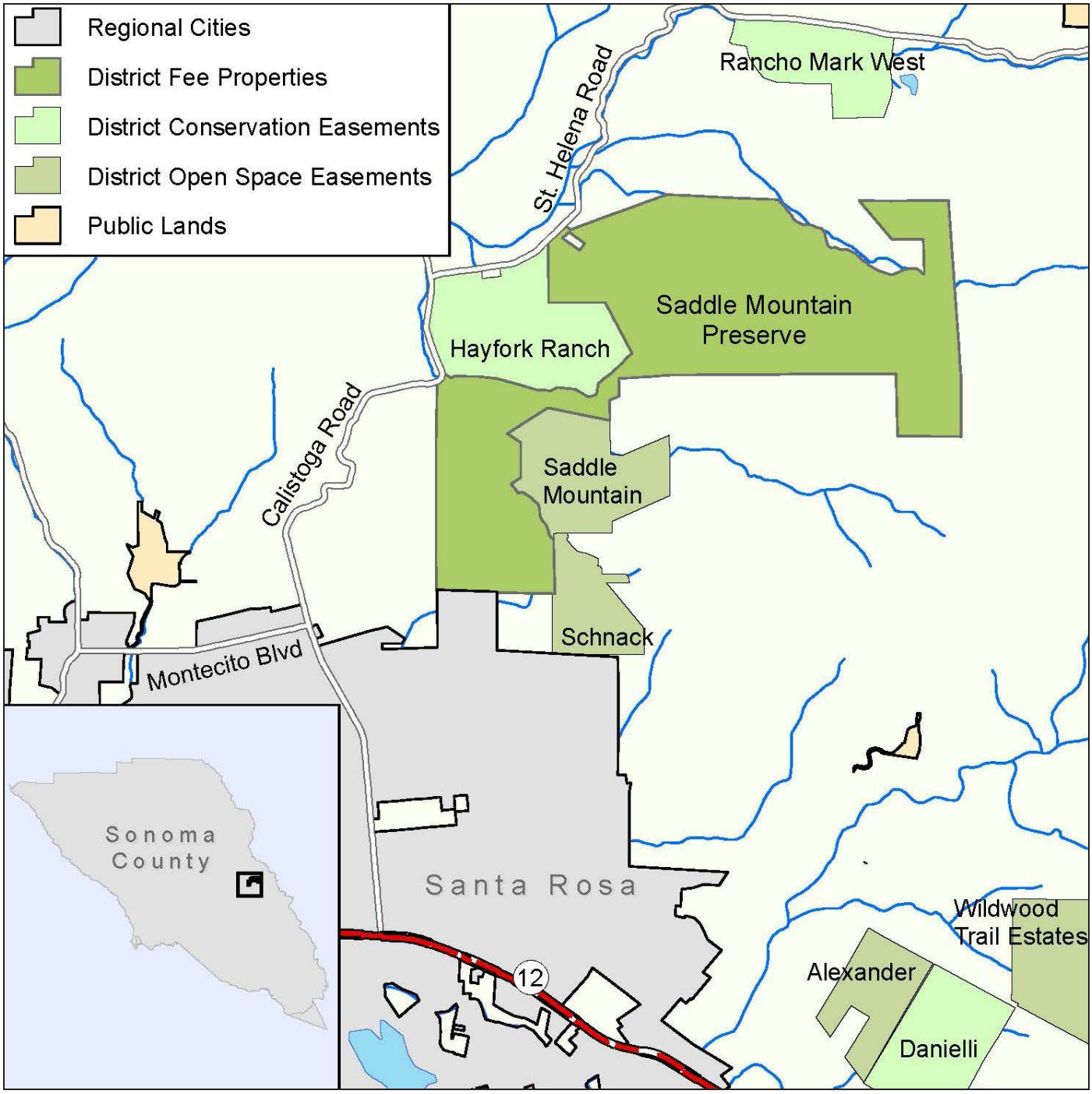

Figure 1. Location of Saddle Mountain Open Space Preserve

The Saddle Mountain Open Space Preserve (Preserve) is located in northern California's central Mayacamas Mountains, northeast of the inland city of Santa Rosa in Sonoma County. The Preserve comprises 960 acres (1.5 mi^2 or 4 km^2) of relatively undeveloped land that is dominated by mixed grasslands with a history of livestock grazing. Elevation ranges from 760 feet (233 meters) at the property's northwest boundary to 1,800 feet (549 meters) in the southeast corner; the summit of the eponymous mountain is 1450 feet (442 meters) above sea level. Climate is Mediterranean, characterized by hot, dry summers and wet, stormy winters. Average annual rainfall for Saddle Mountain is estimated at 45 inches (114 mm; Giblin and Associates 2003b).

The area exhibits flooding and drought conditions at unpredictable intervals. Three tributaries of Mark West Creek (Alpine, Weeks, and Van Buren) and one tributary of Santa Rosa Creek (Ducker Creek) flow from east to west across the Preserve (Section 2.12, Water Resources).

The Preserve is located in one of the most biologically diverse regions in the nation. Potentially, 289 species of wildlife occur amid a range of upland and wetland vegetation communities. The property's watersheds include Alpine and Weeks Creeks, both important tributaries to Mark West Creek, which has been identified by California Department of Fish and Wildlife (CDFW) as supporting salmonid viability. The California Natural Diversity Database (CNDDB) and field surveys identify fourteen rare/ sensitive species on or adjacent to the property. Sonoma County is also part of one of the largest wine grape-growing regions in the world with over a dozen designated American Viticultural Areas and hundreds of wineries in production. Human population in the Santa Rosa vicinity is significant and increasing, along with demand for clean water, homesites, and local employment.

Photo 1. Saddle Mountain

1.2 History of Preserve Establishment

With its sweeping views of the Santa Rosa plain, the Saddle Mountain Open Space Preserve property was considered a prime real estate development location since at least the 1970s. In 1978, the proposed development of a subdivision resulted in the preparation of an Environmental Impact Report. The local community successfully opposed development efforts until July 2003, when final approval was given by Sonoma County to subdivide the property into 29 estate parcels. Then the Sonoma County Agricultural Preservation and Open Space District (Ag + Open Space) became involved in negotiations to purchase the property to conserve habitat value and preserve a key viewshed from Annadel State Park and Spring Lake Regional Park.

Photo 2. View of Santa Rosa from Saddle Mountain

In January 2006, the Board of Directors adopted resolution #06-0041 approving the fee title purchase of the 960-acre Saddle Mountain property. The State Coastal Conservancy contributed grant funding to assist with the acquisition of the property and to provide funding for a management plan (i.e. this document). The total purchase price was $9,213,000. Terms of the sale agreement include an access easement to an existing residence for the seller, an easement for water use for the seller, and a trail easement over the two lots retained by the seller. Additionally, Ag + Open Space possesses a Right of First Offer over the lots retained by the seller.

1.3 Vision Statement

The Saddle Mountain Open Space Preserve will protect and conserve riparian woodland, montane forest, mixed grassland, and chaparral providing high quality habitats in support of native Sonoma County biodiversity and improving watershed function. Public access will be structured to ensure minimal impacts to sensitive species and habitats while maintaining a high-quality visitor experience.

1.4 Conservation Purpose

The purpose of the acquisition is to conserve and protect the natural, scenic, agricultural, aesthetic, biotic, rare and endangered species habitat, and openness values of the Preserve. The Preserve is visible from much of the city of Santa Rosa and provides viewsheds for Annadel State Park and Spring Lake Regional Park; it serves as an important backdrop that contributes to quality of life and community identity in Santa Rosa.

1.5 Goals and Objectives

The goal of the Saddle Mountain Open Space Preserve Management Plan (Plan) is to thoroughly assess the property's biotic and abiotic conditions, and develop recommendations that will direct Ag + Open Space's actions to preserve the property's unique mosaic of complex native California habitat types, biodiversity value and ecosystem function.

Specific Objectives for the Preserve include:

- Conservation of large stands of contiguous oak woodland in the Mark West Creek watershed
- Conservation of high quality riparian habitat and adjacent uplands and wetlands in the Mark West Creek and Santa Rosa Creek watersheds
- Protection of highly visible open space land with outstanding scenic qualities
- Management of the Preserve in a manner that minimizes impacts and enhances natural resources
- Provision of recreational opportunities in close proximity to urban areas that are compatible with the conservation purposes

The three chief conservation challenges that will direct short-term responses on the Preserve are:

- Control and remediation of erosion sources, with integrated management of sediment delivery to stream and wetland systems
- Control and prevention of non-native plant species, with eradication where feasible and long-term reduction of coverage elsewhere
- Strategic reduction of fuel buildup and overcrowded conditions within forest habitats

1.6 Existing Plans and Partnerships

The significant ecological resources reflected by the diverse plant communities, high water quality, intact in-stream and riparian habitat, and endangered species occurrence in the area make the upper Mark West Watershed extremely regionally significant for conservation projects, including planning documents, projects, and partnerships. Mark West Creek has been identified as a high priority stream for preservation and restoration by a number of state, federal and local agencies. The Association of Bay Area Governments, with the concurrence of the Sonoma County Board of Supervisors, has designated the Upper Mark West Watershed as a Priority Conservation Area in recognition of its extraordinary environmental values, regional significance, urgency for protection, and level of community involvement. Exceptional natural resources are coupled with a highly engaged community of landowners and residents who have demonstrated their interest, awareness, and stewardship ethic to restore and protect the watershed. Voluntary participation is particularly important due to the fact that the Preserve is surrounded by private rural residential land holdings.

1.6.1 Existing Plans

Introduced below is a small selection of the dozens of existing planning efforts/ plan documents that directly address the Preserve area.

Sonoma County General Plan 2020[1]

Sonoma County General Plan 2020 (GP 2020) was adopted September 2008 and is a revision of the previous General Plan that was adopted in 1989. The broad purpose of GP 2020 is to express policies which will guide decisions on future growth, development, and conservation of resources through 2020 in a manner consistent with the goals and quality of life desired by the county's residents. Under State law many actions on private land development, such as Specific Plans, Area Plans, zonings, subdivisions, public agency projects and other decisions must be consistent with the General Plan. The SCGP includes ten elements: Land Use, Housing, Agricultural Resources, Open Space and Resource Conservation, Water Resources, Public Safety, Circulation and Transit, Air Transportation, Public Facilities and Services and Noise. Each of these will need to be considered in the development and restoration activities proposed on the Saddle Mountain Open Space Preserve.

[1] Sonoma County General Plan portal http://www.sonoma-county.org/PRMD/gp2020/index.htm

Sonoma County Biodiversity Action Plan[2]

This document was compiled with Ag + Open Space by the Community Foundation of Sonoma County (2010) to highlight the enormous biodiversity of and threats to the area's plant and animal species, habitats, and communities. Natural history information and stakeholder viewpoints are provided in support of general recommendations that managers can utilize to take action.

Franz Valley Area Plan[3]

This plan was originally adopted in 1979 and modified in 2008. It focuses on the Franz Valley Study area: 91,520 acres in northeastern Sonoma County that drain into the Maacama and upper Mark West Creek watersheds. Specific area plans provide intermediate level of detail between the county general plan and site specific plans which are intended to provide information, analysis, and citizen participation on a local basis. This plan includes local Land Use and Open Space Planning sections that cover information ranging from rural residential development intensity, riparian setbacks and historical site preservation that apply to the upper Mark West Creek region including the Saddle Mountain Open Space Preserve.

Upper Mark West Watershed Management Plan, Phase 1[4]

The goal of the Upper Mark West Watershed Management Plan (2008) is to "provide tools, resources and guidance for stakeholders to protect the natural environment in the upper Mark West Creek watershed, restore and enhance altered landscapes, and to steward the land in perpetuity." The Draft Upper Mark West Watershed Management Plan, Phase 1 includes a compilation of existing information, and a needs assessment. The Sonoma Resource Conservation District is developing a comprehensive Integrated Watershed Management Plan for the Upper Mark West and Maacama Creek Watersheds to develop a list of recommendations to improve water quality and riparian and aquatic habitat conditions in the watersheds.

1.6.2 Existing Studies

An array of projects in the Saddle Mountain area have provided relevant information and templates that contribute to priority preservation goals related to road upgrade, sensitive habitat restoration, water monitoring, and fisheries viability. See Appendix 1, Projects and Studies in the Saddle Mountain Open Space Preserve Area.

Road Assessments and Improvements

Unpaved rural road systems and concentrated runoff from paved roads are significant sources of erosion and fine sediment delivery to streams. The assessment and improvement of roads for sediment reduction is a primary habitat restoration priority in the upper Mark West Creek watershed. Publicly funded road assessment and improvement projects in the project area include:

- The assessment and upgrade of approximately 12 miles of private, unpaved roads including Cleland Ranch Road, which runs through the Saddle Mountain Open Space Preserve, was completed in 2006 by the Sonoma Resource Conservation District and Pacific Watershed Associates in cooperation with over 70 landowners.
- The County of Sonoma Transportation and Public Works Department worked with Pacific Watershed Associates to assess the public roads and associated drainage in the upper Mark West Creek watershed.
- Ross Taylor & Associates' "Russian River Stream Crossing Inventory and Fish Passage Evaluation" assessed passage of juvenile and adult salmonids and developed a project scheduling document to prioritize corrective treatments to provide unimpeded fish passage at road/stream intersections, and included recommendations for Van Buren and Alpine Creek crossings at St. Helena Road.

Habitat Restoration and Improvements

- A native riparian revegetation project was conducted on Mark West Creek on private land upstream of the Saddle Mountain Open Space Preserve in 2004 by the Sonoma Resource Conservation District and Circuit Rider Productions, Inc.
- Monan's Rill Association conducted a forest improvement and fuel loads management project in the upper Mark West watershed in cooperation with California Department of Forestry and Fire Protection.
- Several instream habitat improvement projects were conducted by CDFW along the lower reaches of Mark West Creek.

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[2] Sonoma County BAP http://www.lagunafoundation.org/knowledgebase/?q=node/272

[3] Franz Valley Area Plan http://www.sonoma-county.org/prmd/docs/divpages/franz_vly_area_plan.pdf

[4] Upper Mark West Watershed MP, P1 http://www.lagunafoundation.org/knowledgebase/?q=node/262

Water and Biological Quality Monitoring

Water quality and associated aquatic habitat monitoring has been conducted intermittently in a number of locations in the project area. Below is a list of the organizations that have collected water quality monitoring data; refer to Section 6.1.2, Water Quality Improvement Projects for additional information.

- Sonoma Resource Conservation District Monitoring and Assessment Program
- Sonoma County Water Agency, Fisheries Enhancement Program
- California Department of Fish and Wildlife, Stream Inventory Reports for Mark West, Weeks, and Van Buren Creeks
- Community Clean Water Institute, Volunteer Citizen Water Quality Monitoring Program
- Friends of Mark West Watershed, Continuous Temperature Monitoring Program

Biological surveys to assess the type, population size and distribution of fish species in Mark West Creek and its significant tributaries has primarily focused on assessing the presence/absence and related population size of salmonid fish, steelhead trout, and Coho salmon occurring in the upper watershed. Below is a list of the organizations that have conducted fisheries studies.

- Sonoma County Water Agency, Fisheries Enhancement Program
- Merritt-Smith Consulting, Salmonid Juvenile Density Monitoring
- California Department of Fish and Wildlife, Stream Inventory Reports for Mark West, Weeks, and Van Buren Creeks
- Sonoma State University researcher Kristy Deiner sampled in the upper reaches of Mark West Creek as research for a paper titled "Population structure and genetic diversity of trout (*Oncorhynchus mykiss*) above and below natural and man-made barriers in the Russian River, California," published in Conservation Genetics in 2007.

Grazing

Lisa Bush, Certified Rangeland Manager, developed a Conceptual Grazing Plan for the Saddle Mountain Open Space Preserve in April 2008. The study included field observations of grassland areas, describing potential benefits of grazing as a grassland management technique on the property. The Plan describes various constraints and requirements of a successful grazing program. Identified grazing challenges include the property's geographic position, rugged topography, intergrading vegetation types, and current paucity of grazing infrastructure (e.g. sound fencing and water sources). Due to these challenges, Ag + Open Space has determined that introducing grazing to the Preserve is not feasible at this time.

1.6.3 Existing Partnerships

In addition to the agencies and organizations directly involved in the purchase and management of the Preserve (Section 2.2, History of Preserve Establishment), due to the high level of community engagement in the upper Mark West Creek watershed there are several community and watershed-based groups that are invested in the management of the Preserve.

The Alpine Club, a "social benefit" organization for the residents of the upper watershed, was formed in the 1940s and has performed work such as creek cleanups in additional to its social function. Today the Alpine Club has over 120 member families in the upper Mark West Creek watershed.

The Friends of the Mark West Watershed (FMWW) formed in 2001 as the environmental advocacy arm of the Alpine Club. The FMWW has been instrumental in establishing the Saddle Mountain Open Space Preserve since it first challenged a proposal to subdivide and develop estate homes on 1300-acre Saddle Mountain Ranch. The FMWW promoted a win-win solution, partnering with Ag + Open Space, the Coastal Conservancy, and others in the public acquisition of the property.

Recent activities of the Alpine Club and Friends of Mark West Creek that affect the Preserve include:

- Establishing Saddle Mountain Volunteer Patrols in partnership with the District
- Preparing for Emergencies and Fire Preparedness Task Force
- Creating a historical record of the Mark West watershed and its community
- Installing road signs marking the Mark West creek and watershed boundaries
- Carrying out Upper Mark West Creek Restoration and Preservation projects in the Mark West Creek watershed

Ag + Open Space policy regarding research on preserve lands states, "The District encourages appropriately reviewed natural and cultural resource studies on a preserve when these studies are consistent with the District's mission and the preserve's conservation purpose. Research will be allowed if the results of the research could be used to advance the District's understanding of preserve resources, natural processes, values and uses." Research should support and provide a basis for "preserve planning, development, operations, management, education and interpretive activities." Engaging with local organizations can also help further the District goals of raising awareness of the natural and cultural resource management priorities as well as involving the community and neighboring landowners in expanding beneficial management strategies beyond the District's property.

Research projects that inventory and/or establish baseline conditions for species or habitats targeted for restoration or enhancement are recommended. Inventories of initial conditions using standardized protocols can serve as a tool for measuring the effectiveness of various management strategies. Additionally, comparative research projects that test the effectiveness of various management methodologies can be used to refine future management. An example of this would include trials of various invasive plant management techniques such as grazing, burning, tarping, etc. and associated ongoing botanical surveys.

Local entities engaged in related research include the California Native Plant Society, Milo Baker Chapter, which supports conservation activities such as rare plant inventories; Sonoma State University students, who can be engaged in a variety of natural and cultural resource projects; and the Sonoma Resource Conservation District's Watershed Monitoring and Assessment Program, which has been supporting monitoring and assessment activities in the upper Mark West Creek watershed for over ten years. These entities should be considered potential research partners for Ag + Open Space. Additionally, the Pepperwood Preserve, located in the upper Porter Creek watershed, tributary to Mark West Creek, is a venue for research projects conducted by numerous universities, colleges, and institutions on aspects of flora, fauna, and ecology.

1.6.4 Funding Opportunities

Several partners have played an important role in helping Ag + Open Space acquire the Saddle Mountain Open Space Preserve, including funding from the California State Coastal Conservancy and project support from the Sonoma Resource Conservation District and Friends of the Mark West Creek Watershed. This management plan identifies many priority implementation projects that provide opportunities for the development of new partnerships or strengthening of existing ties. In addition to Ag + Open Space's existing partnerships, this Preserve provides an opportunity to build or expand upon partnerships with Land Paths, the Community Clean Water Institute, local universities, and other research organizations.

Funding for project implementation, monitoring, and maintenance will be provided in part by Ag + Open Space through its existing sales tax measure reauthorized as Measure F in November 2006. Additional funding may be available through grants provided by the federal or state government or nongovernmental organizations. See Appendix 2 for a list of potential grant sources.

1.7 Management Plan Development Process

The Saddle Mountain Open Space Preserve Management Plan was developed utilizing existing documentation and expert input and analysis. Existing documents were compiled (Appendix 1, Projects and Studies in the Saddle Mountain Open Space Preserve Area, Appendix 2, Saddle Mountain Open Space Preserve Resource Catalog) and evaluated for data gaps. Where information was missing, incomplete, or outdated, consultants who are experts in their fields were enlisted to conduct property assessments and develop recommendations based on their findings and the intended uses of the Preserve. Assessments were conducted in 2008 and 2009 to survey property resources, including a roads survey, botanical inventory, grazing potential, and a cultural resources inventory. Each consultant identified issues of concern including but not limited to the condition of the Preserve roads and trails, the presence of invasive non-native plants, fire hazard, and possible degradation of cultural resources. Follow up field surveys were conducted in 2010 – 2017 to monitor the federally endangered Clara Hunt's milk-vetch populations and in 2014 to monitor the priority non-native species.

Preliminary management strategies were developed based upon the existing data analysis, property assessments, and expert recommendations. These management strategies and recommendations were reviewed by the project team and Ag + Open Space staff in a series of small group meetings designed to integrate management strategies and determine final recommendations for plan implementation. Public review of the draft plan occurred from March – April 2015 and is described in Appendix 3, Public Comment.

1.7.1 Data Acquisition and Analysis

Several contractors with specific professional expertise were involved in acquiring and/or analyzing data to inform the SMPMP. Their contributions are summarized below.

Pacific Watershed & Associates, Inc.

Pacific Watershed Associates Inc. assessed approximately nine miles of rural roads and one mile of trails within the Preserve, via aerial photo analysis, field inventories, and analysis of new field data. The study identified 28 current and potential road-related erosion sites and locations where sediment is delivered into streams.

Rob Evans & Associates

Rob Evans & Associates conducted a natural resources inventory of the Preserve, focusing on sensitive habitats most likely to contain listed plant species. Fieldwork included botanical surveys in 2008 and 2009, as well as documentation of local threats to ecosystems, habitats, and species, including locations of invasive plant species, potential Sudden Oak Death infestations, and Douglas-fir encroachment. Natural resource management opportunities are identified pertaining to invasive species management, sensitive habitat preservation, potential restoration sites, suitable parking areas, and principle view-sheds. Photo-documentation of the property includes photographic examples of natural resource problems, rare plants, representative habitat types, view-sheds, human development, roads, and trails. A GPS unit was used to document sensitive features and photo locations. Rob Evans conducted surveys during the spring bloom season in 2010 – 2014, and in 2016 and 2017 to monitor the federally endangered Clara Hunt's milk-vetch populations on the property. During the summer months of 2014 he re-surveyed the Preserve to update the spatial data for the priority non-native species' locations and extent. The botanical survey confirmed the occurrence of a variety of plants on the Preserve: 56 families, 231 genera, and 346 species were documented. Of the 346 total species, 267 are native to California and 76 non-native; 42 of the latter are considered "invasive." Six of the native species are designated "rare" by the California Native Plant Society (CNPS).

Tom Origer & Associates

Tom Origer & Associates conducted a historical and archaeological resources survey of the Preserve for Ag + Open Space. The study included archival research at the Northwest Information Center and Sonoma State University; consultation with the Native American Heritage Commission and local Native American representatives; field inspection of the project location; and written resources documentation and reports. Field surveys conducted by Tom Origer & Associates in 2008 found four of the six previously documented prehistoric sites. In addition, one prehistoric site, six historic period sites, two stone fences, and four isolated finds were identified on the property. These sites were re-surveyed in 2018 by Tom Origer & Associates.

1.7.2 Public Participation in Planning

Ag + Open Space hosted a public meeting February 18, 2015 at the Rincon Valley Library Community Meeting Room. It was attended by 52 people. Ag + Open Space presented the draft management plan, and offered the public the opportunity to provide input and comments on the management actions proposed by Ag + Open Space (Appendix 3, Public Comment).

1.7.3 Management Plan Updates

This plan is a "living" document: as more information from assessments of the Preserve's natural resources and monitoring results from implementation projects become available, this management plan will be revised to better protect resources and provide recreational opportunities for the area's residents. Outputs from implementation projects, including monitoring and reports, will be used to refine Ag + Open Space's management approach and redirect implementation projects if necessary. An evaluation framework has been developed (Section 4.7, Adaptive Management) to incorporate monitoring, assessment, and research results into future iterations of the plan. Monitoring is a key component of each project's implementation, with results analyses feeding back into the evaluation framework to inform future management practices.

Effectiveness of management strategies and implementation projects will be evaluated and compared to desired outcomes, and strategies adjusted accordingly as needed. If significant new information suggests that plans are inadequate or would benefit from changes, management goals and objectives will likely be modified. The proposal of significant changes will initiate the appropriate level of California Environmental Quality Act (CEQA) compliance.

1.8 Management Plan Structure

This iteration of SMPMP is organized into five sections, with related subsections (and sub-subsections) where warranted. Main document Sections 1-5 are supported by dozens of Fig-

ures (maps) and Tables. An Appendix is provided to supplement the Plan with detailed/ site-specific information that is indispensable, though too cumbersome for placement in the main document. Studies, reports, and conversations that provide the knowledge-base for the SMPMP recommendations are listed in the References. Plan structure is summarized below.

Section 1, Introduction: Presents the planning context, including the regional setting, Preserve history, shared vision, existing efforts, and Plan development process.

Section 2, Description of Saddle Mountain Open Space Preserve: Gives a detailed overview of property boundaries and adjacent ownership; access points and roads; built infrastructure and historical relics; cultural significance and land use; natural disturbance regimes; topography, geology, and soils; climate and water resources; vegetation communities and habitats; and wildlife and plant species.

Section 3, Overview of Resource Management Issues: Synthesizes results from studies (including on the Preserve) to reveal several management concerns that impair Saddle Mountain conservation value. Three issues have become the priority focus of this Plan and the recommended projects proposed herein: (1) erosion and sediment delivery, (2) invasive, non-native plants, and (3) fire and fuels management. Issues that require monitoring and assessment in the long-term, but are not of immediate treatment concern (e.g. oak mortality, fire hazard, cultural resources, human use impacts) are also described.

Section 4, Potential Management Strategies: Describes a number of tools that have potential for successful application by managers at Saddle Mountain in reducing the priority issues identified in the previous section (i.e. erosion, invasive species). The preferred strategies are (with some inherent overlap) enhancement of plant communities and habitats; native plant revegetation; establishment of buffer zones; restoration of landscape disturbance processes; management of visitor use impacts; and ongoing monitoring and evaluation.

Section 5 Priority Project Implementation: Proposes a collection of projects to implement specific, high-priority actions to achieve the goals of the SMPMP. The projects highlighted in this section are organized into four broad categories: erosion control projects, invasive species control projects, habitat enhancement projects, and fuel management projects. However, these four areas are functionally integrated in practice (e.g. control of erosion-site sediment delivery supports enhancement of sensitive habitats, and vice versa).

2. DESCRIPTION OF SADDLE MOUNTAIN OPEN SPACE PRESERVE

2.1 Location and Boundaries

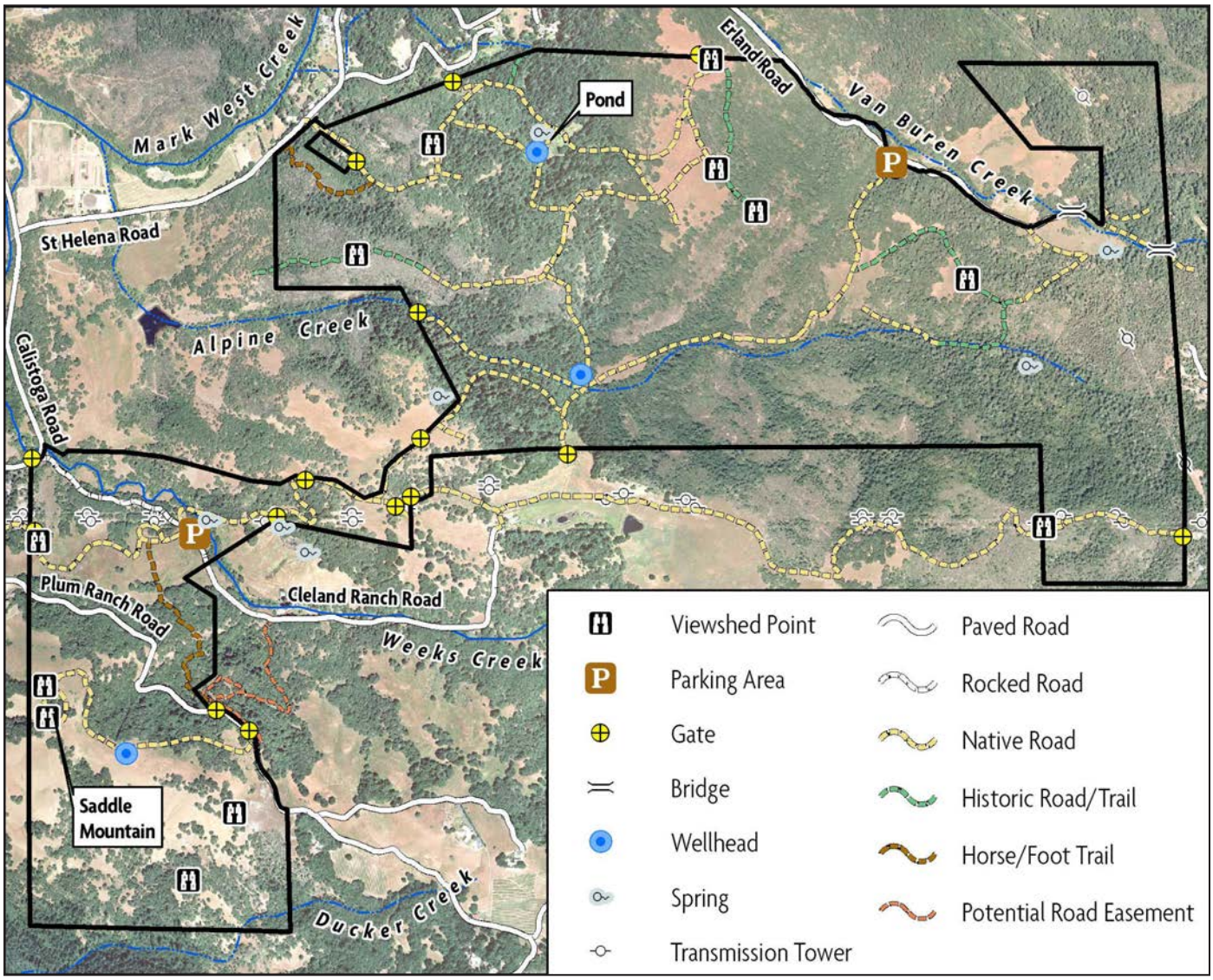


Figure 2. Saddle Mountain Open Space Preserve Base Map

The Saddle Mountain Open Space Preserve is located in the Mark West Creek and Santa Rosa Creek watersheds in the Russian River Hydrologic Unit in unincorporated eastern Sonoma County. It lies at the intersection of four USGS 7.5′ quadrangles: Mark West Springs in the northwest, Calistoga in the northeast, Santa Rosa in the southwest, and Kenwood in the southeast. The Preserve lies just north of the city limits of Santa Rosa, California. The site is accessible from Calistoga Road on Cleland Ranch Road, St. Helena Road, and via an access easement on Plum Ranch Road. Erland Road, another private road, has also been identified as an access point (Bowman Associates 2006).

2.2 Legal Features

The 960-acre Preserve consists of four Sonoma County legal parcels: Assessor's Parcel Numbers (APN) 028-390-028, 028-160-080, 028-160-044, and 028-380-008. All of these parcels are zoned Resources and Rural Development (RRD).

2.3 Adjacent Ownership

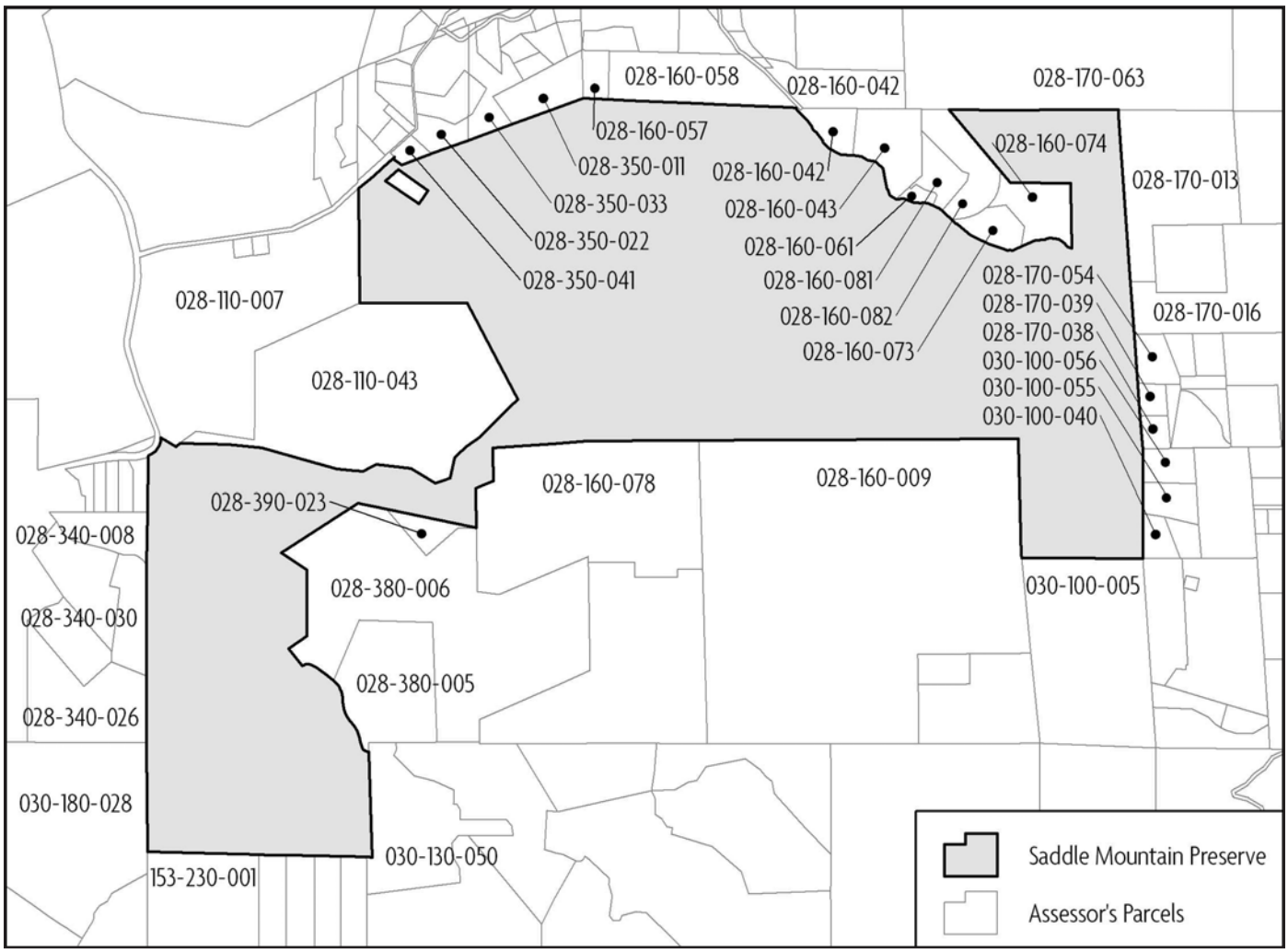


Figure 3. Saddle Mountain Open Space Preserve Parcel Map

The Saddle Mountain area is sparsely populated. Adjacent ownership consists mainly of rural residential lots varying in size from one to hundreds acres. Developed parcels generally contain single-family residences. Rincon Valley subdivisions, which contain incorporated residential city lots, border the southern portion of the property. Some of the adjacent properties consist of relatively undeveloped forest and grasslands, some are maintained as pasture or range for livestock (horses and/or cows), and a few have been intensively developed for wine-grape production. An equestrian facility at the corner of Calistoga and St. Helena Roads is the only commercial enterprise in the vicinity.

2.4 Public and Private Access

Access onto the Preserve has always been limited, as the property frontage along public roads is along two relatively small areas. There is an approximate 500-foot frontage along Calistoga Road at the junction of Calistoga Road and Cleland Ranch Road. Calistoga Road is a county maintained road and Cleland Ranch Road is private. The other public road frontage is an approximate 500-foot frontage along St. Helena Road where there is a gravel driveway leading from St. Helena Road to a private in-holding. The driveway leads to a chain across an unimproved, seasonal road that enters the property at the eastern boundary of the private in-holding at or near the property line.

Other access points are via private road easements. Plum Ranch Road, off Calistoga Road, provides access to the southern portion of the property. There is a gated, unimproved, seasonal ranch road on the property off Plum Ranch Road that leads to the summit of Saddle Mountain. Another gated, unimproved, seasonal ranch road is located on the Preserve off Erland Road. PG&E has

transmission tower maintenance road easements that access the southeastern and southwestern portions of the property.

Local residents access the Preserve via several unauthorized trails off Erland and St. Helena Roads and from adjacent properties. Currently public access is restricted to Ag + Open Space-trained volunteer patrollers and staff or partner-led outings and workdays.

Safe public access to the Preserve is limited and is available only from Cleland Ranch Road, which provides access to the southern portion of the property. Cleland Ranch Road is located at a sharp curve on Calistoga Road, and limited visibility and heavy, fast moving traffic on Calistoga Road make this turnoff extremely unsafe for access by buses or horse trailers.

Several private roads or trails provide private access points to the Preserve from neighboring properties.

- Plum Ranch Road enters the southern parcel of the property and provides access to private property located to its east. The turn onto Plum Ranch Road from Calistoga Road is very unsafe due to heavy traffic on Calistoga Road and limited visibility.
- The original property access is onto a private, unnamed road off St. Helena Road and provides access to the northern parcel.
- Along Erland Road, which is a private road that travels along the northern edge of the northern parcel, there is an access point for local residents only.
- A PG&E powerline maintenance road enters the property on the northwest side of the southern parcel and exits from the portion connecting the southern and northern parcels. This road re-enters and exits the property through the southernmost part of the northern parcel.
- A private road bridges the portion of the property that connects the southern and northern parcels. Gates on an un-named side road provide access for livestock movement to a property owner who owns property on both sides of the Preserve.
- A private road leads into the southern part of the northern parcel from private property.
- A private road enters the property on the western edge of the northern parcel from a neighboring property.
- A trail enters a northern property parcel to connect with the property trail and road network.
- A private road enters the eastern part of the northern parcel from a neighboring property just north of Erland Road.
- A horse trail developed by a neighbor enters the northern portion of the property from St. Helena Road and connects to the original property access road.

As part of the purchase transaction, Ag + Open Space completed work at the Cleland Ranch Road entrance to the property off Calistoga Road. These improvements included widening and paving the driveway apron and clearing vegetation and trees to provide clear site lines along a 250 foot distance. Additionally, Ag + Open Space completed work on Plum Ranch Road, which included paving, creating pull-outs, and constructing a fire-safe turnaround at the end on the property line.

2.5 Infrastructure

There are no structures on the Preserve, with the exception of a historic hunting cabin, an outhouse, and a cabin or barn in ruins. All of these structures are considered cultural resources. Current infrastructure is associated with previous land use, including ranching and timber operations. Historic fences from livestock ranching are mostly in disrepair; however, some fencing has been maintained by neighboring property owners who have livestock. The livestock water system has not been maintained and some of it has been lost through sale of some of the historic ranch property. There is a developed well that formerly served a trough in the saddle (Well No. 1) within the southeastern portion of the property, and a developed spring box that formerly served a galvanized cistern off Erland Road in the northeastern portion of the property. There are two capped wells along the road oriented north-south ("Wellhead Roads"), north of the Alpine Creek crossing that were presumably drilled when a subdivision was being planned for the Preserve.

Currently, Preserve visitors access the Preserve from Cleland Ranch Road off of Calistoga Road and park in a small mowed area about a half-mile into the property. This parking area can accommodate approximately 15 cars during the dry season; no improvement or expansion of this parking area is planned. Ag + Open Space installed an electric gate at the entrance to the property at Cleland Ranch Road in July 2015.

2.6 Cultural Resources

This section is included to provide information on the significance of the property from a human cultural perspective. However, the preservation of artifacts *in situ* and the restoration of built structures are both beyond the scope of this Plan at present.

Two studies performed in the Saddle Mountain area in 1977 identified six prehistoric sites, two historic fences, an abandoned cabin, and nine isolated finds (Origer and Fredrickson 1977; and Stradford and Fredrickson 1977); however, only the prehistoric sites were formally recorded. Of the six previously recorded sites located on the Preserve, four were found and records updated during the 2008 and 2018 surveys conducted by Tom Origer and Associates. Historically, the property primarily lay within what was designated as "public land" lying north of the Cabeza de Santa Rosa and Los Guilicos landgrants. A review of ethnographic literature for this area found that there are no ethnographic sites on the Preserve (Barrett 1908; Kroeber 1925, 1932; McLendon and Oswalt 1978). Numerous other studies (Flynn 1981; Greene 2003; Quinn and Origer 2001; Rich and Roscoe 2006; Roop 1988, 1991, and 1992; and Soule 1984) have been performed adjacent or near to the property. These authors identify a total of three cultural resources within one-quarter of a mile of the site. Table 2.1 lists 15 archaeological and/ or historical sites documented on the Preserve.

Table 2.1 Cultural Sites Documented in 2008

SITE NAME	SITE TYPE	DESCRIPTION	LOCATION (WATERSHED)
CA-SON-926 *	Prehistoric	Obsidian flakes and obsidian projectile point fragments on a ridge	Van Buren Creek Watershed
CA-SON-951	Prehistoric	Rock shelter with obsidian and basalt flakes and fragments of mammal bone	Weeks Creek Watershed
CA-SON-952 **	Prehistoric	Obsidian flakes along a road in a swale on a ridge	Weeks Creek Watershed
CA-SON-953	Prehistoric	Obsidian flakes along a road	Alpine Creek Watershed
CA-SON-954	Prehistoric	Obsidian flakes and possible metate (grinding stone) in meadow	Alpine Creek Watershed
CA-SON-955	Prehistoric	Obsidian flakes along a road, possible historic stone fire place and building	Alpine Creek Watershed
Isolated items	Prehistoric	Three obsidian biface fragments and chert tool fragment in roadway	Alpine Creek Watershed
Power Line Scatter	Prehistoric	Obsidian flakes along a road	Weeks Creek Watershed
Coin Camp	Historic	Mid-late 20th century camp along seasonal drainage	Alpine Creek Watershed
Far West Camp	Historic	Mid 20th century camp	Alpine Creek Watershed
Fence 1	Historic	Dry-laid field stone fence	Alpine Creek Watershed
Fence 2	Historic	Dry-laid field stone fence	Alpine Creek Watershed
Plum Ranch Orchard	Historic	Small wood frame building, stone foundation, artificial pond, cistern, privy.	Alpine Creek Watershed
Pond House/ Hunting Camp	Historic	Mid 20th century camp	Alpine Creek Watershed
Way Back Barn	Historic	Collapsed barn	Alpine Creek Watershed

* Note: No evidence of this site was found due to conflicting information about its location.

** Note: Site was visited but no evidence of prehistoric archaeological site indicators was found.

2.7 Current and Historic Land Use

Land use on the Preserve is currently limited to patrolling of the property by volunteers trained by Ag + Open Space. The District also offers approximately 4 public outings a year, led by entities contracted by Ag + Open Space, as well as approximately 6 workdays a year, and 2 trainings a year for people interested in becoming volunteer patrollers on the Preserve. Neighboring residents who live along Erland Road and are trained volunteer patrollers may access the Preserve on horseback.

Early occupants of Saddle Mountain presumably had an economy based largely on hunting, with limited exchange, and social structures based on extended family units. Later, milling technology and an inferred acorn economy were introduced. Both historic and modern human use patterns and natural resource management techniques have altered the property's landscape. The Preserve was a likely place for prehistoric occupation, as it has fresh water sources, well-drained soils, and a mosaic of grassland and woodland, which created an environment rich in natural resources. These features suggest that the property may have been utilized for hunting, resource gathering, and day-to-day activities (Barrow and Origer, 2008).

Since Europeans arrived, logging, land clearing, importation of livestock, and fire suppression have resulted in major changes in the property's vegetation patterns (Hill, 1978). The land was owned for several generations by the Merner family and known by various names (including Merner Lumber Company, Inc., Progress Lumber Company, Inc., and Merner Land Company, Inc.; Bowman and Associates, 2006). Much of the Douglas-fir and coast redwood forest has been logged, and multi-stump growth patterns of many of the oak stands indicate the hardwoods were most likely cut decades ago, presumably for fuel wood.

The Preserve was historically used as a livestock ranch (Bush 2008). The original ranch is located in the northeastern section of the southwestern parcel. Livestock grazing and periodic wildfires prevented the establishment of tree species in the grasslands of the property (Elgar Hill 1978). Other uses of the land have included timber production. While conducting field inspections of the ranch, archeological field crews searched for charcoal-making features that are fairly common in the hills east and north of Santa Rosa. Charcoal making results in features on the landscape that consist of circular level areas some 20 to 40 feet in diameter. These features, often situated on gentle slopes, also are marked by abundant small pieces of charcoal on and just below the ground surface. No archaeological evidence was found that charcoal making took place at Saddle Mountain Ranch.

2.8 Landscape Disturbance

Regular perturbations to the landscape via natural agents (e.g. wildfire, seasonal flooding, herbivores) are critical components of well-functioning ecosystems. Climate, land use, and habitat management practices influence the parameters characteristic of an area's disturbance "regimes," including its recurrence interval, location, and severity (Franklin et al. 2001, 2005). Whether a disturbance is natural, accidental, or managed, it by definition (Harrison et al. 2003) results in the removal of significant above ground biomass (e.g. dry thatch, grasses, forbs). The role of natural disturbance in maintaining species diversity and habitat viability is recognized as a central tenet of ecology, but complete understanding of cause-effect relationships that facilitate ecological resilience remains elusive. Nevertheless, maintenance of appropriate disturbance regimes has become a general practice for conservation biologists and land managers (Harrison et al. 2003).

It is observed that ecosystem function is compromised where natural disturbance regimes have been severely altered or curtailed by human activities (e.g. active fire suppression or complete exclusion of grazers). However, the magnitude of effects from highly modified regimes is not equal across habitat types (Keeley 2006). Some details on the history and effects of the most common disturbance practices (fire and grazing) are introduced below.

2.8.1 Disturbance by Fire

Human interference with natural ecological processes in California has been in place for at least twelve thousand years (Anderson, 2005). According to paleoecologists, California's oak woodlands replaced conifers during the transition of the late Pleistocene to the warmer Holocene epoch, approximately 10,000 years ago (Anderson, 2005). Then, approximately 2,500 to 2,800 years ago, climate conditions became cooler and moister, which favored Douglas-fir over oaks in the North Coast Ranges. Ecologists and soil scientists have concluded that regular burning by California Native Americans likely prevented the establishment of Douglas-fir in oak woodlands and prairies.

The Preserve shows evidence of repeated low intensity fires, which may have been naturally caused by lightning or deliber-

ately set by settlers or Native American residents. These low-intensity fires served to maintain grasslands, facilitate the gathering of acorns in oak woodlands, enhance game species habitat, reduce insect pest populations, and reduce fuels and the occurrence of catastrophic fires (Allen-Diaz et al. 2007, Biswell 1989). In California, only desert ecosystems were not regularly ignited (Bartolome et al. 2007). Thus, when people of European ancestry first arrived in California, they often did not find a pristine wilderness, but rather a managed landscape that was the result of thousands of years of intentional burning, selective harvesting, tilling and sowing, pruning, weeding, and transplanting.

The policy of wildfire suppression since 1935 has led to the establishment of Douglas-fir over much of the open habitat of what is now the Preserve. By 1935 state and local governments initiated programs to rapidly extinguish all wildfires in or near populated areas. Ecological changes that are directly attributable to or exacerbated by fire exclusion include:

- Coastal Oak Woodland habitat type on the Preserve is being encroached upon by Douglas-fir and is now classified Montane Hardwood-Conifer. Oak-dominated woodlands and forests are likely to transition to Douglas-fir dominated, with California bay becoming dominant in some locations.
- The Montane Hardwood habitat of oak, madrone, and bay trees is being invaded by Douglas-fir (Northen 1992b).
- In the chaparral, the trend is toward replacement of chamise with oak as the dominant species; however, the presence of Sudden Oak Death (SOD) on the property may change the direction of this successional trend.
- Douglas-fir and Redwood forests are likely stable in the near term, even in absence of fire, due to the longevity of these species (Moritz 2003) and the general resistance of forests versus grasslands to exotic species invasions (Keeley 2006).
- Grasslands are likely to diminish with encroachment of Douglas-fir or pioneer shrubs such as coyote brush (*Baccharis pilularis*): Cessation of annual burning on a grassland site in Berkeley resulted in an increase in ripgut brome and coyote brush and the eventual extirpation of purple needlegrass (*Nasella pulchra*) from the site (Bush 2008).

Photo 3. Coastal Oak Woodland being encroached upon by Douglas-fir

2.8.2 Disturbance by Grazers

The grazing ecology of California's grasslands extends back millions of years into the Tertiary Period. Present day relationships between grassland plants and grazing animals are strongly linked to these prehistoric associations (Edwards 1996). There is strong evidence that many of California's present-day genera of native perennial grasses evolved over millions of years with the extensive megafauna that once populated California (e.g. mastodon, mammoth, camel, llama, bison, elk, pronghorn, and horses). Modern grass genera that have been found associated with local fossil remains include wheatgrass (*Agropyron*), and oatgrass (*Danthonia*). Over the 10,000 years since the last ice age, the only large native grazers present in this part of California have been elk, which have been extirpated from much of the state.

It is an observable fact that since intensive ranching ended at Saddle Mountain, more grassland acreage has become the thatchy host of coyote brush. In certain instances, light grazing in oak woodland is thought to maximize some measures of local biodiversity (Allen-Diaz et al. 2007). Studies have documented the complete conversion of grassland to coyote brush-dominated coastal scrub in several locations in the bay area where grazing has ceased (Bartolome et al. 2007). However, the long-term effects of these changes are unknown and may include both positive and negative results. Managers at Saddle Mountain should determine case by case whether or not the ongoing physical encroachment of native shrubs (coyote brush) and trees (Douglas fir) into former rangeland areas presents a priority challenge that warrants action, or if unfacilitated habitat conversion to woody-type vegetation is acceptable.

2.9 Topography and Elevation

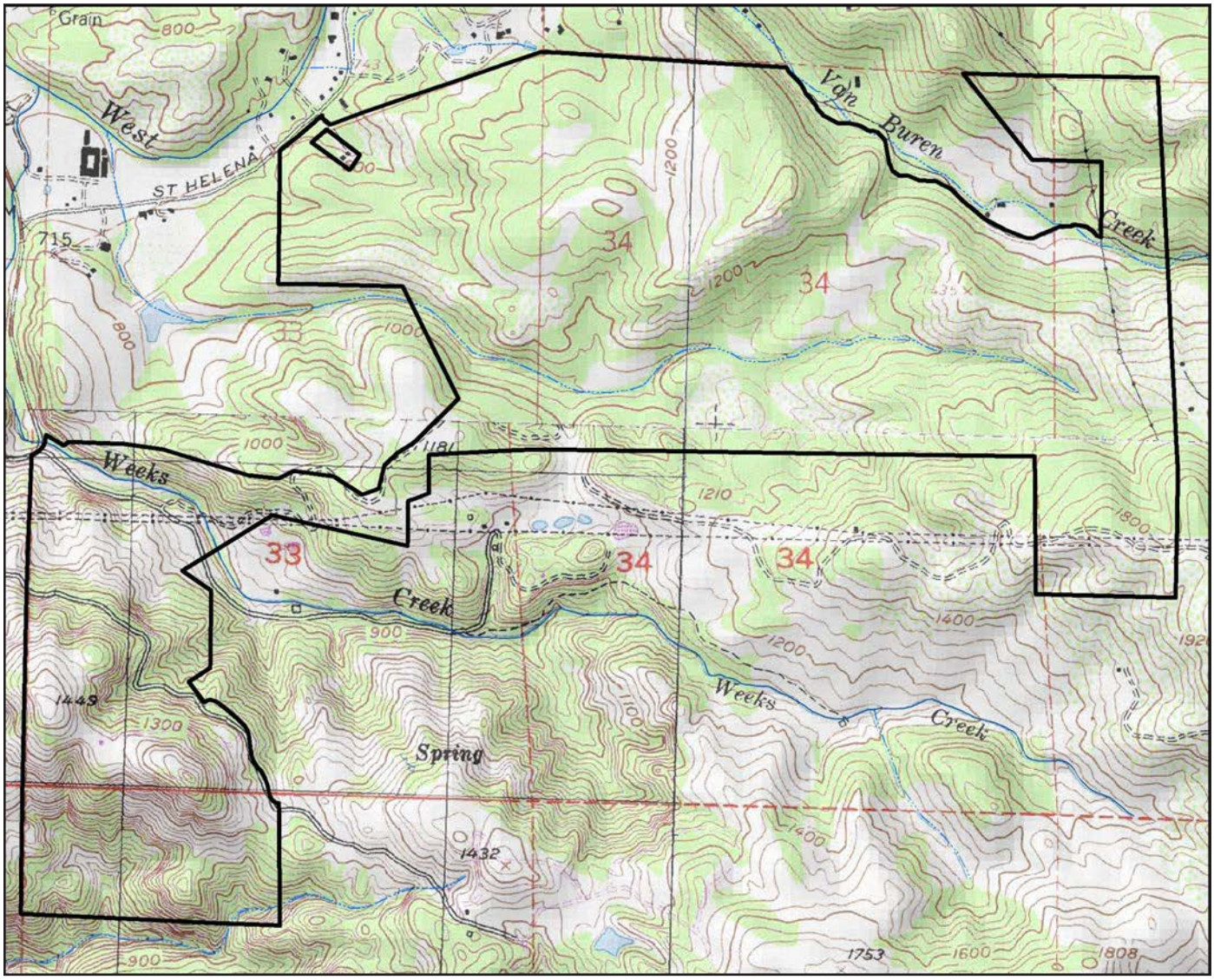
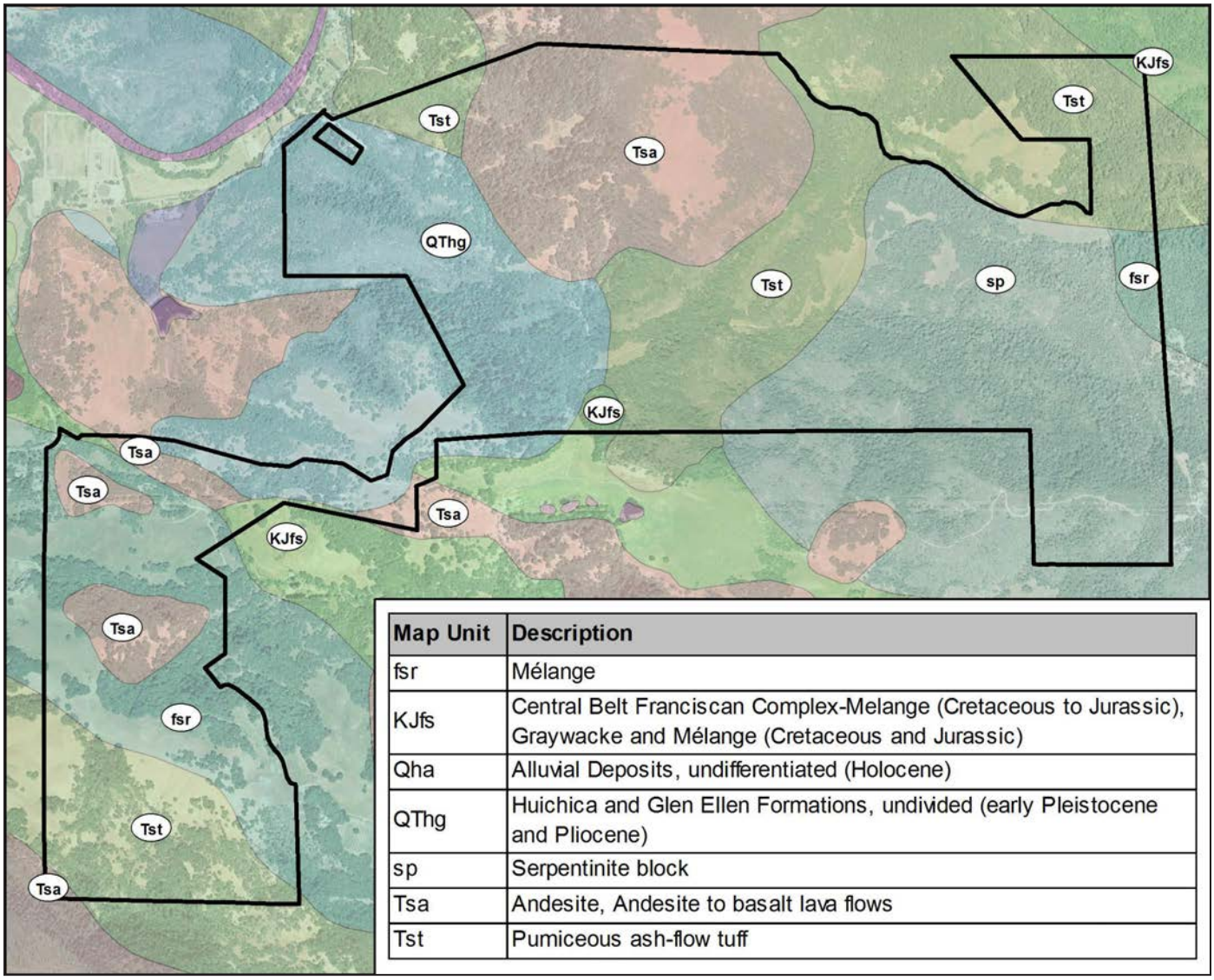


Figure 4. Topography

Elevations on the Preserve range from 760 feet (233 meters) above sea level near St. Helena Road to 1,800 feet (549 meters) in the southeast corner of the property. In the southwestern parcel, the highest point is approximately 1450 feet (442 meters) above sea level on one of the two peaks that form the "saddle" for which the mountain is named. The Preserve contains numerous steep ridges trending in an east-west direction divided by steep canyons carved by creeks. Elevation changes are steeper and occur in shorter distances in the southwest quadrant; the northeast quadrant tends towards more gently rolling topography.

2.10 Geology and Soils



Map Unit	Description
fsr	Mélange
KJfs	Central Belt Franciscan Complex-Melange (Cretaceous to Jurassic), Graywacke and Mélange (Cretaceous and Jurassic)
Qha	Alluvial Deposits, undifferentiated (Holocene)
QThg	Huichica and Glen Ellen Formations, undivided (early Pleistocene and Pliocene)
sp	Serpentinite block
Tsa	Andesite, Andesite to basalt lava flows
Tst	Pumiceous ash-flow tuff

Figure 5. Geology

2.10.1 Geologic Units

The main geologic units underlying the Preserve are the Franciscan Complex and Sonoma Volcanics. Other parts of the property are composed of Glen Ellen and Merced Formations. The Glen Ellen Formation has been mapped along the northwest edge of the southwestern portion of the property (Giblin and Associates 2003a, Elgar Hill 1978).

The Sonoma Volcanics

This unit contains mostly pale volcanic ash that is thought to have erupted from multiple sources near the town of Calistoga during the late Miocene to late Pliocene period. The Sonoma Volcanic rocks, together with the Clear Lake Volcanics, represent the northernmost occurrences of exposed volcanic rocks in the California Coast Ranges and are associated with the movement of the San Andreas Fault (Berkland 2001, Moores and Moores 2001, Alt and Hyndman 2000). Since deposition, the Sonoma Volcanics has undergone uplift and deformation due through faulting and folding (Giblin and Associates 2003b, Elgar Hill 1978).

The Franciscan Complex

This unit consists of an assortment of sedimentary rocks and basalt ocean floor jumbled together and compressed under great pressure in the oceanic trench during the Late Jurassic through Early Tertiary and thrust to the surface during uplift (Alt and Hyndman 2000). The serpentine masses that occur in distinct patches on the property are part of the Franciscan geology

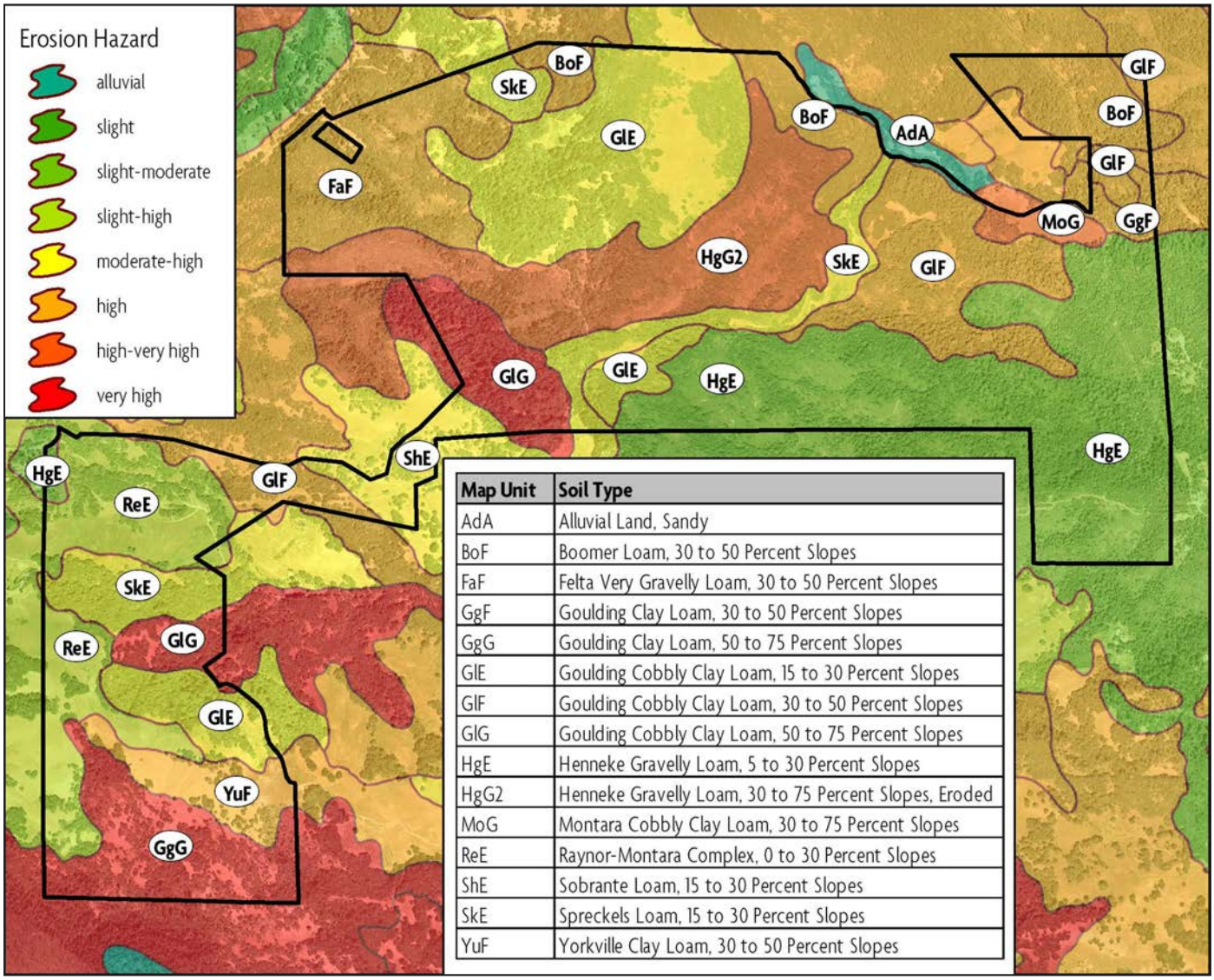
(Elgar Hill 1978). The Franciscan Complex underlies the Sonoma Volcanics formations throughout the property (Dwyer 1992).

The Glen Ellen Formation

This unit was created toward the end of the Sonoma Volcanics Formation period and is composed mostly of sedimentary rock deposited under lagoon and delta conditions. This layer contains lenses of gravel, sand, silt, and clay varying in thickness and extent (Wagner et al 2003, DWR 2004). The Glen Ellen Formation often overlays Sonoma Volcanics and, together with the Merced Formation, contains the principal water body in the Santa Rosa Valley Groundwater Basin (DWR 2004).

The Glen Ellen Formation and the Franciscan Complex are both easily eroded, leading to relatively frequent landslides (for example, in the southwest quarter of the property, occurring mainly in Franciscan sediments, Elgar Hill 1978). The Sonoma Volcanics Formation is much more stable with infrequent landslides (Laurel Marcus and Associates 2004). Fifteen soil types have been identified on the property (Figure 6. Soils); most of these soils have a high erosion hazard with rapid runoff potential. Two major geologic faults have been mapped on the property; one is a major thrust fault trending northwest (Giblin and Associates 2003a).

2.10.2 Soil Types



Map Unit	Soil Type
AdA	Alluvial Land, Sandy
BoF	Boomer Loam, 30 to 50 Percent Slopes
FaF	Felta Very Gravelly Loam, 30 to 50 Percent Slopes
GgF	Goulding Clay Loam, 30 to 50 Percent Slopes
GgG	Goulding Clay Loam, 50 to 75 Percent Slopes
GlE	Goulding Cobbly Clay Loam, 15 to 30 Percent Slopes
GlF	Goulding Cobbly Clay Loam, 30 to 50 Percent Slopes
GlG	Goulding Cobbly Clay Loam, 50 to 75 Percent Slopes
HgE	Henneke Gravelly Loam, 5 to 30 Percent Slopes
HgG2	Henneke Gravelly Loam, 30 to 75 Percent Slopes, Eroded
MoG	Montara Cobbly Clay Loam, 30 to 75 Percent Slopes
ReE	Raynor-Montara Complex, 0 to 30 Percent Slopes
ShE	Sobrante Loam, 15 to 30 Percent Slopes
SkE	Spreckels Loam, 15 to 30 Percent Slopes
YuF	Yorkville Clay Loam, 30 to 50 Percent Slopes

Figure 6. Soils

Edaphic (e.g. "serpentine") soils occur on the Preserve and support serpentine-adapted plant species, some of which are endemic to Sonoma County (Best et al. 1996). Such soils, derived from serpentinite, typically have nutrient profiles that include low levels of nitrogen, potassium, phosphorous, and calcium; high levels of magnesium; and imbalances in heavy metals (Kruckberg 1984). Soil map units occurring on the property that include serpentine-derived soils are Montara cobbly clay loam (30 to 75 percent slopes), Raynor-Montara complex (zero to 30 percent slopes), and Yorkville clay loam (30 to 50 percent slopes) (Bush 2008). Other soil types are described in Table 2.2.

Table 2.2. Soil Types and Commonly-Associated Vegetation Communities

CODE	SITE TYPE	SLOPE CLASS	EROSION HAZARD	RUNOFF POTENTIAL	TYPICAL LAND USE	COMMUNITY OCCURRENCE
BoF	Boomer Loam	30 – 50%	High	Rapid	Timber, limited grazing	Mixed evergreen forest
FaF	Felta Very Gravelly Loam	30 – 50%	High	Rapid	Range	Oak woodland
GgF	Goulding Clay Loam	30 – 50%	High	Rapid	Range	Grassland, oak woodland, chaparral
GgG	Goulding Clay Loam	50 – 75%	Very High	Rapid	Range	Grassland, oak woodland, chaparral
GIE	Goulding Cobbly Clay Loam	15 – 30%	Moderate to high	Medium to rapid	Range	Grassland, oak woodland, chaparral
GIF	Goulding Cobbly Clay Loam	30 – 50%	High	Rapid	Range	Grassland, oak woodland, chaparral
GIG	Goulding Cobbly Clay Loam	50 – 75%	Very high	Very rapid	Range	Grassland, oak woodland, chaparral
HgE	Henneke Gravelly Loam	5 – 30%	Slight to moderate	Slow to medium	Watershed, wildlife habitat, minimal grazing	Chaparral, serpentine chaparral, grassland, serpentine grassland
HgG2	Henneke Gravelly Loam	30 – 75%	High to very high	Rapid	Watershed, wildlife habitat, limited forage: cattle and sheep	Chaparral, serpentine chaparral, grassland, serpentine grassland
MoG	Montara Cobbly Clay Loam	30 – 75%	High to very high	Rapid to very rapid	Limited range, watershed, wildlife habitat, recreation	Grasslands, limited chaparral
ReE	Raynor-Montara Complex	0 – 30%	Slight to high	Slow to rapid	Range and pasture	Grassland, oak woodland
ShE	Sobrante Loam	15 – 30%	Moderate to high	Medium to rapid	Range, minimal use as orchards	Grassland, oak woodland
SkE	Spreckels Loam	15 – 30%	Moderate to high	Medium to rapid	Range and pasture	Oak woodland
YuF	Yorkville Clay Loam	30 – 50%	High	Rapid	Range, some wildlife cover & watershed.	Grasslands, oak woodland

2.11 Climate and Precipitation

The climate of Saddle Mountain is typical of Mediterranean climates with cool, wet winters and hot, dry summers. Temperatures are moderate, with monthly averages in nearby Santa Rosa ranging between 37 and 66 °F (3 to 19°C) during the winter and between 50 and 83 degrees °F (10 to 28°C) during the summer. Extreme temperatures have been recorded at 15 °F (-9°C) in December 1932 and 110 °F (43°C) in September 1971 and July 1972 (Western Regional Climate Center 2008).

Precipitation occurs mainly as rain; snowfall and hail occur infrequently and melt almost immediately. Average annual precipitation in Santa Rosa is 30.5 inches (775 mm) and mostly occurs between October and April (Western Regional Climate Center 2008). Giblin and Associates (2003b) report that precipitation on the Preserve averages about 45 inches (1,143 mm per year), although variability among and between years is common with drought and flood conditions alternating at irregular intervals.

2.12 Water Resources

2.12.1 Surface Waters

The Preserve contains portions of four creeks (Alpine, Ducker, Van Buren, and Weeks Creeks), as well as several of their unnamed tributaries. They are described below:

- The headwaters of Alpine Creek are located in the property's mountainous northeastern parcel. The Alpine Creek subwatershed encompasses roughly 380 acres (0.59 mi^2, 1.54 km^2) in the central portion of the property, ultimately flowing into a reservoir on an adjacent property. From there, an outlet stream crosses St. Helena Road and drains into Mark West Creek. Springs near the head of Alpine Creek provide the water source for summertime flow, which was estimated in 2002 at 10 to 20 gallons per minute (Giblin and Associates 2003b).

Photo 4. Alpine Creek with mature riparian habitat

- Ducker Creek drains a small area in the far southeastern corner of the southwestern parcel; it empties into the Santa Rosa Creek watershed.

Photo 5. Ducker Creek Drainage

- Van Buren Creek drains roughly 125 acres (0.20 mi^2, 0.51 km^2) of the northeastern portion of the property and flows to the Mark West Creek; it is a seasonal creek (i.e. dry during the summer months with only isolated reaches containing very low perennial flow or remnant pools remaining as refugia for aquatic wildlife).

Photo 6. Bridge over Van Buren Creek

- The Weeks Creek subwatershed drains approximately 170 acres (0.27 mi^2, 0.69 km^2) in the southern portion of the project area. Weeks Creek flows into Mark West Creek just north of the intersection of St. Helena and Calistoga Roads. Weeks Creek is seasonal.

Photo 7. Weeks Creek bank erosion

A number of springs were identified within and adjacent to the Preserve during the groundwater assessment (Giblin and Associates 2003a):

- Two small springs are located near the boundary between the overlying Sonoma Volcanics/Glen Ellen rocks to the north and the Franciscan Complex to the south. One of these springs drains to Weeks Creek; the other has been diverted to flow into a ranch pond on an adjacent property. These springs have relatively low flows which fluctuate seasonally.
- A larger spring is located further to the east where the Sonoma Volcanics and Franciscan Complex meet; this spring historically supplied water for the ranch house on an adjacent property.
- Near the Hunting Cabin, perched water forms a small spring that feeds a small man-made and year-round pond. Additionally a vernal pool is located near the hunting cabin that provides habitat for special status plant species as well as invasive species.
- A developed spring is located near Erland Road in the northeastern portion of the Preserve.

Photo 8. Spring box and irrigation line near Erland Road

- In the headwaters of Alpine Creek, a spring flows from serpentine rock providing the majority of late season flow into the creek. In the fall of 2002, seepage from this substantial spring into Alpine Creek was estimated to be 10-15 gallons per minute.

2.12.2 Groundwaters

Although the Glen Ellen Formation is an important groundwater source in the Santa Rosa Valley Groundwater Basin, its capacity to produce groundwater within the project area is limited and most of the aquifers are within zones in the Sonoma Volcanics containing open and interconnected fractures (Giblin and Associates 2003a). The low permeability of the Franciscan Complex, which underlies the Sonoma Volcanics and Glen Ellen Formations, along with the two project area faults (Section 3.10, Geology and Soils), act as barriers to groundwater movement. Groundwater recharge, which is a function of the amount and intensity of rainfall, slope, and soil permeability, was estimated by Giblin and Associates (2003); potential recharge area is limited to the area of volcanic rock and fractured inclusions within the Franciscan Complex.

Existing groundwater wells on and adjacent to the Preserve are described below:

- The southwest portion of the Preserve contains a primary well located at an elevation of about 1,350 feet (411 m) on a ridge in the southwest portion of the property (Figure 2, Saddle Mountain Open Space Preserve Base Map). Standing water level was at a depth of 430 feet (131 m) when the well was constructed in 1996 and the well was set at a depth of 504 feet (154 m) below the ground surface. It has not been utilized to any significant degree. This well was tested in 2002 and reported to have sufficient capacity to supply water for only a portion of the then-proposed housing development project (Giblin and Associates 2003a).
- The northeast parcel contains two wells; one is about 50 (15 meters) feet north of Alpine Creek in the western portion and the other is 2,300 feet (701 meters) north of the first. These wells draw water from depths ranging from 120 to 340 feet (37-104 meters) deep from fractured volcanic rock.
- Numerous offsite neighboring wells were identified and were reported to be between 200 and 500 feet (61-152 meters) deep and individually provided sufficient water for single-family residential use. The wells were mostly drilled within Franciscan and Volcanic Formations and believed to contain water due to the fracture zones between the two Formations.

2.12.3 Stream Depth and Flow

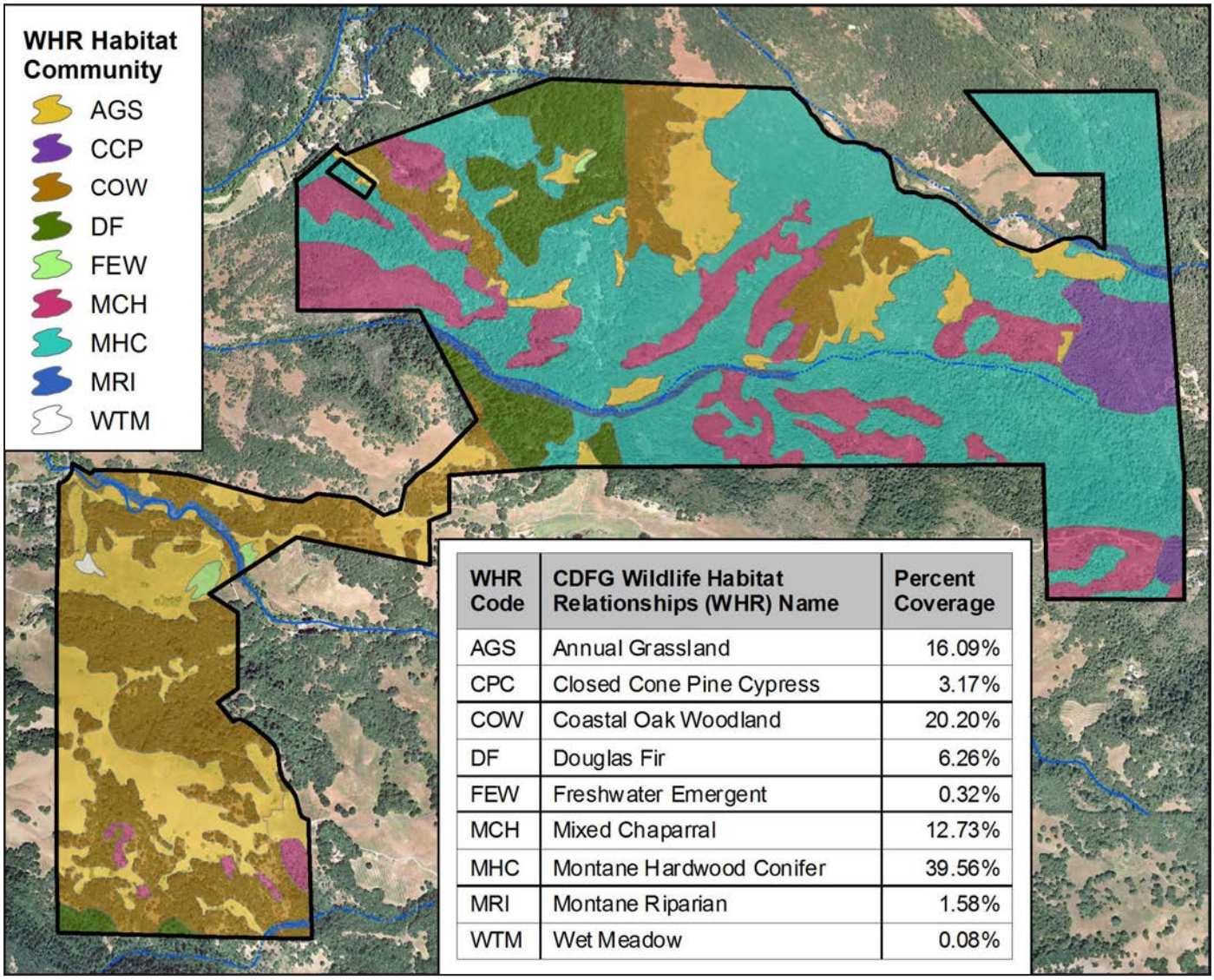
Based on the Mark West Creek Tributaries Stream Inventory Report (2006), which included measurements conducted on Weeks and Van Buren Creeks during the 1997 inventory, DFG noted a small percentage of pools (three percent and eight percent, respectively, of the assessed reaches of Weeks and Van Buren) and an even smaller ratio of primary (i.e. at least two feet deep) pools (one percent and 11 percent, respectively) of the assessed reaches of Weeks and Van Buren Creeks. In addition, in both Weeks and Van Buren Creeks, 100 percent of the pool tail-outs measured had embeddedness ratings of either three or four; only cobble embeddedness measured to be 25 percent or less (a rating of one is considered best for the needs of salmon and steelhead). Both the lack of pool depth and the high embeddedness ratings indicate a need for assessing and reducing sediment inputs into the property's creeks.

Stream flow, particularly through the late summer months, is a critical habitat issue in the upper Mark West Creek watershed and its tributaries. Even small surface reservoirs and low-volume diversions can exacerbate stream-drying in spring and summer (Deitch et al. 2008, 2009). Any land use changes proposed to the Preserve should be evaluated in terms of the potential water demand and projects developed in conjunction with a renewable water source such as winter water storage.

2.12.4 Dams and Impoundments

There is a small man-made pond within the northern portion of the Preserve near the hunting cabin that captures water from a nearby seep. The pond and associated dam at neighboring Hayfork Ranch, downstream of the property along Alpine Creek may serve as a barrier to fish passage, though resident fish were observed during field assessments in 2008.

2.13 Vegetation Communities



WHR Code	CDFG Wildlife Habitat Relationships (WHR) Name	Percent Coverage
AGS	Annual Grassland	16.09%
CPC	Closed Cone Pine Cypress	3.17%
COW	Coastal Oak Woodland	20.20%
DF	Douglas Fir	6.26%
FEW	Freshwater Emergent	0.32%
MCH	Mixed Chaparral	12.73%
MHC	Montane Hardwood Conifer	39.56%
MRI	Montane Riparian	1.58%
WTM	Wet Meadow	0.08%

Figure 7. Vegetation Communities

The Preserve contains ten vegetation communities, as identified by the California Department of Fish and Wildlife Habitat Relationships database, and corroborated during field reconnaissance conducted in May 2008. The boundaries of the habitat types on (Figure 7, Vegetation Communities) are general in nature and should not be used, for example, to delineate the presence or location of any jurisdictional wetlands. Although distribution of plant-life on the Preserve is complex, patterns exist:

- North-facing slopes on the property are predominantly forested while warmer, sunnier south-facing slopes contain open grassland, oak savannah, and chaparral.
- South of the saddle in the Weeks Creek watershed, vegetation is mostly a mixture of oak woodland and grasslands, while to the north vegetation is dominated by Douglas-fir, oaks, and other hardwoods.
- Chaparral is scattered throughout the property, primarily on ridgelines and south- southwest oriented slopes.
- Annual grassland, including a diversity of remnant native perennial grasses, occurs in fairly large expanses in the southwestern portion of the property and in smaller scattered patches in the northern portion.

Photo 9. Forested north-facing slope, oak savannah on south-facing slope, annual grassland

The Botanical Survey List (Appendix 4) compiled for this plan should be considered as a work in progress, as new species will likely be documented in the future. It is recommended that future botanical work focus on additional plant communities that are most likely to have listed or otherwise rare plants, including serpentine grassland, serpentine chaparral, vernal pool, and closed-cone pine-cypress. Recommended timing for botanical surveys is the beginning of February and continuing through June. Fieldwork was conducted on the Preserve from April to September 2008, and February to June 2009, which was an unusually dry period with almost no rainfall.

A total of 42 invasive plant species were documented on the Saddle Mountain property (Appendix 9, Invasive Plant Species List, and Figure 12, Invasive Plant Species). These species vary in their ecological impact, distribution, and invasive potential. Invasive plants, sometimes referred to as "transformer" species, displace native species, change plant community structure, and reduce the value of habitat for wildlife (Bossard et al, 2000). Invasive plants may also disrupt physical ecosystem processes such as fire regimes, erosion and sedimentation, nutrient cycling, and light availability. Native habitat types will exhibit variable susceptibility and response to invasive species.

2.13.1 Annual Grassland (AGS)

Annual grassland habitat covers approximately 16 percent of the Preserve. It occurs extensively throughout the southwestern portion of the property and in isolated patches in the northeastern portion. AGS on the Preserve, particularly in areas with thicker soils, is generally dominated by non-native species, although in areas with thin, rocky, or serpentine soils there are a high proportion of native perennial grasses. The Preserve's steep topography has precluded cultivation, which elsewhere has been responsible for eliminating native perennial grasslands. Overall grassland species composition and structure vary, depending on weather patterns, soil type, fire frequency, and livestock grazing patterns.

Local soil characteristics and topography strongly influence grassland species composition and production: Thin, coarse-textured, low-nutrient soils tend to support a greater diversity of native herbaceous plants because highly aggressive non-native annual grasses are less competitive in these conditions. These conditions are most extreme on soils derived from serpentinite, which typically have nutrient-poor profiles and can have imbalances in heavy metals (Kruckberg 1984). Clay-rich soils, such as Raynor clay, appear to support the highest density of medusahead.

Many grassland areas include significant components of threatened native perennial grasses. Historically, grazing by native ungulates and wildfire (anthropogenic or naturally occurring) maintained the open structure of AGS habitats. Although introduced annual grass species now dominate this habitat, it was historically dominated by native perennial bunchgrasses. Without active management, non-native annual grasses are likely to continue to dominate most native plant species (Bartolome et al. 2007). Thirty of the forty-two invasive species located on the Preserve occur in the Annual Grassland habitat type.

Photo 10. Native bunch grasses (blue wildrye)

Annual grasslands are heavily used by wildlife for foraging and nearby shrub and forested habitat often serve as shelter and breeding habitat. Reptiles known to breed in this habitat include western fence lizard (*Sceloporus occidentalis*), common garter snake (*Thamnophis sirtalis*), and western rattlesnake (*Crotalus oreganus*), and mammals typical of grasslands include the

black-tailed jackrabbit (*Lepus californicus*), California ground squirrel (*Spermophilus beecheyi*), Botta's pocket gopher (*Thomomys bottae*), western harvest mouse (*Reithrodontomys megalotis*), California vole (*Microtus californicus*), American badger (*Taxidea taxus*), and coyote (*Canis latrans*). Birds likely to use annual grassland as breeding habitat include burrowing owl (*Athene cunicularia*), short-eared owl (*Asio flammeus*), horned lark (*Eremophila alpestris*), and western meadowlark (*Sturnella neglecta*). Turkey vulture (*Cathartes aura*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), white-tailed kite (*Elanus leucurus*), and prairie falcon (*Falco mexicanus*) use this habitat for foraging (Kie 2005).

2.13.2 Coastal Oak Woodland (COW)

On Saddle Mountain, deciduous oaks dominate coastal oak woodland (COW) habitat, which covers about 20 percent of the landscape. COW habitat is extremely variable, both in composition and structure: The interplay of slope, aspect, soil, precipitation, and temperature leads to the formation of habitat that can resemble either savannah or montane hardwood forest. Coastal oak woodland overstory is made up of deciduous and evergreen hardwoods [Oregon oak (*Quercus garryana*), black oak (*Q. kelloggii*), blue oak (*Q. douglasii*), valley oak (*Q. lobata*), and coast live oak (*Q. agrifolia*) form both mixed and monospecific stands] with occasional conifers. The structure can be very dense with a closed canopy in mesic soils, but is sparse and open in drier soils. The shrub understory (often poison oak, *Toxicodendron diversilobum*) ranges from very dense to extremely sparse and ground cover can range from tightly packed ferns and forbs to a thick carpet of litter or even open grassland (Holland 1995).

Photo 11. Coastal oak woodland

The understory of the Coastal Oak Woodlands on the Preserve is largely made up of annual grasses and forbs, some of which are invasive. Fires historically occurred statewide throughout COW as low-intensity ground fires, so it is likely that the coastal oak woodland on Saddle Mountain experienced relatively frequent fire events. Oak recruitment is associated with fire events and has decreased since the onset of active fire suppression and cessation of the use of fire by ranchers for oak woodland management in the 1950s (Allen-Diaz et al. 2007).

Sudden Oak Death (SOD) occurs throughout the Preserve; thus, the presence of Oregon oak, blue oak, and valley oak, which are resistant to SOD, is likely to increase as coast live oak, tan oak, and black oak populations decline. The oak woodland on the property is also being threatened by Douglas-fir (*Pseudotsuga menziesii*) encroachment. If Douglas-fir continues to expand its range and becomes increasingly established, much of the COW habitat type on the Preserve will likely convert to Mixed Hardwood-Conifer forest.

COW in Sonoma County provides valuable habitat for a variety of reptile, amphibian, mammalian and avian species; in total, 215 vertebrate species of wildlife utilize this habitat for at least a portion of their life cycle. California newt (*Taricha torosa*), red-bellied newt (*Taricha rivularis*), California slender salamander (*Batrachoseps attenuatus*), northern western pond turtle (*Actinemys marmorata*), western fence lizard (*Sceloporus occidentalis*), and western skink (*Eumeces skiltonianus*) use many of the stages of coastal oak woodlands for reproduction, forage, and cover. Turkey vulture (*Cathartes aura*), white-tailed kite (*Elanus leucurus*), and red-tailed hawk (*Buteo jamaicensis*) also use coastal oak woodlands for reproduction, forage and cover. The more mature and dense this habitat is, the better its reproductive value for these birds. Coastal oak woodland also provides important habitat for Yuma myotis (*Myotis yumanensis*), big brown bat (*Eptesicus fuscus*), Sonoma chipmunk (*Neotamias sonomae*), California ground squirrel (*Spermophilus beecheyi*), black rat (*Rattus rattus*), brush mouse (*Peromyscus boylii*), coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), raccoon (*Procyon lotor*), long-tailed weasel (*Mustela frenata*), western spotted skunk (*Spilogale gracilis*), striped skunk (*Mephitis mephitis*), bobcat (*Lynx rufus*), and black-tailed deer (*Odocoileus hemionus columbianus*) (CDFG CIWTG 2005). Quail, squirrels, and deer are so highly dependent on acorns for forage that a poor acorn year may be partially responsible for a temporary population decline for these species (Holland 1995).

2.13.3 Closed-Cone Pine-Cypress (CPC)

On the Preserve, Closed-Cone Pine-Cypress habitat accounts for just three percent of the area and occurs on serpentine soil in the southeastern corner of the property. CPC habitat is primarily composed of species of evergreen needle-leaved trees. Usually in CPC habitats, a single species of closed-cone pine or cypress dominates, with different associates accompanying each species. On the Preserve, Sargent cypress (*Cupressus sargentii*) is the dominant conifer and is largely associated with serpentine soil (Barbour 2007). Other serpentine-related species occurring there are leather oak (*Quercus durata*) and Sonoma ceanothus (*Ceanothus sonomensis*), the latter listed by CNPS as fairly threatened in California (1B.2). CPC habitat typically occurs within a matrix of chaparral or forest on sites that are less fertile than the surrounding soils (Jensen, 2005). On the Preserve, CPC habitat intergrades with serpentine bunchgrass habitat and serpentine chaparral (Northen 1992a).

Photo 12. Closed-cone pine-cypress habitat with Sargent cypress, Sonoma ceanothus & hoary manzanita

This habitat is fire dependent: Both closed-cone pines and cypress produce serotinous cones that require the heat of fire to open and release seeds, although cones of some species will gradually open with age, with summer heat, or partially upon maturity (Barbour 2007). The full sunlight and bare soil present after fire events is conducive to seed germination and results in even-aged, dense stands of the dominant species. In the absence of fire, CPC habitat is likely to succeed to serpentine chaparral or grassland habitat due to the inability of the dominant species to reproduce in sufficient numbers to replace senescing individuals without the heat of fire. However, too-frequent fire recurrence (e.g. before the build-up of a canopy seed bank) can lead to stand extinction (Barbour 2007).

Closed-Cone Pine-Cypress habitat provides habitat for 148 vertebrate wildlife species including the western terrestrial garter snake (*Thamnophis elegans*), western skink (*Eumeces skiltonianus*), turkey vulture (*Cathartes aura*), sharp-shinned hawk (*Accipiter striatus*), American kestrel (*Falco sparverius*), peregrine falcon (*Falco peregrinus*), great horned owl (*Bubo virginianus*), and white-throated swift (*Aeronautes saxatalis*). Yellow-cheeked chipmunk (*Neotamias ochrogenys*), coyote (*Canis latrans*), long-tailed weasel (*Mustela frenata*), western spotted skunk (*Spilogale gracili*), striped skunk (*Mephitis mephitis*), bobcat (*Lynx rufus*), and mule deer (*Odocoileus hemionus*) all use at least some stages of this habitat for reproduction, cover, and forage (CDFG CIWTG 2005).

2.13.4 Douglas-Fir (DFR)

Douglas-fir habitat accounts for about six percent of the vegetation cover on the property. DFR habitat varies in structure and composition according to geology, slope, aspect, soil type and moisture content, and latitude. The typical structure contains a sparse, irregular overstory of needle-leaved evergreens with a dense lower overstory of broad-leaved evergreens. In general, older stands contain a denser canopy layer while younger stands are more open.

Photo 13. Douglas fir forest

Although species composition varies, DFR habitat usually includes tanoak (*Lithocarpus densiflora*, not a "true" *Quercus* oak), and Pacific madrone (*Arbutus menziesii*) in association with various pines and oaks. DFR habitat on Saddle Mountain is dominated by Douglas-fir, usually in pure stands, but also occurs intermixed with redwood (*Sequoia sempervirens*) or madrone. The shrub layer may contain canyon live oak (*Quercus chrysolepis*), California blackberry (*Rubus ursinus*), poison oak, snowberry (*Symphoricarpos albus*), ceanothus, coffeeberry (*Rhamnus*

californica), and hazelnut (*Corylus cornuta* var. *californica*). Douglas-fir forests often intergrade with Montane Hardwood, Montane Hardwood-Conifer, Montane Riparian, and Montane Chaparral (Raphael 2005).

The Douglas-fir (DFR) habitat type on the Preserve is largely devoid of invasive species, with the exception of a small stand of Himalayan blackberry and scattered Italian thistle along Erland-Cleland Tie Road. Most of the Douglas-fir forest on the Preserve has been harvested for timber at least once. In 1970, an intense crown fire occurred in a Douglas-fir stand on the property. When allowed to spread in the absence of fire or other mechanism of control, Douglas-fir can act as an invasive, particularly in grassland habitats.

DFR habitat provides for a variety of wildlife species. In Sonoma County, 198 wildlife species utilize this habitat for at least part of their life cycle (CDFW CIWTG 2005). The distributions of northwestern, Pacific giant, Olympic, Del Norte, black and clouded salamander, tailed frog, and northwester garter snake and the distribution of Douglas-fir habitat are very similar. This habitat is critical for reproduction, cover, and forage for California giant salamander (*Dicamptodon ensatus*), California slender salamander (*Batrachoseps attenuatus*), northern alligator lizard (*Elgaria coerulea*), and rubber boa (*Charina bottae*). Common birds utilizing DFR include Pacific-slope flycatcher (*Empidonax difficilis*), chestnut-backed chickadee (*Poecile rufescens*), golden-crowned kinglet (*Regulus satrapa*), Hutton's vireo (*Vireo huttoni*), Cassin's vireo (*Vireo cassinii*), hermit warbler (*Dendroica occidentalis*), and varied thrush (*Ixoreus naevius*). Mammals that are typically associated with this habitat include fisher (*Martes pennanti*), deer mouse (*Peromyscus maniculatus*), dusky-footed woodrat (*Neotoma fuscipes*), western red-backed vole (*Clethrionomys californicus*), creeping vole (*Microtus oregoni*), Douglas' squirrel (*Tamiasciurus douglasii*), Trowbridge's shrew (*Sorex trowbridgii*), and shrew-mole (*Neurotrichus gibbsii*) (Raphael 2005).

2.13.5 Fresh Emergent Wetland (FEW)

On the Preserve, fresh emergent wetlands comprise less than one percent of land cover. The FEW habitats consist of frequently flooded wetlands characterized by erect, rooted, water-loving plants such as sedges (*Carex* sp.), rushes (*Juncus* sp.), cattail (*Typhus* sp.) and bulrush (*Scirpus* sp.). This habitat occurs in association with both aquatic (e.g. streams) and terrestrial habitats. The boundary between fresh emergent wetland and upland habitat is the delineation between mainly hydrophilic and meso- or xerophilic plant life (Kramer 1995). On the Preserve, FEW is particularly associated with the seeps and springs that naturally occur in several locations there (Section 2.12, Water Resources). FEW often occurs adjacent to vernal pool and grasslands on the property (Northen 1992).

Photo 14. Freshwater emergent wetland

Invasive species in this habitat type are primarily within the wetland/upland transition zone. Species include Himalayan blackberry, Harding Grass (*Phalaris aquatica*), velvet grass (*Holcus lanatus*), bull thistle (*Cirsium vulgare*) and pennyroyal (*Mentha pulegium*). Pennyroyal, an obligate wetland plant, is well established within the vernal pool near the hunting cabin.

Fresh emergent wetlands are among the most productive habitats in California; in Sonoma County this vegetation type provides habitat for 161 species of vertebrate animals for at least part of their life cycle (Kramer 1995, CDFW CIWTG 2005). Reptile species for which this is important habitat include the aquatic garter snake (*Thamnophis atratus*), western terrestrial garter snake (*Thamnophis elegans*), and northern western pond turtle (*Actinemys marmorata*). The California newt (*Taricha torosa*), Pacific chorus frog (*Pseudacris regilla*), California red-legged frog (*Rana draytonii*), and tiger salamander (*Ambystoma tigrinum*) utilize this habitat to a high degree for reproduction, cover, and foraging. Many migrant and resident species of waterfowl and wading birds utilize fresh emergent wetlands for all or a part of their life history. Mammals that extensively utilize this habitat include common muskrat (*Ondatra zibethicus*), marsh shrew (*Sorex bendirii*), and American mink (*Mustela vison*) (CDFG CWITG 2005).

2.13.6 Lacustrine (LAC)

On the Preserve, lacustrine habitat consists of the vernal pool and man-made pond near the hunting cabin within the northern portion of the property. Environmental conditions in these relatively calm waters contrast sharply with those of running water. Oxygen levels are usually much lower in lacustrine environments than that of rivers and streams. Vegetation along the man-made pond edge is dominated by the non-native lance-leaved water-plantain (*Alisma lanceolatum*), and also includes the invasive plant pennyroyal (*Mentha pulegium*) and the special status plant Lobb's buttercup (*Ranunculus lobbii*) (CNPS 4.2). Vegetation in the vernal pool is dominated by pennyroyal and popcorn flower (*Plagiobothrys* sp.) and also includes Lobb's buttercup.

Lacustrine habitats may occur in association with Fresh Emergent Wetlands, Riverine, and any of the terrestrial habitats. Lacustrine habitat is used by numerous species of birds, mammals, reptiles, and amphibians for food, water, cover, and reproduction (California Department of Forestry and Fire Protection 1988). A northern western pond turtle (*Actinemys marmorata*), listed as a California Species of Special Concern, was observed in the man-made pond during the botanical survey in 2009.

Photo 15. Man-made pond with berm

2.13.7 Mixed Chaparral (MCH)

On Saddle Mountain, Mixed Chaparral habitat occurs on very shallow, rocky soils with chamise (*Adenostoma fasciculatum)* as the dominant species over about thirteen percent of the property. Scrub oak (*Quercus berberidifolia*), ceanothus, and manzanita (*Arctostaphylos* spp.) are co-dominant species with toyon (*Heteromeles arbutifolia*), California buckeye (*Aesculus californica*), poison oak (*Toxicodendron diversilobum*), stunted bay-laurel (*Umbellularia californica*), northern sticky monkeyflower (*Mimulus aurantiacus*), and coffeeberry (*Rhamnus californica*) as associates or local dominants. MCH usually matures to a dense canopy layer from one to four meters in height. Herbaceous ground cover is common in young stands but becomes less frequent as stands age. Mixed chaparral intergrades with Annual Grassland, Coastal Oak Woodland, and mixed conifer habitat (England 2005b).

Photo 16. Mixed chaparral

MCH is a fire-adapted habitat. Herbaceous ground cover has a long-lived seed bank ready to sprout following fire; existing shrub cover resprouts or recolonizes from seed following fire (England 2005b). Many chaparral shrub species are considered fire dependent because seed germination is negligible after the first year postfire. Even after prolonged fire-free intervals, other vegetation communities do not replace chaparral. Instead, dominant canopy shrubs are likely to change in response to changes in fire regime (Keeley and Davis 2007). Recovery is rapid after fire; for the first 30 years, shrub cover increases and canopies begin to overlap and shrubs outcompete herbaceous species. Stands older than 25 to 35 years eventually become senescent with the rate dependent on species composition, slope, aspect, elevation, and soil type. Senescent stands tend to be highly flammable, with a lot of accumulated dead material.

The Mixed chaparral on the Preserve is largely devoid of invasive species, with the exception of a stand of French broom (*Genista monspessulana*) within a serpentine chaparral plant community along the PG&E access road and under a transmission line tower in the far eastern portion of the property. French broom is an aggressive invader and is likely to spread, particularly in disturbed areas. Mixed chaparral provides habitat for 197 species of vertebrate wildlife. This habitat has high value for western rattlesnake

(*Crotalus viridis*), common garter snake (*Thamnophis sirtalis*), common kingsnake (*Lampropeltis getula*), California whipsnake (*Masticophis lateralis*), gopher snake (*Pituophis catenifer*), and California newt (*Taricha torosa*). Mixed chaparral is valuable breeding habitat for turkey vulture (*Cathartes aura*), California quail (*Callipepla californica*), barn owl (*Tyto alba*), white-throated swift (*Aeronautes saxatalis*), Anna's hummingbird (*Calypte anna*), and rock wren (*Salpinctes obsoletus*). It also provides important habitat for brush rabbit (*Sylvilagus bachmani*), black-tailed jackrabbit (*Lepus californicus*), Sonoma chipmunk (*Neotamias sonomae*), deer mouse (*Peromyscus maniculatus*), brush mouse (*Peromyscus boylii*), coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), skunks, mountain lion (*Puma concolor*), and bobcat (*Lynx rufus*) (CDFW CIWTG 2005).

2.13.8 Montane Hardwood-Conifer (MHC)

Montane hardwood-conifer forest is composed of conifers (at least one-third habitat composition) in the upper canopy and broad-leaved trees, usually evergreen, in the lower overstory. MHC covers about 13 percent of the landscape on the Preserve. Coast live oak, California bay, Pacific madrone, Douglas fir, and black oak dominate MHC habitat. The shrub layer contains any of several species: poison oak, hazelnut, creambush (*Holodiscus discolor*), California blackberry, and false indigo (*Amorpha californica* var. *napensis*), the latter listed by CNPS as fairly threatened in California (1B.2). Douglas-fir and California bay seedlings and saplings constitute a significant fraction of the shrub horizon in many areas of the property. The Montane Hardwood-Conifer on the Preserve is largely devoid of invasive species, with the exception of a small stand of French broom near a population of Napa false indigo along Well Head Road.

Photo 17. Montane hardwood-conifer forest

MHC forest is usually closed, with little understory except following disturbance or in ecotones between habitat types: It commonly intergrades with closed-cone pine-cypress, montane hardwood, redwood, montane riparian, and mixed chaparral. Basal fire scars are present on many of the older trees on the Preserve, indicating a long history of wildfire in this habitat with most of the fires being low-intensity ground fires. Because Douglas-fir seedlings and saplings are killed by fire but most hardwood species survive by resprouting, periodic low-intensity fires favor the presence of Montane Hardwood and Montane Hardwood-Conifer habitat (Elgar Hill 1978).

MHC habitat provides food, shelter, and reproductive opportunities for 221 species of vertebrate wildlife in Sonoma County. Western fence lizard (*Sceloporus occidentalis*), northern alligator lizard (*Elgaria coerulea*), rubber boa (*Charina bottae*), red-bellied newt (*Taricha rivularis*), and wandering salamander (*Aneides vagrans*) breed, forage, and find cover in this habitat type. Several raptor species, including osprey (*Pandion haliaetus*), sharp shinned hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperii*), northern goshawk (*Accipiter gentilis*), golden eagle (*Aquila chrysaetos*), and peregrine falcon (*Falco peregrinus*) reproduce in MHC, with mature stands especially suitable for nesting habitat. Mountain quail (*Oreortyx pictus*), band-tailed pigeon (*Patagioenas fasciata*), flammulated owl (*Otus flammeolus*), northern pygmy owl (*Glaucidium gnoma*), northern flicker (*Colaptes auratus*), western wood-pewee (*Contopus sordidulus*), northern rough-winged swallow (*Stelgidopteryx serripennis*), hermit thrush (*Catharus guttatus*), Cassin's vireo (*Vireo cassinii*), and western tanager (*Piranga ludoviciana*) also use this habitat extensively. Mammals for which MHC habitat is important include big brown bat (*Eptesicus fuscus*), brush rabbit (*Sylvilagus bachmani*) (in early successional stands), yellow-cheeked chipmunk (*Neotamias ochrogenys*), western gray squirrel (*Sciurus griseus*) (in mid- to late successional stands), deer mouse (*Peromyscus maniculatus*), brush mouse (*Peromyscus boylii*), ringtail (*Bassariscus astutus*), mountain lion (*Puma concolor*), and bobcat (*Lynx rufus*).

2.13.9 Montane Riparian (MRI)

Montane riparian habitat comprises just two percent of the property; nevertheless, viability in this zone is integral to maintaining high local biodiversity and watershed function. MRI usually presents as a narrow band of closely spaced deciduous trees with a closed overstory and variable understory. Tree species include big-leaf maple, California bay laurel, coast redwood, white alder (*Alnus rhombifolia*), and Oregon ash (*Fraxinus*

latifolia). Understory trees and shrubs may include willow (*Salix* sp.), poison oak, creambush, osoberry (*Oemleria cerasiformis*), California blackberry, and snowberry. At higher elevations, trees may drop out of this habitat with only shrubs remaining (Grenfell 1995, CRP 2003).

MRI occurs along Van Buren, Alpine, and Weeks Creeks. The riparian zone along Alpine Creek is largely devoid of invasive species. The riparian vegetation along the tributary of Ducker Creek on the property contains a limited amount of Himalayan blackberry (*Rubus armeniacus*). Weeks Creek is infested with substantial stands of Spanish broom (*Spartium junceum*) and Himalayan blackberry and lesser amounts of wild plum. Stands of greater periwinkle (*Vinca major*), English ivy (*Hedera helix*), and Himalayan blackberry are located along the reach of Van Buren Creek on the property, adjacent to Erland Road.

MRI habitat in Sonoma County provides valuable cover, reproductive potential, and forage for over 227 species of vertebrate wildlife in Sonoma County. All stages of this habitat are valuable for the aquatic garter snake (*Thamnophis atratus*), western terrestrial garter snake (*Thamnophis elegans*), California mountain kingsnake (*Lampropeltis zonata*), sharp-tailed snake (*Contia tenuis*), and southern alligator lizard (*Elgaria multicarinata*). Amphibians for which MRI habitat is essential include California giant salamander (*Dicamptodon ensatus*), red-bellied newt (*Taricha rivularis*), black salamander (*Aneides flavipunctatus*), and Pacific chorus frog (*Pseudacris regilla*). Many species of migrant and resident birds utilize this habitat as an important component of at least part of their life cycle, including black-crowned night heron (*Nycticorax nycticorax*), wood duck (*Aix sponsa*), osprey (*Pandion haliaetus*), sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperii*), and several other raptors, band-tailed pigeon (*Patagioenas fasciata*), several species of owls, white throated swift (*Aeronautes saxatalis*), woodpeckers, and many species of songbirds. Mammals that are typical of riparian forest include vagrant shrew (*Sorex vagrans*), ornate shrew (*Sorex ornatus*), long-eared myotis (*Myotis evotis*), long-legged myotis (*Myotis volans*), big brown bat (*Eptesicus fuscus*), and American mink (*Mustela vison*). Other mammals that regularly utilize this habitat include western harvest mouse (*Reithrodontomys megalotis*), deer mouse (*Peromyscus maniculatus*), brush mouse (*Peromyscus boylii*), common muskrat (*Ondatra zibethicus*), coyote (*Canis latrans*), black bear (*Ursus americanus*), ringtail (*Bassariscus astutus*), long-tailed weasel (*Mustela frenata*), mountain lion (*Puma concolor*), bobcat (*Lynx rufus*), and mule deer (*Odocoileus hemionus*) (CDFW CIWTG 2005).

Photo 18. Montane riparian

2.13.10 Wet Meadow (WTM)

Wet meadow habitat is generally composed of a layer of herbaceous plants with no shrubs or trees except rarely along the edges. WTM habitat occupies about one percent of the Preserve. These habitats often spring from bog communities and in time may be succeeded by grassland/ savannah if the hydroperiod is altered or if some other environmental perturbation occurs. WTM habitats may occur as ecotones between freshwater emergent wetlands and grasslands (Ratliff 2005). Representative plant species include native California oatgrass (*Danthonia californica*) and meadow barley (*Hordeum brachyantherum*), sedges, and rushes. Invasive species within the Wet Meadow habitat type on the Preserve include moderate invasive species velvet grass (*Holcus lanatus*) and bull thistle (*Cirsium vulgare*).

Photo 19. Wet meadow

WTM is an important resource for wildlife. Wet meadow provides habitat for as many as 208 species of vertebrate wildlife. Aquatic garter snake (*Thamnophis atratus*), western terrestrial garter snake (*Thamnophis elegans*), common garter snake (*Thamnophis*

sirtalis), California mountain kingsnake (*Lampropeltis zonata*), sharp-tailed snake (*Contia tenuis*), California newt (*Taricha torosa*), and Pacific chorus frog (*Pseudacris regilla*) utilize all stages of wet meadow for reproduction, cover, and forage. Great blue heron (*Ardea herodias*) forage in all vegetative stages of this habitat, as do many ducks and raptors. The peregrine falcon (*Falco peregrinus*) and prairie falcon (*Falco mexicanus*) use wet meadow for cover and reproduction as well as forage. Vagrant and fog shrew (*Sorex sonomae*) utilize dense wet meadow for reproduction, cover, and forage, while Botta's pocket gopher (*Thomomys bottae*), Pacific jumping mouse (*Zapus trinotatus*), and California vole (*Microtus californicus*) make use of all vegetative stages of this habitat to meet lifecycle requirements. Several predators, such as coyote (*Canis latrans*) and gray fox (*Urocyon cinereoargenteus*), forage in wet meadow habitat (CDFW CIWTG 2005).

2.14 Sensitive Habitats

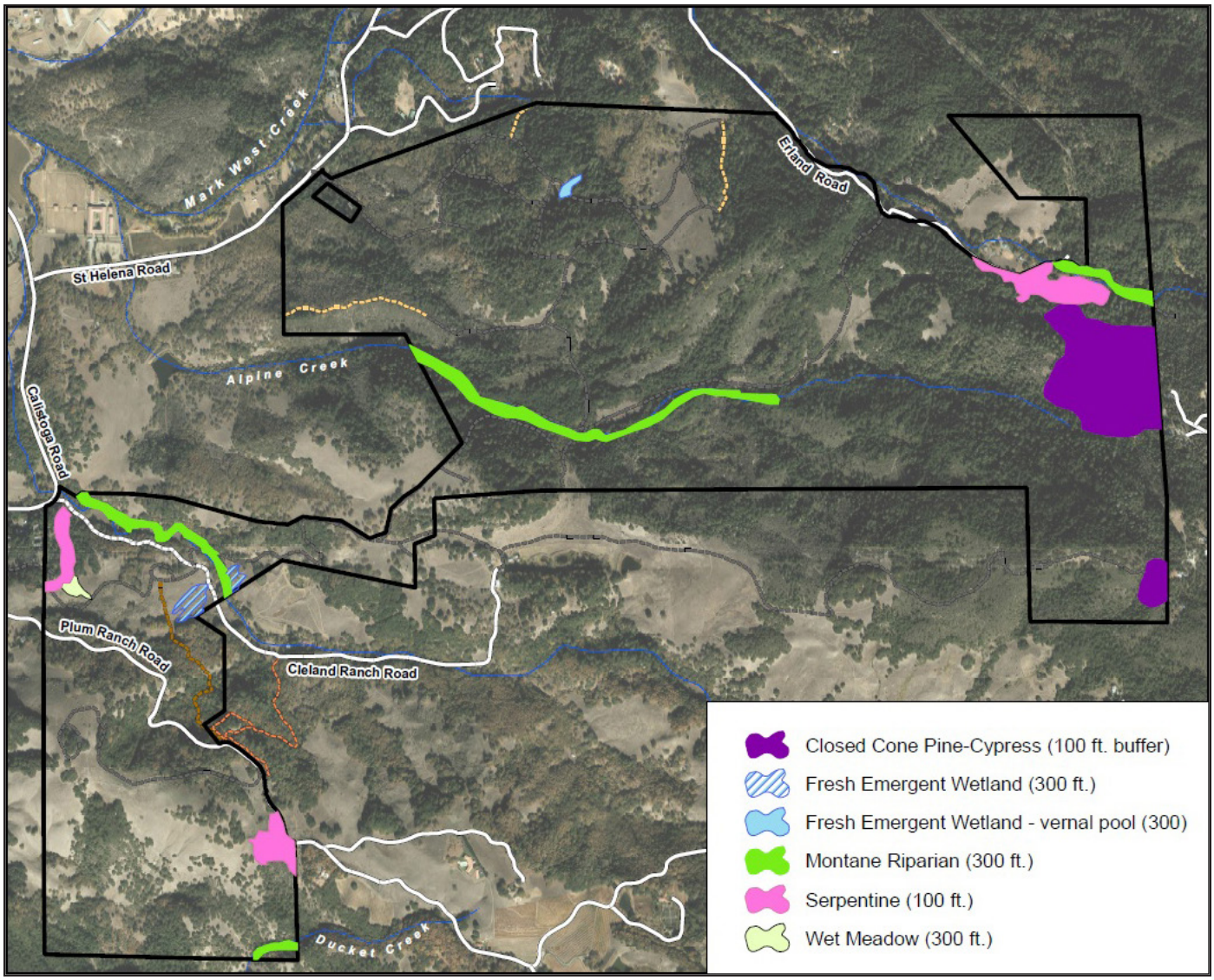


Figure 8. Sensitive Habitats

A suite of particularly significant or imperiled habitats has been identified on Saddle Mountain (Figure 8, Sensitive Habitats). Some are plant communities identified by Holland for CDFW as "rare" (Northen 1992) and others are known or suspected to support threatened or endangered species. Six of these habitats are documented on the Property: freshwater seeps, a vernal pool, valley needlegrass, serpentine chaparral, serpentine bunchgrass, and cypress forest. Instream and forest habitats support listed wildlife species (i.e. salmonids and northern spotted owl, respectively).

2.14.1 Freshwater Seeps

Freshwater seeps (Holland 45400) occur on the property, including one occupying the property's lower portions. It contains stands of *Juncus xiphioides, J. patens,* other rushes, sedge, and grasses common to wet habitat, including meadow barley (*Hordeum brachyantherum*). Off Cleland Road, between the serpentine bunchgrass habitat and meadow, is a small freshwater seep containing rush (*Juncus* spp.), sedge (*Carex* sp.) and creeping wildrye (*Elymus triticoides*) (Northen 1992).

2.14.2 Vernal Pool

A vernal pool (Holland 44000) is located near the hunting cabin within the northern portion of the Preserve. Vegetation includes Lobb's buttercup (CNPS 4.2), as well as popcorn flower, semaphore grass (*Pleuropogon californicus*), and spikerush (*Eleocharis macrostachya*). The invasive plant pennyroyal is well established within the pool, and a small patch of Himalayan blackberry is located adjacent to the pool.

2.14.3 Valley Needlegrass Grassland

The Valley Needlegrass Grassland (Holland 42110) occurs just uphill from the vernal pool (Northen 1992). The grassland contains native bunchgrasses such as purple needlegrass (*Nassella pulchra*) and California oatgrass (*Danthonia californica*). It is being threatened by coyote brush encroachment as well as invasive species, including velvetgrass, Himalayan blackberry, and bull thistle.

2.14.4 Serpentine Chaparral and Bunchgrass

Most of the property's Serpentine Chaparral (Holland 37620) and all of the Northern Interior Cypress Forest (Holland 83220) occur in the far eastern portion of the Preserve. Serpentine soils support distinctive flora that is uniquely adapted to high concentrations of heavy metals and low concentrations of calcium and other important nutrients. Serpentine chaparral is also located near the Cleland Ranch entrance road off Calistoga Road and at the eastern extent of Plum Ranch Road. This chaparral intergrades with Serpentine Bunchgrass (Holland 42130) habitat that contains a variety of native perennial grasses including California melic (*Melica californica*), slender wheatgrass (*Elymus trachycaulus* ssp. *trachycaulus*), junegrass (*Koeleria macrantha*), and big squirreltail (*Elymus multisetus*) (Northen 1992).

Photo 20. Serpentine Chaparral

2.14.5 Habitats Occupied by Listed Species

All habitats documented to support threatened or endangered species require special attention. On the property, these include habitat for two salmonids (threatened steelhead trout, *Oncorhynchus mykiss*; and endangered Coho salmon, *O. kisutch*) and the endangered northern spotted owl (*Strix occidentalis caurina,* "NSO"). This latter species is documented to nest in forest on the northern edge of the northeastern parcel.

2.15 Sensitive Plant Species

Seven of the native plant species occurring on the Preserve are considered of special conservation interest. Federally endangered Clara Hunt's milk-vetch (*Astragalus claranus*) was identified on the property in April 2009. The CNPS "rare" species that were encountered on the property during the 2008 botanical survey were: Lobb's buttercup (*Ranunculus lobbii*), Napa false indigo (*Amorpha californica* var. *napensis*), narrow-anthered California brodiaea (*Brodiaea californica* var *leptandra*), Sonoma canescent manzanita (*Arctostaphylos canescens* ssp. *sonomensis),* Sonoma ceanothus (*Ceonothus sonomensis*), and St. Helena morning glory (*Calystegia collina* ssp. *oxyphylla*). Table 2.3 lists the habitat where these species are found as well as the CNPS Rare Plant Ranking. These species warrant special consideration during management planning and implementation. Confidential Appendix 16 contains a map of sensitive habitats and sensitive plan species occurrences on the Property.

Table 2.3 Rare Plant Species Documented in 2009

SPECIES	COMMON NAME	CNPS[5] RANK	HABITAT
Amorpha californica var. napensis	Napa false indigo	CNPS 1B.2	MCH/MHC
Arctostaphylos canescens ssp. sonomensis	Sonoma canescent manzanita	CNPS 1B.2	MCH/CPC
Astragalus claranus	Clara Hunt's milk-vetch	CNPS 1B.1	AGS/COW
Brodiaea californica var. leptandra	Narrow-anthered brodiaea	CNPS 1B.2	MCH/CPC
Calystegia collina ssp. oxyphylla	Mt. St. Helena morning-glory	CNPS 4.2	AGS/MCH
Ceanothus sonomensis	Sonoma ceanothus	CNPS 1B.2	MCH/CPC
Ranunculus lobbii	Lobb's aquatic buttercup	CNPS 4.2	LAC

5 The California Rare Plant Ranking System (i.e. "CNPS Rank") according to CA Native Plant Society standards at http://www.cnps.org/cnps/rareplants/ranking.php

The presence of Rincon Ridge ceanothus (*Ceanothus confusus*) (CNPS 1B.1) and Calistoga ceanothus (*Ceanothus divergens*) (CNPS 1B.2) has been confirmed within a mile of the southeast corner of the northeastern parcel and is considered extant (CDFG 2008a). Rincon Ridge ceanothus grows in appressed groundcover mats and is tolerant of serpentine while Calistoga ceanothus is a rare chaparral plant. These species were not encountered during the 2008 botanical survey, but may occur within the Mixed Chaparral habitat type on the Preserve. The Mixed Chaparral habitat type is difficult to access as it forms a nearly impenetrable thicket of shrubs and small trees with intertwined branches and unyielding stems.

2.15.1 Clara Hunt's Milk-Vetch

Clara Hunt's milk-vetch (*Astragalus claranus*) (federal endangered, CNPS 1B.1) is exceedingly rare worldwide: There are only six documented locations, all in either Sonoma or Napa counties. One of these is within the Preserve. Any habitat documented to support this species should be considered highest priority for conservation, restoration, or other actions to foster the species. The local population was identified in April 2009. It is part of a larger, previously unknown population that extends across the property line onto an adjacent property. Additional populations of Clara Hunt's milk-vetch have been previously documented on the Hayfork Ranch property (CDFG 2008a).

Photo 21. Clara Hunt's milk-vetch

A small annual plant in the pea family (Fabaceae), the only known populations are located in Sonoma and Napa counties, where it typically is located in open areas or grasslands on thin, volcanic, clay soils. The bloom period is generally April-May (Best et al. 1996). It seems to favor lightly disturbed areas on the property, and in areas lightly grazed by horses on an adjacent property.

2.15.2 Lobb's Buttercup

Lobb's buttercup (*Ranunculus lobbii*), a rare vernal pool species (CNPS 4.2), was identified previously in the vernal pool by the old hunting cabin during a rare plant survey in 1992 (Northen 1992a). It is considered locally common in shallow vernal pools where it floats in the water (Best et al. 1996). It was documented in both the vernal pool and the manmade pond during the 2008-09 survey. The bioregional distribution of Lobb's buttercup is the North Coast, North Coast Ranges, Central Coast, and San Francisco Bay Area.

Photo 22. Lobb's buttercup

2.15.3 Napa False Indigo

Napa false indigo (*Amorpha californica* var. *napensis*) (CNPS 1.B.2) has been documented just north of the northeastern parcel and is considered extant (CDFG 2008a). It is considered locally common on dry brushy or wooded slopes (Best et al. 1996). During the 2008 botanical survey, Napa false indigo was encountered throughout the Preserve within the montane hardwood-conifer, montane riparian, and coastal oak woodland habitat types. The bioregional distribution of this species is the North Coast Ranges (Napa, Lake, Sonoma counties) and north San Francisco Bay Area (Marin County) (Hickman 1993).

Photo 23. Napa false indigo

2.15.4 Narrow-Anthered California Brodiaea

During the 2008 botanical survey, narrow-anthered California brodiaea (*Brodiaea californica* var. *leptandra*) (CNPS 1.B.2) was identified in serpentine chaparral habitat in the far southeastern portion of the property. Narrow-anthered California brodiaea is typically found in open forests and chaparral, often on serpentine soils (Hickman 1993). The bioregional distribution of this species is the Inner North Coast Ranges (Napa, Lake, Sonoma counties).

Photo 24. Narrow-anthered California brodiaea

2.15.5 Sonoma Ceanothus

Sonoma ceanothus (*Ceanothus sonomensis*) was previously identified on serpentine soil in the southeastern corner of the northeastern parcel during a rare plant search of the Preserve (Northen 1992a). It was found in association with Sargent cypress, leather oak, and other serpentine plants, extending beyond property boundaries to the south and east. During the 2008 botanical survey, Sonoma ceanothus was encountered in the closed cone pine-cypress and serpentine chaparral habitat types in the far eastern portion of the property. It is typically associated with chaparral, in sandy, serpentine, or volcanic soils (Hickman 1993). The bioregional distribution of this species is the Outer North Coast Ranges (Hood Mtn. Range, Sonoma and Napa counties).

Photo 25. Sonoma ceanothus

2.15.6 Sonoma Manzanita

Sonoma manzanita (*Arctostaphylos canescens* spp. *sonomensis*), listed by CNPS as 1B.2, may be present and should receive further taxonomic review during flower, typically from January to April. Sonoma manzanita is difficult to distinguish from Hoary manzanita (*Arctostaphylos canescens* spp. *canescens*), which was identified on the Preserve during the 2008 botanical survey. Thus, the manzanita genus (*Arctostaphylos*) should receive further taxonomic attention, particularly in the eastern portion of the property within the Closed-Cone Pine-Cypress and Mixed Chaparral habitats where Sargent cypress, Sonoma ceanothus, and serpentine soils are located. The bioregional distribution of Sonoma manzanita is the western Klamath Ranges and Outer North Coast Ranges.

Photo 26. Sonoma manzanita

2.15.7 St. Helena Morning Glory

During the 2008 botanical survey, St. Helena morning glory (*Calystegia collina* ssp. *oxyphylla*) was identified in serpentine chaparral habitat near the Cleland Ranch Road entrance to the Preserve. A serpentine endemic, the bioregional distribution of this species is the North Coast Ranges (Napa, Lake, Sonoma counties) (Hickman 1993).

Photo 27. St. Helena morning glory

2.16 Animal Species

2.16.1 Native Wildlife

Field studies could confirm the specifics, but it is known that Saddle Mountain provides habitat for as many as 289 wildlife species: twenty reptile species, 17 amphibian species, 63 mammal species, and 189 bird species. See Appendix 5, Potential Wildlife list (CDFW CIWTG 2005) for complete listings of species either documented to occur on the property, or known to occur in similar habitats in locations off the property.

2.16.2 Naturalized Exotic Animals

Wild turkeys (*Meleagris gallopavo*) are the only naturalized (i.e. established exotic) animal species encountered on the Preserve. Other species that may occur but were not documented on site are feral pig (*Sus scrofa*) and opossum *(Didelphis virginiana)*. The CDFW released wild turkeys starting in 1908 with the intent of establishing a new species for hunting. Concerns about their potential impacts to native plants and animals have been raised by both government agencies and the public since the early 1990s, when CDFW was still actively releasing wild turkeys to expand their range and provide new hunting opportunities. More recently, concerns have been raised about turkey populations in areas where sustaining native species is a primary management goal.

Feral and domestic cats as well as domestic dogs are likely on the property. Cats can travel long distances and are inclined to hunt birds and small mammals (Hill, 1978). Dogs are rarely successful in catching the wildlife they chase, but do occasionally kill wildlife, or injure the wildlife enough to cause their subsequent death. Packs of dogs are particularly threatening to wildlife and have been known to kill livestock. In particular, pregnant wildlife and newborn animals do not have the reserves to repeatedly expend in avoiding dogs.

2.17 Listed Wildlife Species

Several vertebrate species that are documented to or potentially occur on the Preserve are threatened, endangered, or otherwise designated special conservation status species. These include two native salmonids, one amphibian, one reptile, one bird, and five mammal species (Appendix 6, Endangered, Threatened and Special Status Species List).

As elsewhere, these species' population declines and special status is largely a result of habitat alteration/ fragmentation and reduced resource (especially water) quality. Management actions on the property should be implemented with consideration of these species' habitats and other requirements in mind. Costs and benefits must be weighed. For example, removal of excess woody debris, while desirable for fire management purposes, also removes a primary source of amphibian habitat; debris removal would not be expected to affect reptiles in the same way (Bury 2004).

2.17.1 Fishes

Some of the streams located within the Preserve provide habitat for steelhead trout (*Oncorhynchus mykiss;* state listed as threatened) and may potentially provide habitat for Coho salmon (*O. kisutch;* federal and state listed as endangered). The Mark West Creek watershed is known to still support a steelhead population; Coho were recorded there in 2001 but were not detected in 1993, 1994, or 2002 (CDFG 2002, CDFG 2004). They were again documented as present in 2015 (CDFW 2019). Stream-specific descriptions of potential limiting factors on the Preserve follow:

- A field survey in 2003 found Alpine Creek unsuitable as habitat for either steelhead or Coho due to the presence of long bedrock chutes without adequate resting areas (Halligan 2003).
- In Van Buren Creek, steelhead and roach were observed during a fish habitat inventory in 1997 (CDFG 2006). The California Department of Fish and Wildlife (CDFW) identifies migration barriers due to impoundments and gravel quality as the highest priority limiting factors to salmonid presence in Van Buren Creek.
- In Weeks Creek, no steelhead were observed during the 1997 fish habitat inventory (CDFG 2006). Water temperature and gravel quality are considered the highest priority limiting factors in Weeks Creek (CDFG 2002). However, Ag + Open Space consultant Rob Evans documented a steelhead trout in Weeks Creek constructing a redd near the road crossing in March 2018.
- The Santa Rosa Creek watershed supports steelhead and historically supported Coho salmon as recently as 1993 and 1994; however, surveys in 2000, 2001, and 2002 failed to detect Coho in Santa Rosa Creek (CDFG 2004).
- Limiting factors to salmonid survival in Ducker Creek include gravel quality, riparian stability, water temperature, and water quality (CDFG 2002).

2.17.2 Amphibians

The California Natural Diversity Database (CNDDB) (CDFG 2008a) identifies two documented sightings of foothill yellow legged frog (*Rana boylii*) on and near the Preserve. The foothill yellow legged frog is currently listed as a California Species of Special Concern by CDFG and as a Sensitive Species by the Bureau of Land Management (BLM) and US Forest Service (USFS) (CDFG 2008b). This species inhabits rocky streams in many habitat types including mixed conifer, mixed chaparral, and wet meadow (CDFG CIWTG 2005).

2.17.3 Reptiles

A northern western pond turtle (*Actinemys marmorata*), listed as a California Species of Special Concern, was observed in the manmade pond during the botanical survey in March 2009. In 2014, a turtle nest was also observed. The CNDDB (CDFG 2008b) contains a documented sighting (1999) of western pond turtle just west of the property boundary. Northern western pond turtles are associated with permanent to nearly permanent water bodies in a variety of habitat types (CDFG CIWTG 2005).

2.17.4 Birds

There is a confirmed northern spotted owl (*Strix occidentalis caurina*) nesting location in the northeastern parcel on the property (CNDDB 2008a). Northern spotted owls are listed as federally threatened, as a California Department of Forestry (CAL FIRE) Sensitive Species, and as a California Species of Special Concern by CDFW (CDFG 2008b, CDFG 2008c). This species inhabits dense, mature, multi-layered mixed-conifer and Douglas-fir habitats.

2.17.5 Mammals

Townsend's big-eared bat (*Corynorhinus townsendii*) and the pallid bat (*Antrozous pallidus*) are listed as California Species of Special Concern by CDFW and as Sensitive Species by BLM and USFS. The long-eared myotis (*Myotis evotis*) is listed as a Sensitive Species by BLM. All three species may inhabit the Preserve; these bats are found throughout the state at low and mid-elevations in a variety of habitats, but are not common. A bat survey by a quali-

fied biologist could confirm the presence of these species on the Preserve. The Sonoma tree vole (*Arborimus pomo*) is listed as a California Species of Special Concern by CDFW and may inhabit the property. It is rare to uncommon, but can occur in Douglas-fir and montane hardwood-conifer habitats. Fishers (*Martes pennanti*) are uncommon in the North Coast Ranges, but may inhabit the property. They are found in mature coniferous and deciduous riparian forests with a high degree of canopy closure and are listed as a California Species of Special Concern and a USFS Sensitive Species (CDFG 2008b, CDFG CIWTG 2005).

3. OVERVIEW OF RESOURCE MANAGEMENT ISSUES

This section describes priority and long-term issues identified during field surveys. Priority issues are (1) erosion and (2) invasive plant species: these warrant immediate action via implementation of projects targeted at reducing adverse impacts and enhancing existing viability. Other issues are included in this Plan because they present legacy challenges to be addressed, or because they might emerge as significant threats in the future. These include the woodland pathogen known as Sudden Oak Death; fire risk management; human use management; preservation of cultural resources; and mitigation of off-site factors.

3.1 Erosion and Sedimentation

3.1.1 Approach to Erosion Control

In the summer of 2008, Pacific Watershed Associates (PWA) conducted an assessment of erosion problems associated with the network of rural roads and trails within the Preserve. The purposes of the assessment project were: (1) to identify and quantify all current and potential erosion problems associated with the roads and trails, and (2) to develop a prioritized plan for erosion remediation, long-term erosion control, and maintenance for these roads and trails (Section 6.1.1, Erosion Remediation Projects). The PWA survey covered approximately 10 miles of road and trail. In 2015, PWA completed a reevaluation of inventoried roads, trails, and identified sites to update the treatment recommendations based on existing conditions (Appendix 7, Summary of PWA Field Data and Recommended Erosion Treatment Schematics).

An important element of long-term restoration and maintenance of both water quality and fish habitat is the reduction of impacts from upland erosion and sediment delivery. Sediment delivery to stream channels from roads and road networks has been extensively documented, and is recognized as a significant impediment to the health of salmonid habitat (Harr and Nichols, 1993; Flosi et al., 1998). Unlike many watershed improvement and restoration activities, erosion prevention and "storm-proofing" of rural, ranch, and forest roads has an immediate benefit to the streams and aquatic habitat of a watershed (Pacific Watershed Associates, 1994; Weaver and Hagans, 1999; Weaver et al., 2006). It helps ensure that the biological productivity of the watershed's streams is minimally impacted by future road-related erosion, and that future storm runoff can cleanse the streams of accumulated sediment, rather than depositing additional sediment from managed areas.

According to data collected by the California Department of Fish and Wildlife (CDFW) in 1996, excessive delivery of fine sediment is an issue affecting salmonid habitat in Mark West Creek, which has been identified by CDFW as an important component of recovery plans for salmonids in both the Russian River watershed and central California. Road-related erosion and sediment delivery has been identified as a significant contributor of fine sediment to the Mark West Creek stream system.

3.1.2 Condition of Road Network

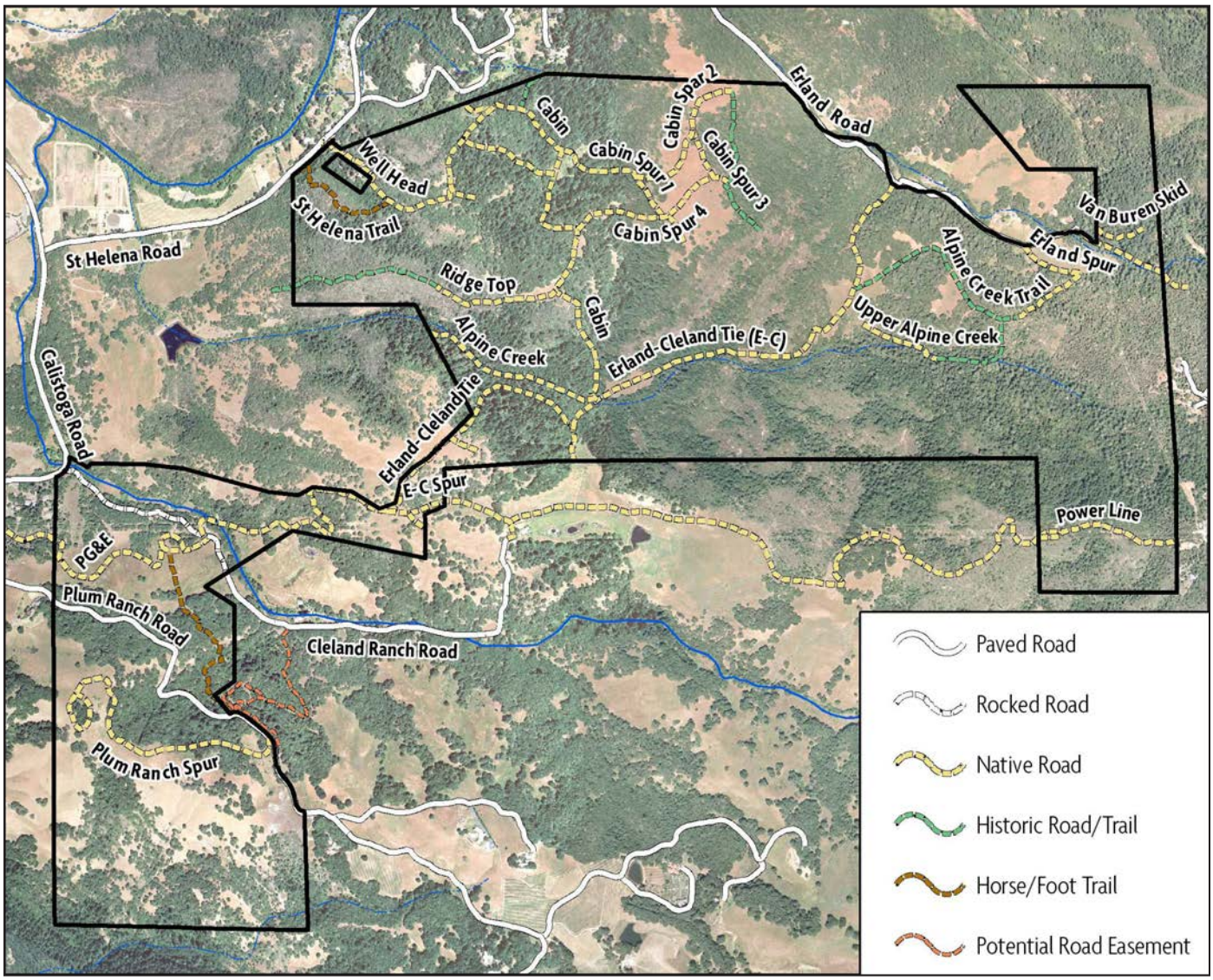


Figure 9. Road Network

On the whole, the erosion issues identified on the Preserve by PWA do not currently have a major impact on water quality or fish habitat in the affected streams. The roads on the Preserve are minimally developed, and have received little or no use in recent years, but identified problems are likely to worsen if left untreated, and have the potential to more significantly degrade both water quality and fish habitat in the future. PWA identified 3.35 miles of roads and 34 individual road-related sites that either are currently eroding and delivering sediment to the stream system, or show a strong potential to do so in the future (Table 3.1, Condition of Roads and Trails). Two sites of current or potential erosion and sediment delivery were identified on trails within the project area. One site was identified at which erosion was occurring without delivery of eroded sediment to streams; this location was assessed as a "maintenance" site. Rob Evans & Associates identified several additional non-road related erosion sites while performing the natural resources inventory fieldwork. These sites, located in the Weeks Creek watershed, were identified as potential Restoration Areas.

Roads listed below are in order of major roads and their spurs, followed by minor roads. Both trails described are undeveloped, "social" trails that appear to have been created by local users, both on foot and horseback. Neither of these trails had a developed fill prism or cutbank.

Cleland Ranch Road

Cleland Ranch Road is a well-maintained, rock surfaced road that begins at its gated intersection with Calistoga Road and runs for approximately 0.4 miles across the Preserve. This road was inventoried by PWA in 2004 as part of the Upper Mark West Creek Sediment Source Assessment (Pacific Watershed Associates, 2004). Road upgrades were constructed on Cleland Ranch Road under PWA supervision in 2007, and no further work is required. One site of road surface discharge was identified on Cleland Ranch Road in 2015; however, recommended treatments are located along the nearby PG&E Road, which intersects with Cleland Ranch Road.

Erland-Cleland Tie Road

Erland-Cleland Tie Road crosses both Weeks and Alpine Creeks. This road has the most significant cutbanks and fill prisms of any of the assessed roads (excluding Cleland Ranch and Plum Ranch Roads). Erland-Cleland Tie Road is unsurfaced for almost its entire length, except for a roughly 400 foot gravel-surfaced section located near the Erland Road intersection; this lower section of road is severely gullied. This road traverses both grassland and oak woodland areas. Eleven sites of erosion and existing or potential future sediment delivery were identified and assessed along this road, of which 10 are recommended for treatment: six stream crossings, two gullies, and two sites of bank erosion. Four small spur roads branch off from Erland-Cleland Tie Road. These are essentially tracks in the grass, and have no associated erosion sites.

Cabin Road

Cabin Road has a significant cutbank and fill prism from the Erland-Cleland Tie Road intersection for about 1,000 feet, and then becomes more of a track as it traverses a grassland setting. Five sites were identified on this road: three stream crossings and two gullies. We recommend treatment for each of these. While most of the Cabin Road will be upgraded, we recommend decommissioning one section of this "loop" road where the surface is severely gullied as the stream has diverted down the section of road. There are four spur roads off Cabin Road into grassland areas; these roads are essentially tracks in the grass and have no associated erosion sites.

Alpine Creek Road

Alpine Creek Road was located during field surveys. This 0.4 mile unsurfaced road extends west from Cabin Road along Alpine Creek, and exits the property on the west. For most of its length, Alpine Creek Road lies on the floodplain of Alpine Creek and has no road fill.

Upper Alpine Creek Road

Upper Alpine Creek Road is an unsurfaced, abandoned road that becomes evident where it enters an oak woodland area and continues along the right bank of Alpine Creek, which it fords. PWA inventoried three stream crossings on this road. Due to access, we recommend abandoning the road in place.

Alpine Creek Trail

Alpine Creek Trail is approximately 0.6 mile long and extends from the ridgetop terminus of Erland Spur Road, down to and across Alpine Creek, and then follows the left bank of Alpine Creek to Upper Alpine Creek Road. Past equestrian and hiking use has developed this "social" trail and is only evident by signs of brush clearing and tracks left by horses. No trail bed has been developed. PWA staff identified two erosion sites (stream crossings) along this trail.

Wellhead Road

Wellhead Road is an unsurfaced road that extends from Cabin Road (near the abandoned cabin) to the northwestern edge of the Preserve. PWA identified three sites that require treatment on this road: one stream crossing and one gully. Wellhead Road has one very short spur with no apparent erosion sites.

Wellhead II Road

Wellhead II Road is a very short (0.10 miles) abandoned spur road off of Cabin Spur Four Road that provides access to a wellhead. The road is grassed over and there are no erosion sites.

Ridge Top Road

Ridge Top Road is an unsurfaced road measuring approximately 0.25 miles. It extends from Cabin Road along the ridgetop that defines the northwestern boundary of the Alpine Creek watershed. The road may originally have been established to act as a fire break. No erosion sites were identified on this road.

Erland Spur Road

Erland Spur Road is an abandoned, overgrown road that is partially intermittent along its length. It is primarily used by recreational hikers and equestrians. It is approximately 0.3 mile long, extending uphill from Erland Road across grassland and oak woodland to the top of the ridge that divides the Alpine and Van Buren Creek watersheds, and then connecting with the Alpine Creek Trail. PWA identified one stream crossing along this road; however, no treatments are recommended.

PG&E Road

PG&E Road is a half-mile unsurfaced power line access road that extends across a grassland area to the south from Cleland Ranch Road, continuing beyond the Preserve boundary into an adjacent rural subdivision. The lower extent of the road is in poor condition, with a deeply rutted surface. PWA staff identified five problematic erosion sites along this road, each of which requires treatment: four stream crossings and one gully.

Power Line Road

Power Line Road is also an unsurfaced PG&E maintenance access road that crosses a series of power line corridors near the southeastern corner of the Preserve. The portion of this road that lies within the project area measures approximately 0.3 mile. No erosion sites were identified along this stretch of road.

Plum Ranch Road

Plum Ranch Road is a paved rural residential access road that crosses the southwestern portion of the Preserve. It includes three erosion sites: two sediment delivery sites (a stream crossing and a ditch relief culvert) and one maintenance site (a ditch relief culvert).

Plum Ranch Spur Road

Plum Ranch Spur Road is unsurfaced and approximately 0.7 mile long. It extends uphill towards the south from its gated intersection with Plum Ranch Road to a saddle on the ridgetop that defines the watershed boundary between Ducker and Weeks Creeks. This road lies under dense tree cover for most of its length. No erosion sites were identified on this road.

Van Buren Skid Road

Van Buren Skid Road is the only road that lies to the north of Erland Road. This abandoned, partially revegetated skid road extends from the vicinity of Erland Road to a broad flat area near the ridgetop, mostly under coniferous forest canopy. One erosion site (a gully) was identified along this road. However, due to access issues, this road is recommended for abandonment.

St. Helena Trail

St. Helena Trail is a 0.25 mile long, undeveloped trail that extends to the west from the western portion of Wellhead Road to St. Helena Road. This trail also is evident only by tracks left by horse use and brush clearing. No erosion sites were found along this trail.

Table 3.1 Road and trail characteristics, erosion site distribution, and treatment recommendations, Saddle Mountain Road and Trail Erosion Reevaluation, Sonoma County, California.

ROAD OR TRAIL NAME	TOTAL LENGTH (MI)	SURFACE TYPE	INVENTORIED SITES THAT ARE RECOMMENDED FOR TREATMENT	INVENTORIED SITES THAT ARE NOT RECOMMENDED FOR TREATMENT	TREATMENT RECOMMENDATION	FUTURE SEDIMENT DELIVERY (YD^3)
ROADS/TRAILS WITH INVENTORIED EROSION SITES						
Alpine Creek Road	0.37	Unsurfaced	-	2 stream crossings (#33, 34)	Abandon in place	10
Alpine Creek Trail	0.60	Unsurfaced	-	2 stream crossings (#28, 29)	Abandon in place	3
Cabin Road	0.70	Unsurfaced	3 stream crossings (#11, 13, 36) 1 gully (#14)	-	Upgrade	338
	0.17	Unsurfaced	1 gully (#12)	-	Decommission	63
Cleland Ranch[a]	0.42	Rock	1 road surface discharge point (#35)	-	Upgrade	94
Erland-Cleland Tie Road	2.00	Unsurfaced[b]	6 stream crossings (#2, 6, 7, 8, 9, 17) 2 gullies (#3, 4) 2 bank erosion sites (#1, 5)	1 stream crossing (#10)	Upgrade	802
Erland Spur Rd	0.33	Unsurfaced	-	1 stream crossing (#27)	Abandon in place	43

ROAD OR TRAIL NAME	TOTAL LENGTH (MI)	SURFACE TYPE	INVENTORIED SITES THAT ARE RECOMMENDED FOR TREATMENT	INVENTORIED SITES THAT ARE NOT RECOMMENDED FOR TREATMENT	TREATMENT RECOMMEN-DATION	FUTURE SEDIMENT DELIVERY (YD^3)
PG&E Road	0.51	Unsurfaced	4 stream crossings (#18, 20, 21, 22) 1 gully (#19)	-	Upgrade	69
Plum Ranch Road	0.78	Pavement	1 maintenance ditch relief culvert (#25) 1 stream crossing (#24)	1 ditch relief culvert (#23)	Upgrade	94
Upper Alpine Creek Road	0.17	Unsurfaced	-	3 stream crossing (#30, 31, 32)	Abandon in place	21
Van Buren Skid Road	0.10	Unsurfaced	-	1 gully (#26)	Abandon in place	12
Wellhead Road	0.50	Unsurfaced	1 stream crossing (#15) 1 gully (#16)	-	Upgrade	102
ROADS/TRAILS WITH NO INVENTORIED EROSION SITES						
Cabin Spur Roads 1-4	1.00	Unsurfaced	-	-	-	-
Cleland Ranch	0.42	Rock	-	-	-	-
Erland-Cleland Tie Spur Roads 1-4	0.50	Unsurfaced	-	-	-	-
Plum Ranch Spur Road	0.72	Unsurfaced	-	-	-	-
Power Line Rd	0.34	Unsurfaced	-	-	-	-
Ridge Top Rd	0.25	Unsurfaced	-	-	-	-
St. Helena Trail	0.26	Unsurfaced	-		-	-
Wellhead II Rd	0.10	Unsurfaced	-	-	-	-
Totals	**10.24**					**1,651**

[a] Recommended road drainage treatments associated with this site are actually located on PG&E Road.

[b] The road is partially rocked from Erland Road to site #2

[c] Includes sediment delivery from ALL sites, not just those recommended for treatment.

3.1.3 Erosion Sites and Sediment Delivery Volumes

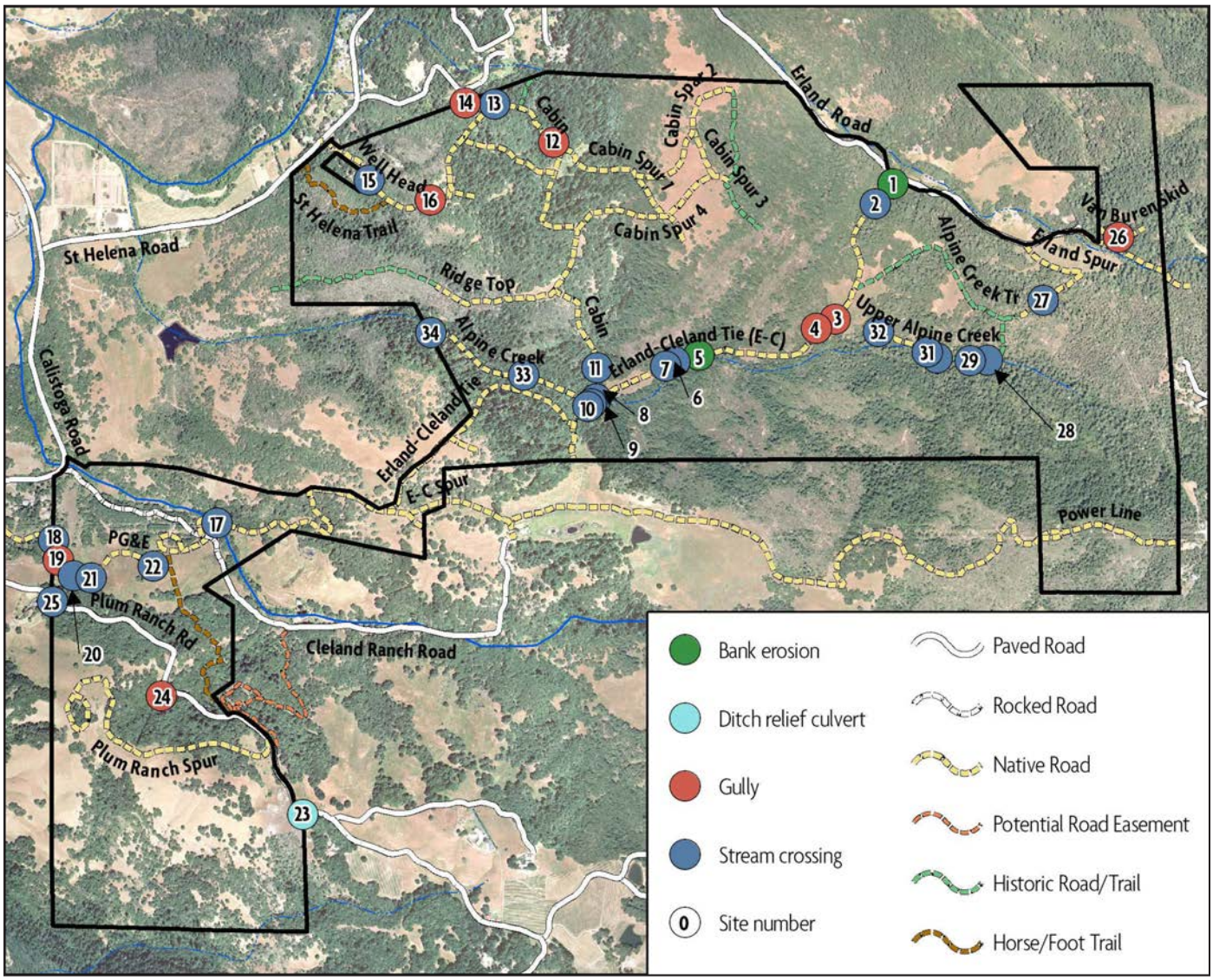


Figure 10. Road Related Erosion Sites

Erosion Sites/ Sources

PWA identified a total of 34 road-related erosion sites with the potential to deliver sediment to streams in the Saddle Mountain assessment area: 22 stream crossings, two ditch relief culverts, seven gullies, one road surface discharge point, and two sites of bank erosion (Table 3.2 Road Related Assessment Results). PWA also identified two trail-related erosion sites in the Saddle Mountain assessment area, both of which are stream crossings located on the Alpine Creek Trail.

Table 3.2. Assessment results for inventoried erosion sites and hydrologically connected road and trail segments, Saddle Mountain Road and Trail Erosion Reevaluation, Sonoma County, California.

SOURCES OF SEDIMENT DELIVERY	TOTAL SITES INVENTORIED (#)	MAINTENANCE SITES RECOMMENDED FOR TREATMENT[A] (#)	SEDIMENT DELIVERY SITES RECOMMENDED FOR TREATMENT (#)	HYDROLOGICALLY CONNECTED ROADS ADJACENT TO SEDIMENT DELIVERY SITES		TOTAL LENGTH OF ROADS AND TRAILS SURVEYED FOR PROJECT (MI)
				Inventoried (mi)	Recommended for treatment (mi)	
Stream crossings	24	0	15	2.05	1.89	-
Gullies	7	-	6	0.78	0.75	-
Ditch relief culverts	2	1	1	0.06	0	-
Road surface discharge point	1	-	1	0.16	0.16	
Bank erosion	2	-	2	0.30	0.30	-
TOTAL	**36**	**1**	**25**	**3.35**	**3.10**	**10.13**

[a]The maintenance site is a location where there is road related erosion but no observable sediment delivery to streams.

Evidence of one naturally occurring landslide was noted on the slope above the south bank of Van Buren Creek near the eastern property boundary. No other recent landslide activity has occurred on the property. Based on California Geological Survey map data, landslide potential on the Saddle Mountain Open Space Preserve ranges from high to extremely high in the southwestern portion of the property; moderate to extremely high in the middle portion; and low to extremely high in the eastern portion of the property.

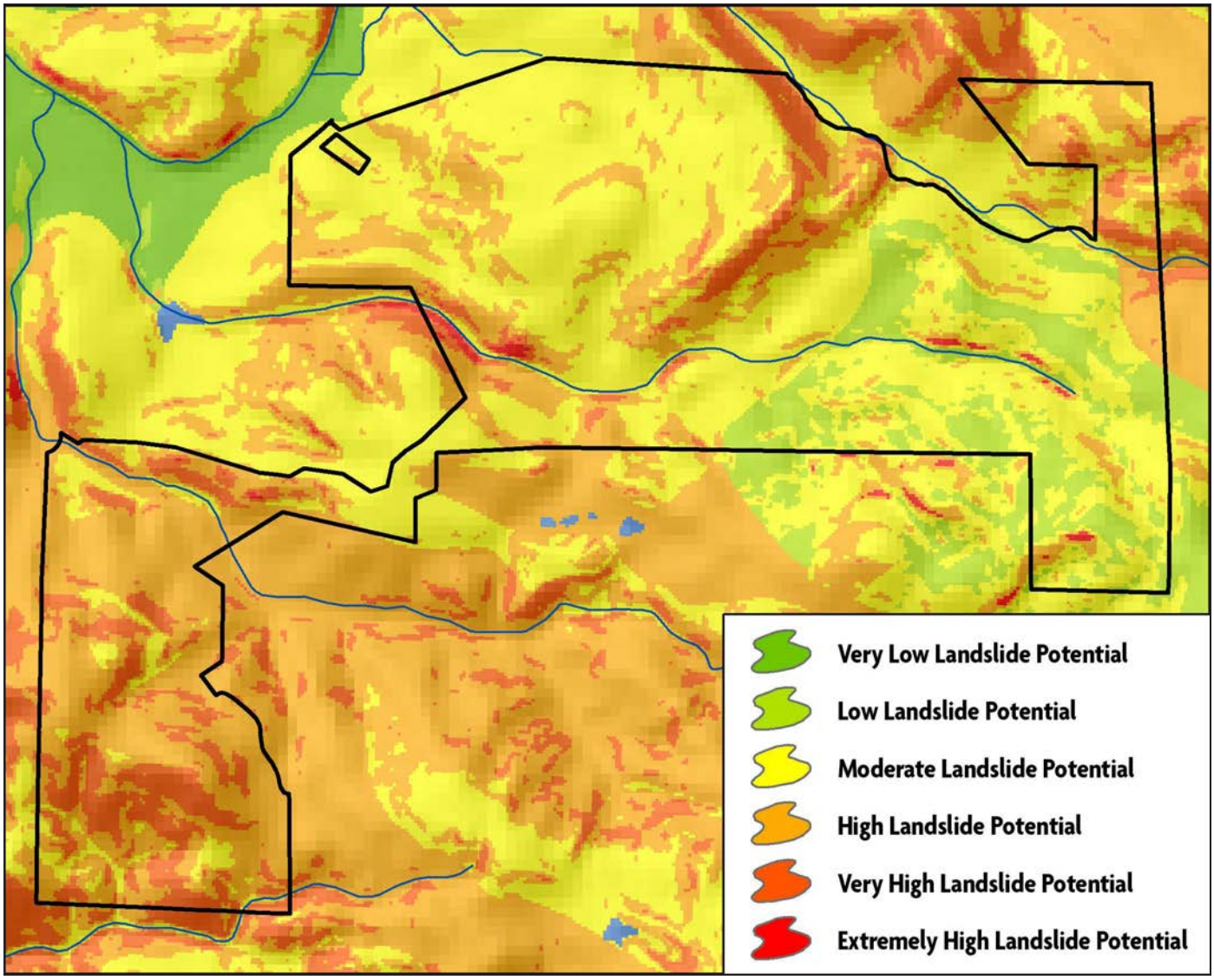


Figure 11. Landslide Potential

Future Sediment Delivery Estimate

Estimated future sediment delivery is the volume of sediment projected to be delivered to the stream system during the coming decades if no efforts are made to remediate the erosion problems identified in the field assessment. Sediment production from hydrologically connected road segments will originate from eroding cutbanks (through dry ravel, failure, brushing/grading practices, etc.) and ditches, as well as through mechanical pulverizing and surface wear of any unpaved road reaches. Field measurements indicate that approximately 1,391 cubic yards of sediment (89 percent of the project total) could be delivered to the stream systems in the project area over the next decade due to current road drainage patterns (Table 3.3, Estimated Future Sediment Delivery). The estimated future sediment delivery from stream crossings is approximately 150 cubic yards of sediment (ten percent of the total potential future sediment delivery within the assessment area). All this sediment would be delivered to Mark West Creek.

Estimated future sediment delivery resulting from gully enlargement at these sites is estimated to be 3 cubic yards, or less than 1 percent of the project total. Although the roads receive minimal use, the steepness of the terrain allows gullies to form on the hill slope below the roads where flow exits the road prism. The gullies then help to funnel concentrated flow down slope into the stream system. Sediment delivery from the two bank erosion sites is approximately 14 cubic yards (approximately 1 percent of the total). No site-specific future sediment volumes are associated with the ditch relief culverts or road surface discharge point. However, if left untreated, the sites will continue to act as a conduit for concentrated runoff from adjacent hydrologically connected road segments.

Table 3.3 Estimated future sediment delivery for sites and hydrologically connected road segments recommended for treatment, Saddle Mountain Road and Trail Erosion Reevaluation, Sonoma County, California.

SOURCES OF SEDIMENT DELIVERY	ESTIMATED FUTURE SEDIMENT DELIVERY (YD^3)	PERCENT OF TOTAL
Stream crossings	150	10%
Gullies	3	<1%
Ditch relief culverts	0[a]	0%
Road surface discharge point	0[a]	0%
Bank erosion	14	1%
Hydrologically connected road and cutbank surfaces adjacent to individual sediment delivery sites[b]	1,391	89%
TOTAL	**1,558**	**100%**

[a]No site-specific erosion at these sites.

[b]Decadal sediment delivery for paved and unpaved roads. Calculations assume a combined road, ditch and cutbank width of 12-18' for native surfaced or rocked roads, and a combined ditch and cutbank width of 5' for paved roads. Road surface lowering rates are averaged for each hydrologically connected road segment based on observed conditions.

Of the 24 stream crossings surveyed (Table 3.4, Stream Crossing Survey Results), three have culverts installed, eleven are fill crossings without drainage structures, eight are ford crossings with no fill within the crossing, and two are trail ford crossings. Eight of the 24 crossings show the potential for stream diversion, while three of these crossings are currently diverted. Field measurements show that the three existing stream crossing culverts were set too shallow in the road fill, which increases the potential for the culverts to plug as well as for the fillslope to be eroded below the culvert outlet. Two culverted stream crossings were determined to be undersized for a 100-year storm event.

Table 3.4. Erosion problems at stream crossings, Saddle Mountain Road and Trail Erosion Reevaluation, Sonoma County, California.

STREAM CROSSING PROBLEM	# INVENTORIED	PERCENTOF TOTAL[A]
Stream crossings with diversion potential	8	33%
Stream crossings currently diverted	3	13%
Crossings with culverts likely to plug[b]	2	8%
Crossings with culverts that are currently undersized[c]	2	13%

[a]From Table 2, total stream crossings inventoried = 24.

[b]Culvert plug potential is moderate to high.

[c]Culverts in stream channels that are less than the recommended minimum 24" diameter or culverts larger than 3 ft x 1 ft that are too small to convey the calculated 100-year peak storm flow.

3.2 Exotic and/or Invasive Plant Species

3.2.1 Approach to Exotic/ Invasive Species Control

The invasion of native habitats by non-native plant and animal species is a widespread problem in California, including on the Saddle Mountain property. An "invasive" is an exotic species that is in the process of increasing in its abundance across the landscape from a point of introduction and has the potential to spread widely (D'Antonio et al. 2007). Invasive plants, sometimes referred to as "transformer" species, displace native species, change plant community structure, and reduce the value of habitat for wildlife (Bossard et al, 2000). Invasive plants may also disrupt physical ecosystem processes such as fire regimes, erosion and sedimentation, nutrient cycling, and light availability.

Beginning with the first European settlements, non-native species were carried to California attached to the hulls of ships, submerged in the ships' ballast, or carried along in shipments of grain. In modern times, people as well as livestock unintentionally spread invasive species. Livestock can transport undigested seeds, and people can transport invasive species by means of their vehicles, equipment, and clothing. Invasive species have also been introduced purposely, without an understanding of the potential consequences of those introductions.

Invasive species threaten the diversity or abundance of native species through competition for resources, preying on or parasitizing wildlife, interbreeding with native populations, transmitting diseases, or causing physical or chemical changes to the invaded habitat. A large population of an invasive species can start from a very small number of individuals, and as those individuals can be difficult to see they may easily go undetected. Early detection and rapid response are the most effective and cost-efficient responses to invasive species, after prevention. It may be possible to eradicate an invasive plant species from the Preserve if it has not yet become widespread. However, in many cases plants may be widespread, which makes eradication difficult because re-invasion from adjacent properties is likely.

Cal-IPC suggests using an approach referred to as the "Bradley Method." In this approach, weed control is begun in portions of the site with the best stands of desirable native vegetation (e.g. those with few weeds) and proceeds slowly to areas with progressively worse weed infestations. This advice is based on modeling work that indicated that the rate of spread of small satellite populations is generally significantly higher than that of older, larger populations, and that containing or eliminating the outliers ultimately saves time and effort in the long run. The Bradley Method dictates that the targeted area should expand at a rate that allows previously treated areas to be monitored and maintained. It also advocates the use of techniques that minimize damage to native plants and disturbance to the soil so that the natives can thrive and defend against reinvasion.

The Preserve invasive species control program is best viewed as a component of an overall habitat restoration program, and should be focused on the overall objective rather than simply eradicating individual invasive species occurrences. This Plan advocates a pragmatic approach to the control of invasives that emphasizes both prevention and removal (i.e. control or eradication). Each method has advantages and disadvantages and often the best approach is an integrated management plan that combines the optimum use of all control strategies, providing various techniques that are compatible.

Prevention: Potential methods to prevent invasive plant establishment include:

- Reduction or removal of seed sources from dispersal routes, including roads, trails, stream corridors, and rights-of-way
- Closure of unnecessary roads and trails
- Minimizing soil disturbance
- Enhancing native habitats to better resist invasives
- Purchasing weed-free materials such as straw, mulch, and gravel for construction projects
- Establishing follow-up monitoring of work sites to detect new invasive plant populations
- Public outreach on the importance of early detection and prevention, for properties immediately adjacent to the Saddle Mountain property

Removal: Potential invasive plant eradication and/or reduction methods are listed below.

- Manual removal
- Mechanical control techniques (e.g. mowing, thatch removal)
- Application of herbicides
- Bio-control (e.g. weevils to control thistles)
- Solarization
- Flooding
- Prescribed burning
- Grazing

Control of invasives in grasslands presents an especially difficult challenge, as these species occur in a matrix of native species. It should be understood that weed management in grasslands is a long-term process that requires a flexible and persistent adaptive weed management program. Early detection and rapid response to new invaders in a given area has been shown to be effective (Stromberg et al, 2007).

Managed livestock grazing is not considered broadly feasible on the Saddle Management Preserve for invasive plant management. The Preserve is no longer suitable for large-scale commercial livestock production, but the disturbance provided by grazing can be used as a tool for specific management purposes such as weed control, maintaining open and diverse grasslands, and reducing fire fuels. However, the site is constrained by numerous factors that make grazing a challenge to implement, including steep topography, lack of existing grazing infrastructure, and difficulties with site access. Although these constraints would not preclude a successful grazing program, working with a custom grazier may be required for at least some portions of the grazing. Neighboring livestock owners may be interested in grazing some areas of the Preserve.

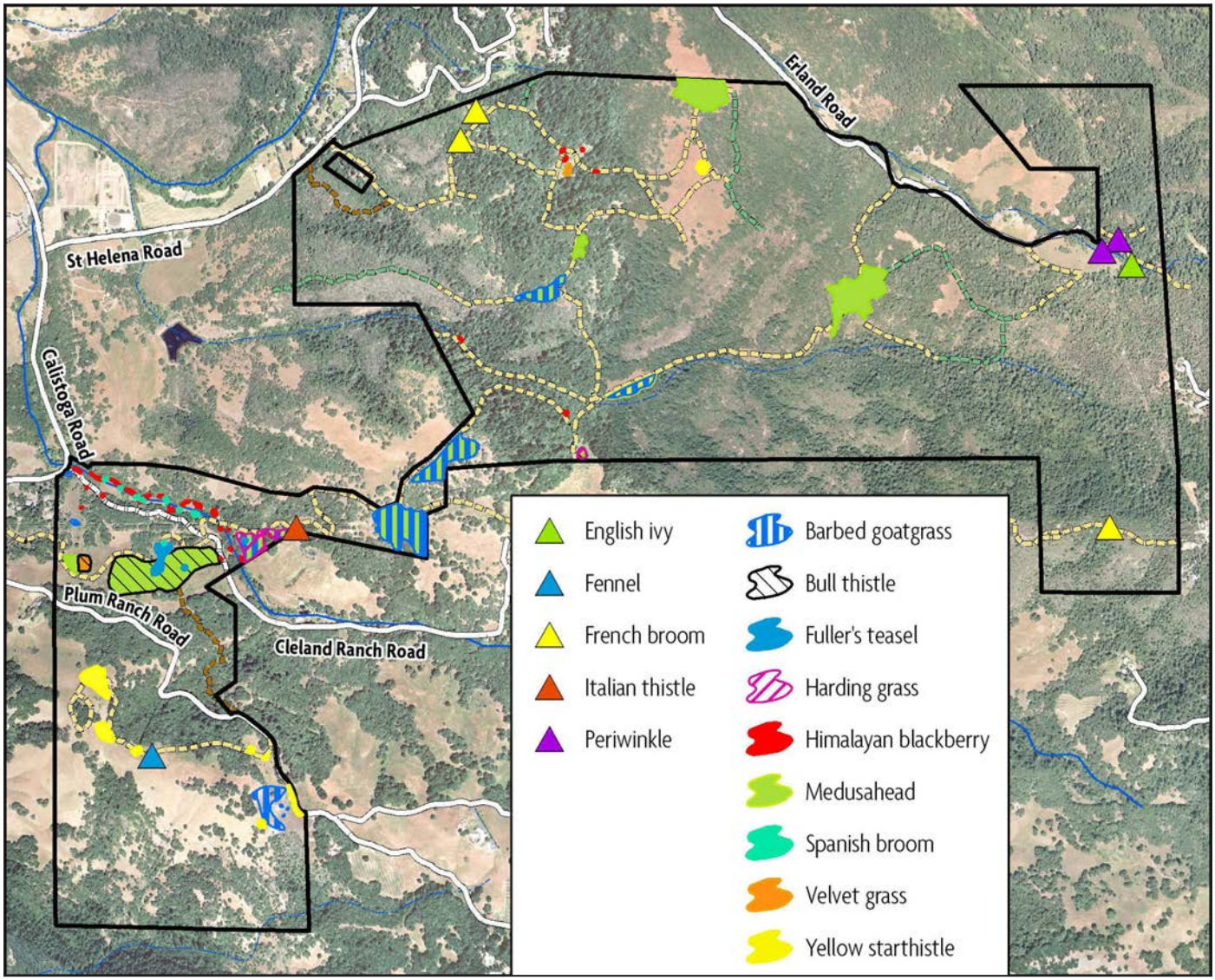


Figure 12. Invasive Plant Species Distribution

3.2.2 Exotic/ Invasive Species Occurrences

In addition to California's 4,200 native plant species, there are approximately 1,800 non-native plant species that grow wild in the state (California Invasive Plant Council, 2006). The California Invasive Plant Council (Cal-IPC) considers approximately 200 of these non-native plants invasive to California's wildlands. A total of 42 of these invasive plant species were documented on the Saddle Mountain property. According to criteria developed by Cal-IPC (California Invasive Plant Inventory[6]), eight are rated as "High," 19 "Moderate," and 14 "Limited." A list of all the plant species on the Preserve designated as invasive by Cal-IPC, along with the growth form, habitat type, and Cal-IPC rating are included in Appendix 9, Invasive Plant Species List. It is recommended that these species be monitored closely and a priority should be to limit their spread into serpentine grasslands and other sensitive plant communities.

Invasive plant species are impacting a number of the sensitive plant communities on the Preserve. Lobb's buttercup (*Ranunculus lobii*) was documented in the vernal pool near the historic hunting cabin on the property during a 1992 rare plant survey on the property (Northen 1992a). The vernal pool is being overrun by the invasive plant pennyroyal (*Mentha pulegium*). Velvetgrass (*Holcus lanatus*) and Himalayan blackberry (*Rubus armeniacus*) thrive in freshwater seeps. French broom is established along the transmission line maintenance road in the southeastern portion of the property contiguous with populations of Sonoma ceanothus and narrow-anthered brodiaea in the Serpentine Chaparral plant community. Serpentine Bunchgrass communities are threatened by barbed goatgrass and yellow starthistle. Sonoma ceanothus and narrow-anthered brodiaea, found within chaparral plant communities, are being threatened by Douglas-fir encroachment and by shading out by overstory trees and shrubs with the absence of fire. In 2016, a small population of rosy sandcrocus (*Romulea rosea*) was detected in the vicinity of the Clara Hunt's milk vetch population. Rosy sandcrocus is currently listed by Cal-IPC as a "watch" species with a high risk of becoming invasive. In addition to the priority species listed in Table 3.5 below, treatment of this population through hand removal should be a high priority due to its small size and its potential to impact a sensitive habitat area.

Infestations of English ivy, fennel, yellow starthistle, and French broom are currently relatively small and could be eradicated from the property with a minimum of effort and expense. There is a large patch of Himalayan blackberry with Spanish broom along Weeks Creek, which would require more effort. Medusahead and barbed goatgrass are relatively widespread and will require considerable planning and effort to control.

3.2.3 Priority Species for Treatment

Invasive plant species found on the property rated as High, as well as the highest priority Moderate species, are listed in Table 3.5 and are described in Appendix 10, Priority Invasive Plant Species Descriptions. Complete eradication from the property of a number of high priority species (e.g. medusahead) is not to be expected; they have become too widespread and already occur in high densities. The most pragmatic option for addressing established invasive species is to control their future spread and lessen their impact on native species.

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[6] Cal-IPC categories include species rated High as having "severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Most are widely distributed ecologically." Species rated as moderate "have substantial and apparent, but generally not severe ecological impacts on physical processes, plant and animal communities, and vegetation structure." Species rated as limited "are invasive but their ecological impacts are minor." http://www.cal-ipc.org/ip/inventory/index.php

Table 3.5 Priority Invasive Species to Control

NAME	RATING	INVADED HABITATS	CONTROL EFFORT	NOTES
Barbed goatgrass (*Aegilops triuncialis*)	High	• Grassland • Serpentine	high	• seeds can remain viable for two years • tolerates shallow, dry, gravelly soils
Medusahead (*Taeniatherum caput-medusae*)	High	• Grassland • Oak Savannah • Oak Woodland • Chaparral	high	• only palatable to grazers early in the growing season • produces large quantities of high-silica litter, which smothers native species
Yellow starthistle (*Centaurea solstitialis*)	High	• Grassland	minimum (complete removal)	• only palatable to grazers early in the growing season • seeds can remain viable for ten years • staggered stages of maturity • resprouts from deep taproot
Fennel (*Foeniculum vulgare*)	High	• Disturbed Habitats	minimum (complete removal)	• tolerates drought • prolific seed production
English ivy (*Hedera helix*)	High	• Riparian	minimum (complete removal)	• vine mats cover native vegetation • leaves and seed can be toxic
Himalayan blackberry (*Rubus armeniacus*)	High	• Riparian • Wetland	medium (complete removal)	• reproduces vegetatively and by seed
French broom (*Genista monspessulana*)	High	• Grassland • Riparian • Woodland • Chaparral	minimum (complete removal)	• prolific seed production • mature stands are potential fire hazard
Spanish broom (*Spartium junceum*)	High	• Grassland • Riparian • Woodland • Chaparral	medium (complete removal)	• prolific seed production • mature stands are potential fire hazard • stump sprouting
Greater periwinkle (*Vinca major*)	Moderate	• Riparian	high	• reproduces vegetatively • vine mats cover native vegetation
Fuller's teasel (*Dipsacus sativus*)	Moderate	• Grassland • Riparian		• seeds can remain viable for six years
Pennyroyal (*Mentha pulegium*)	Moderate	• Wetland • Vernal Pool		• reproduces vegetatively and by seed
Harding grass (*Phalaris aquatica*)	Moderate	• Wetland • Riparian • Grassland • Woodland		• tolerates moist and dry soils • deep root system • potential fire hazard in dry months

3.3 Human Use Impacts

Both historic and modern human use patterns and natural resource management techniques have altered the property's landscape. The Preserve was a likely place for prehistoric occupation, as it has fresh water sources, well-drained soils, and a mosaic of grassland and woodland, which created an environment rich in natural resources. These features suggest that the property may have been utilized for hunting, resource gathering, and day-to day activities (Barrow and Origer, 2008). Six prehistoric sites were documented previously, and one additional prehistoric site was documented during Tom Origer & Associates' 2008 archaeological resources survey of the property for Ag + Open Space.

Since Europeans arrived, logging, land clearing, importation of livestock, and fire suppression have resulted in major changes in the property's vegetation patterns (Hill, 1978). Prior to Ag + Open Space's purchase of the property, the land was owned for

several generations by the Merner family under various names, including Merner Lumber Company, Inc., Progress Lumber Company, Inc., and Merner Land Company, Inc. (Bowman and Associates, 2006). Much of the Douglas-fir and coast redwood has been logged, and multi-stump growth patterns of many of the oak stands indicate the hardwoods were most likely cut decades ago, presumably for fuel wood.

The property's grasslands have been grazed in the past by livestock, and the remnants of an old stone fruit orchard are located off Plum Ranch Road.

3.3.1 Illegal Uses

Illegal activities encountered on the Preserve during the natural resources inventory fieldwork include evidence of marijuana cultivation, water diversion, unauthorized trail construction, and unauthorized herbicide use.

Local residents off Erland Road have reportedly encountered marijuana patches on the property in past years. None were encountered during the 2008 natural resources inventory fieldwork, though irrigation drip lines in disrepair and watering buckets were noted, and a grow site was eradicated in the Alpine Creek watershed in 2017. Marijuana growers can have a significant impact on the environment, including the clearing of native vegetation, increased erosion, and the introduction of fertilizer, pesticides, fencing, guard dogs, illegal campsites, and human waste.

Water diversion pipes were noted in portions of Alpine Creek and Van Buren Creeks on the property. Some of these water diversion lines are no longer functioning and are probably remnants of past marijuana cultivation operations, and have since been removed. Others appear to have been previously used to divert water from the property to private residences along Erland Road.

Unauthorized trail construction for horse access was noted off St. Helena and Erland Roads. Brush had been recently pruned, and a nearly full container of Roundup herbicide was encountered. An unauthorized trail off St. Helena Road, was constructed immediately adjacent to a listed plant, Napa false indigo (CNPS 1B.2), and continued use of this trail in its current location will likely impact the plant. It is recommended that these trails be closed and perimeter fences repaired.

3.3.2 Property Hazards

Property hazards of primary concern are related to the property's roads. Calistoga Road is a popular commute route from Santa Rosa to Napa and Lake Counties and traffic can be heavy at times. The junctions of both Plum Ranch Road and Cleland Road with Calistoga Road are located on curves, which makes pulling out onto Calistoga Road potentially hazardous. The Preserve's road system does not meet current Sonoma County Fire Safe Regulations in several categories, including road grades, road radius, road widths, and gates (Moritz, 2003).

Plum Ranch Road is a narrow paved road with several blind curves. It has "substandard road widths" that "cannot be corrected," according to the 2003 Fire Management Plan (although the plan does list several mitigation measures). Traffic on paved roads tends to lead to increased speeds, which makes driving on this road potentially hazardous if oncoming traffic is encountered.

There are no bridges at the creek crossings of Weeks Creek and Alpine Creek along Erland-Cleland Tie Road, making the crossing of these creeks, either on foot or in a vehicle, potentially hazardous during high flows. Currently, a four-wheel drive vehicle with high clearance is recommended during low flows.

There are several potentially hazardous non-road related conditions on the Preserve related to public access:

- The property consists of steep, rugged terrain that could lead to injury and the potential for getting disoriented or lost. It is recommended that directional signs be installed along Preserve roads and trails.
- Wildlife-related hazards include potential encounters with mountain lions, black bear, and rattlesnakes due to presence of suitable habitat for these species.
- There are remnants of interior fencing in disrepair that pose a tripping hazard to humans and an entanglement hazard to wildlife.
- Practices associated with the illegal cultivation of marijuana include armed guards, guard dogs, hazardous materials, and booby traps.

3.4 Other Issues

3.4.1 Sudden Oak Death

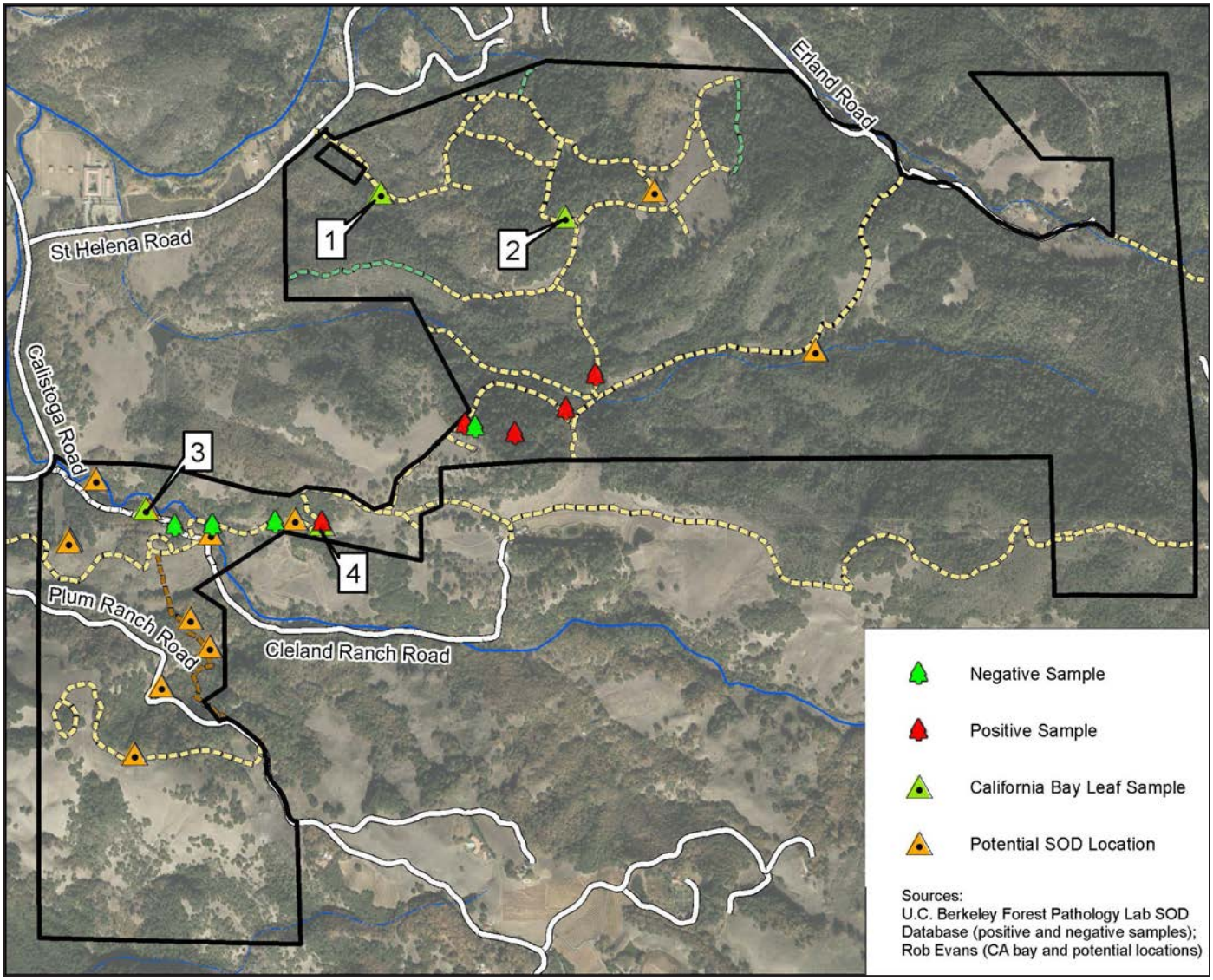

Figure 13. Documented and Potential Sudden Oak Death Areas

Sudden Oak Death (SOD) is the name given to a recently expressed plant epidemic caused by the foreign pathogen *Phytophthora ramorum*. First detected in 1995, the pathogen is hosted by, weakens, and/or kills three true oak species as well as a growing list of additional native plant species. Two oak species that are susceptible to SOD are found on the Preserve: coast live oak (*Quercus agrifolia*) and black oak (*Q. kelloggii*). Additional susceptible species that occur on the property include tanbark oak (*Lithocarpus densiflorus*), madrone (*Arbutus menziesii*), California bay-laurel (*Umbellularia californica*), California buckeye (*Aesculus californica*), big-leaf maple (*Acer macrophyllum*), western azelea (*Rhododendron* spp.), manzanita (*Arctostaphylos* spp.), toyon (*Heteromeles arbutifolia*), coffeeberry (*Rhamnus californica*), and honeysuckle (*Lonicera hispidula*).

Photo 28. Potential Sudden Oak Death infestation of coast live oak

SOD can be fatal to coast live oak, black oak, tanoak, and western azelea. To date, this disease has been found infecting plants in coniferous forests, oak woodlands, and urban-wildland interfaces. Several coast live oak trees on the Preserve displayed symptoms of SOD, including dieback of major branches, as well as entire trees. Locations of these trees are within the Weeks Creek and Alpine Creek watersheds.

There is no fully proven, universally effective method for controlling the spread of SOD once infestation sources are established. Spores of *P. ramorum* have been isolated from plant debris in infested forests and it is likely that the spread of this pathogen in California has been facilitated by the activities of hikers, bikers, and vehicles, as well as by horses and deer. The California Oak Mortality Task Force[7], a nonprofit organization under the California Forest Pest Council that brings together public agencies, other nonprofit organizations, and private interests to address *P. ramorum*-related issues has developed guidelines and best management practices (BMPs) related to SOD that are applicable to the Preserve.

[7] For more detailed information on SOD, the COMTF website is: http://www.suddenoakdeath.org/

3.4.2 Fire Hazard and Fuels

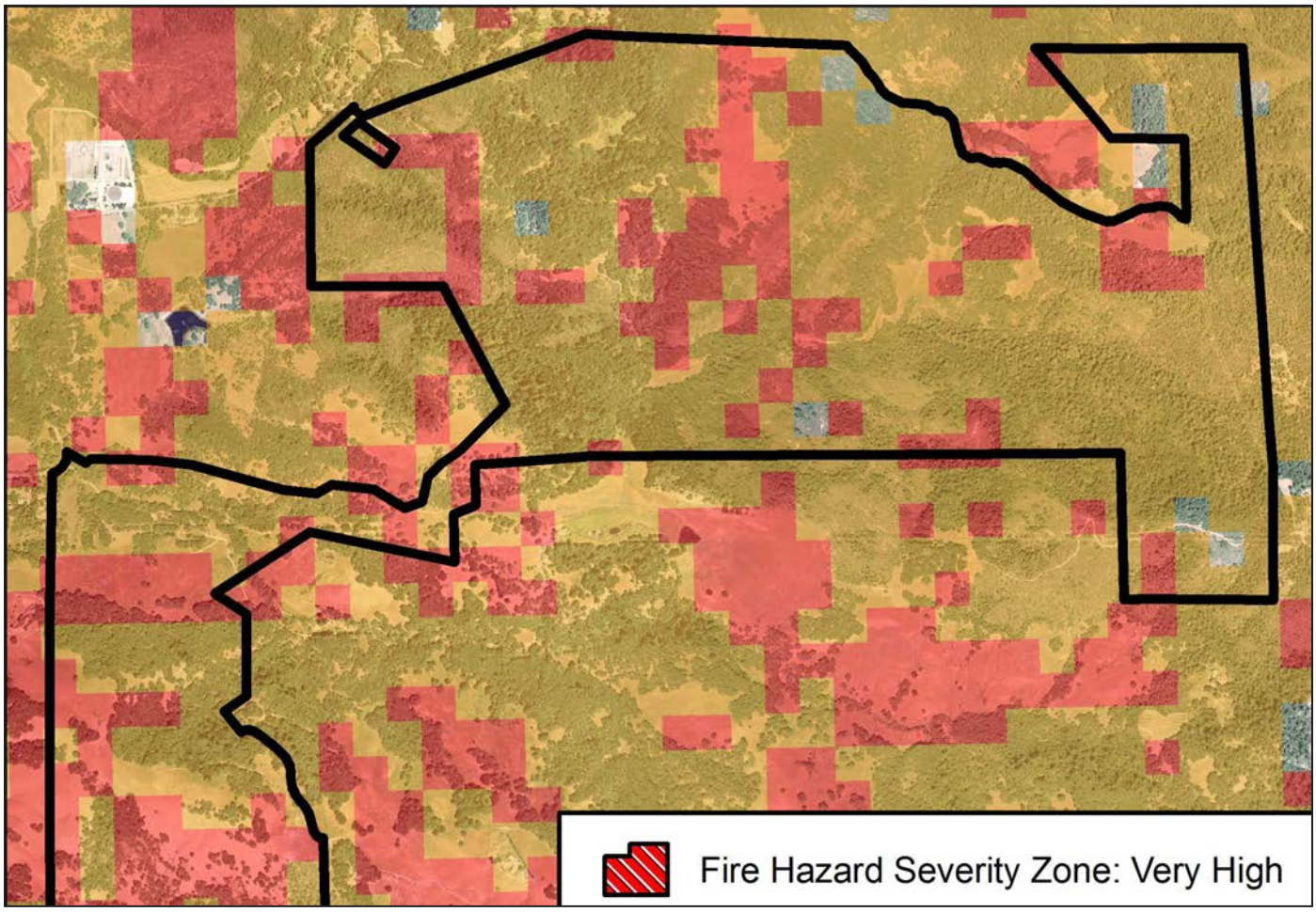

Figure 14. Fire Hazard

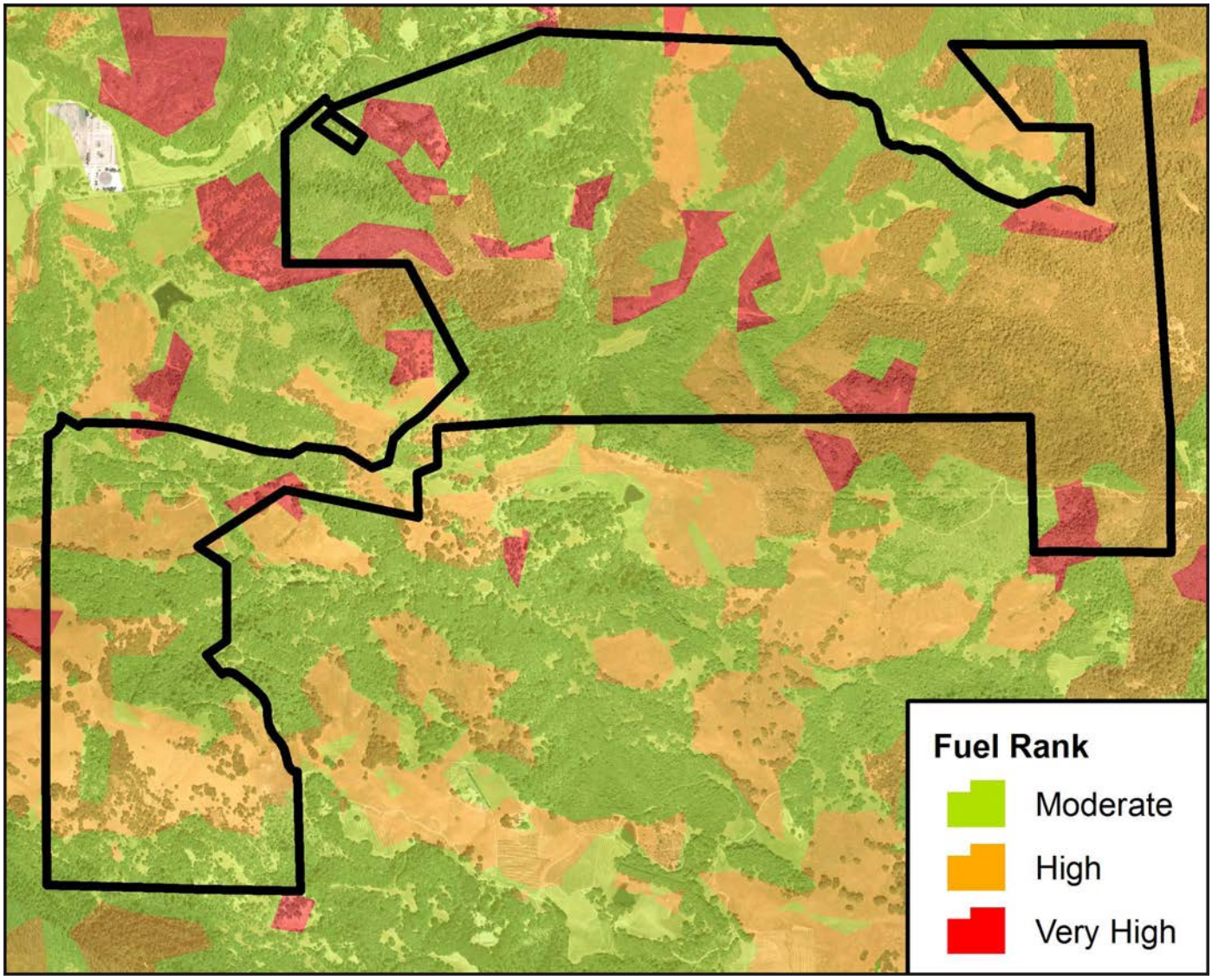

Figure 15. Fire Fuel Rank

Regardless of ongoing fire suppression efforts in the region, wildfire is likely to occur eventually, either by natural causes such as lightning, or by accident (Quinn and Keeley, 2006). The absence of fire for an extended period of time, particularly in chaparral, creates large contiguous areas with highly flammable fuel loads that are difficult to contain once a fire breaks out.

Fire Management Concepts, Inc. prepared a report entitled "Wildland Urban Interface Hazard Fuel Risk Assessment: City of Santa Rosa, California" for local fire agencies as a first step in developing a comprehensive Community Wildfire Protection Plan. According to Fire Management Concepts, Inc. (2004), "The vegetation communities that surround Santa Rosa to the north, east and south are similar in fuel type classification to those that burned in the Oakland Hills. In addition, many areas surrounding Santa Rosa have fuel types and dead fuel loading that are even more hazardous than those present during the Oakland Hills Fire. These areas contain coniferous forest, woodland and chaparral fuel types, which have not burned in over sixty years, creating excessive levels of dead fuel loading (dead logs, branches and forest debris). Excessive accumulations of dead fuels is one of the primary factors that contribute to the development of the extreme fire behavior, crown fire and long range spotting, which often characterize wildland fire in the urban interface."

Reliable predictions of wildfire behavior allow fire control agencies to determine what resources are needed to contain wildfires, minimize damage to natural resources, and protect property. Moritz (2003) developed a preliminary fire management plan to assess the Preserve so as to meet requirements

for development approval in 1996. Moritz used the BEHAVE[8] computer modeling system to assess fire behavior for the five wildland fuel models found on the Saddle Mountain Findings include (1) determination that the old stand of manzanita off St. Helena Road is "potentially explosive" and that (2) woodlands with an understory of brush or thickets of young Douglas-fir trees could also burn with an intensity that could create crown fires and spotting; these conditions are particularly hazardous along roads that must be used for emergency access and evacuation. The study also noted that Sudden Oak Death on the Preserve will increase near-term fire hazard, as infected dead wood becomes a highly flammable fuel ladder.

In recent years, fire behavior on several regional wildfires has far exceeded modeled predictions, due in part to extremely low fuel moistures associated with drought and/or offshore wind events prior to the onset of the rainy season. It is worth noting that the modeled outputs in the Moritz Saddle Mountain fire management plan are more than twenty years old at this point, and that wildfire hazards on the Preserve may be more severe than predicted in the 1996 plan. It may be helpful to re-assess fuel loading and potential fire behavior on the Preserve using current, fine-scaled vegetation and fuels data.

3.4.3 Cultural Resources Protection

The Preserve contains a number of important cultural resources and archaeological sites (Section 2.6, Cultural Resources). Prehistoric archaeological site indicators generally include: obsidian and chert flakes and chipped stone tools; grinding and mashing implements (e.g. slabs and handstones, and mortars and pestles); bedrock outcrops and boulders with mortar cups; and locally darkened midden soils. Midden soils may contain a combination of any of the previously listed items with the possible addition of bone and shell remains, and fire-affected stones. Historic period site indicators generally include: fragments of glass, ceramic, and metal objects; milled and split lumber; and structure and feature remains such as building foundations and discrete trash deposits (e.g. wells, privy pits, dumps).

In keeping with the CEQA guidelines, the primary recommendation for each archaeological site is that it should be avoided. If avoidance is not feasible, further study (i.e. site excavation and/or historic research) is necessary to determine site significance in terms of eligibility for inclusion on the California Register. Direct impacts to cultural resources for the Preserve could result if activities such as trail construction or improvement, and construction of visitor facilities (e.g. parking and restrooms) are undertaken near sites. Avoidance buffer zones of 100 feet (30 meters) should be established for visible cultural sites and ground disturbance restricted in areas where cultural resources occur but are not visible (Section 4.3, Buffer Zones for Sensitive Features). Every effort should be made to retain historic stone fences and avoid impacts to them, as described above. If improvements are planned that could affect the integrity of the stone fences they should be documented with photographs, measurements, thorough descriptions, and historical research.

There is the possibility that buried archaeological deposits could be present, and accidental discovery could occur. In keeping with the CEQA guidelines, if archaeological remains are uncovered, work at the place of discovery should be halted immediately until a qualified archaeologist can evaluate the finds (15064.5 [f]); and "if the find is determined to be an historical or unique archaeological resource, contingency funding and a time allotment sufficient to allow for implementation of avoidance measures or appropriate mitigation should be available."

4. POTENTIAL MANAGEMENT STRATEGIES

There are a number of long-term strategies and opportunities that are recommended to maintain and enhance the conservation priorities (i.e. conservation values) on/ of the Preserve. These include enhancement of plant communities and native habitats; revegetation; buffer zones around sensitive features; restoration of landscape disturbance processes; and ongoing monitoring.

4.1 Enhance Plant Communities and Habitats

Riparian woodlands, grasslands (including valley needlegrassland), wetlands, and chaparral (including serpentine and cypress microcosms) habitats on the property support sensitive and/or rare plant communities that would benefit from directed enhancement measures. A brief listing is provided below.

[8] BEHAVE, a widely distributed and accepted fire behavior predictive model, developed by the USDA Forest Service, allows planners to predict fire rate-of-spread, flame lengths, and fireline intensity (rate of heat release) using one of several generalized fuel models. Studies have shown that BEHAVE can be used to accurately predict fire behavior, but may or may not be appropriate for certain conditions (U. S. Department of the Interior, USGS, 2006)

Annual Grassland

- Mt. St. Helena morning-glory (*Calystegia collina* ssp. *oxyphylla*)

Fresh Emergent Wetland & Vernal Pool

- Lobb's aquatic buttercup (*Ranunculus lobbii*)

Mixed Hardwood- Conifer Forest

- Napa false indigo (*Amorpha californica* var. *napensis*)

Mixed Chaparral

- Napa false indigo (*Amorpha californica* var. *napensis*)
- Sonoma canescent Manzanita (*Arctostaphylos canescens* ssp. *Sonomensis*)
- narrow-anthered brodiaea (*Brodiaea californica* var. *leptandra*)
- Mt. St. Helena morning-glory (*Calystegia collina* ssp. *oxyphylla*)
- Sonoma ceanothus (*Ceanothus sonomensis*)

Closed Cone Pine-Cypress

- Sonoma canescent Manzanita (*Arctostaphylos canescens* ssp. *Sonomensis*)
- narrow-anthered brodiaea (*Brodiaea californica* var. *leptandra*)
- Sonoma ceanothus (*Ceanothus sonomensis*)

4.1.1 Riparian Habitat Enhancement

Most of the riparian zones on the Preserve are well vegetated with native riparian vegetation and largely devoid of invasive plants. However, past land use practices and establishment of invasive plant species have impacted some of the riparian and wetland habitats on the Preserve.

Riparian habitats should be managed to enhance cover for erosion prevention and/ or bank stabilization, and to conserve native plant communities and species. Downcutting and bank erosion along Weeks Creek, for example, is compromising habitat and water quality. In the same creek, establishment of Himalayan blackberry and Spanish broom threatens montane riparian habitat viability. All riparian zones on the Preserve would benefit from identification and treatment (including, as described, revegetation) of locations where invasive species have become established.

4.1.2 Grassland Habitat Enhancement

The Annual Grassland habitat type on the Preserve should be managed to enhance the local diversity of native perennial grasses and native forbs. Management of grasslands with a significant native component should be long-term and flexible to adapt to changing conditions. A combination of management techniques focused on invasive species control should be considered. Management efforts should be monitored in the long-term, and observations recorded. Given the abundance and diversity of native perennial grasses on the property, there are unique opportunities for research projects related to the ecology and management of the property's grasslands. Full restoration of natural landscape-scale disturbance processes (e.g. native grazers, wildfire) would be ideal. However, widespread application of livestock grazing is at present unfeasible and/ or impractical. Due to lack of access and grazing infrastructure, the use of livestock to improve native habitats is more applicable in theory than as a Preserve management strategy. The use of prescribed fire or mechanical removal of invasives and their thatch layer, followed by revegetation as necessary, are recommended treatment approaches for grassland areas threatened by invasive species.

The use of prescribed fire has been shown to be effective in controlling non-native annual grasses and encouraging regeneration on native perennial grasses and forbs. Prescribed fire presents significant liability and logistical concerns that would need to be thoroughly and appropriately addressed prior to reintroducing fire on the Preserve. Prescribed fire is being contemplated as a tool to manage invasive species, improve vegetation species composition and habitat conditions, and reduce fuel loading within the Preserve's grasslands and forests (See Section 5.4.3, Prescribed Fire). Ag + Open Space anticipates working with Cal Fire and potentially with local partners and programs such as a Prescribed Fire Training Exchange ("TREX") program to plan and execute prescribed burns, as resources and conditions permit.

Enhancement opportunities within the serpentine bunchgrass plant communities on the property include control of select invasive plant species as well as control of encroaching coyote brush and Douglas-fir, where appropriate. This habitat type has been shown to benefit from fall prescribed burns and year-round grazing (Bartolome et al. 2007); further research is warranted. Douglas-fir is a native tree species that is encroaching into Annual Grassland habitat on the Preserve. Its seeds fall and are spread by wildlife to suitably open sites. The great majority of seed falls within 330 feet (100 meters) from the mother tree, but can range as far as 1.2 miles or greater (US Dept. of Agriculture, 1965). Aggressively invasive Himalayan blackberry, velvetgrass, and bull thistle more immediately threaten the integrity of the Saddle Mountain's grasslands.

4.1.3 Wetland Habitat Enhancement

The property's freshwater wetlands (vernal pools and wet meadows) require revegetation and, where possible, management of invasive species. Exclusion of grazing around vernal pools can promote certain exotic species (e.g. medusahead grass) and, thus, grazing may be considered as an experimental (though not wide-spread) means of treatment. Prescribed burning has been used at other sites for enhancing vernal pools and other wetland habitats (Pollack and Kan 1998), though these means are not generally feasible on the Preserve.

Wetlands on the Preserve have been impacted by past grazing practices, road-related erosion, and invasive species establishment. The freshwater seep and vernal pool near the historic hunting cabin on the property have a variety of invasive species established, as does the wetland south of Cleland Road. Surrounding native wetland vegetation would most likely become re-colonized in areas treated for invasives, provided hydrologic conditions are unchanged and treatment methods are carefully conducted with minimal impact to native vegetation. It has been demonstrated that enhancement of vernal pool habitats that have been degraded can be effective, at least up to a decade following restoration efforts. In these cases, restored pools can offer similar ecosystem functions (e.g. habitat and hydrological function) as "natural" pools (Ferren et al. 1998). Maintaining vernal pools on the property may provide a positive feedback loop supporting the persistence of the pools: studies have shown that migrating waterbirds who use the pools as stop-over habitat act as vectors, moving plant propagules from pool to pool (Silviera 1998).

4.1.4 Chaparral Habitat Enhancement

Chaparral, including Serpentine Chaparral, and Northern Interior Cypress Forest, is a fire-adapted plant community. Fire is an essential part of the life cycle of these plant communities, which depend on fire for seed dispersal and/or germination. Without fire in these habitats, species composition is likely to change, resulting in reduced native biodiversity and wildlife habitat. Douglas-fir, oaks, and bay-laurel are becoming established in these habitat types on the property with the suppression of fire.

Chaparral is not resilient to alterations in the fire regime that involve excessive fire frequency (Keeley, 2007). This applies to both the trunk re-sprouting and seed germination of chaparral shrubs. Non-native grasses and forbs readily invade frequently burned shrublands and directly outcompete native herbs, perhaps favored by their early germination keyed to autumn rains. In addition, these invasive species modify the environment to further favor their persistence. They commonly form a dense herb layer that produces highly ignitable fuels and extends the length of the fire season. Additionally, the fire regime switches to a combination of surface and crown-fire, with the non-native grasses and forbs spreading fire to native chaparral shrubs before the shrub canopies have closed in. Because surface fuels generate lower fire intensities, such fires favor survival of the non-native seed bank, which would otherwise be destroyed in a crown-fire. Type conversion of native shrublands to alien grasslands has occurred over large portions of California (Keeley, 2007).

4.1.5 Forest & Woodland Habitat Enhancement

Habitat enhancement opportunities within the Douglas-fir Forest, Mixed Hardwood-Conifer, and Coastal Oak Woodland habitat types on the property include thinning of dense even-aged stands, fuel reduction, and invasive plant control. The absence of fire on the property in recent decades, as well as the clearing of oaks and other hardwoods in the mid to late 1800s, has led to unnaturally large areas of dense stands of even-aged tree species, invasion by shade-tolerant Douglas-fir within mixed hardwood and oak woodlands, and an abundance of fuel, including dead, low-hanging branches, dead saplings, and downed wood. Unnaturally dense forests provide fuel for severe wildfires. In overcrowded forests, trees compete for water, light, and nutrients, and without sufficient nutrients to go around, trees become stressed and susceptible to disease and beetle attacks (Bonnicksen, 2008).

Douglas-fir encroachment into the Coastal Oak Woodland habitat is threatening to convert the habitat to an eventual dominance of Douglas-fir (Moritz, 2003). Land managers at nearby Annadel State Park, and also at Pepperwood Preserve, are dealing with Douglas-fir encroachment by utilizing management techniques including prescribed burning, manual removal of Douglas-fir saplings, and girdling of larger Douglas-fir trees.

4.2 Native Plant Revegetation

A successful revegetation project will establish a diversity of plant types and native species that will improve fish and wildlife habitat, aid in sediment reduction, and provide erosion control. Once established, generally after two to three years, the project should require a minimal amount of management. The first step is development of a site-specific plan: The project site should be assessed and a budget designed that takes into account

project design, permitting, plant sources and nursery costs, cost of protective hardware and irrigation materials, as well as labor costs for project layout, implementation, maintenance and monitoring. It is recommended that plant material brought into the project site be of local sources within the watershed. Revegetation is recommended in disturbed areas that are not naturally regenerating with the native species that normally populate the habitat type, including areas where invasive species are removed. Revegetation will help prevent re-invasion of other invasive species. Revegetation is also an erosion prevention measure. The need to revegetate should be evaluated following any grading operation or other significant disturbance.

Various regulatory agencies may have jurisdiction over a habitat enhancement project and permits may be needed, depending on the project's character and extent. This is particularly true in riparian and wetland habitats. It is the property owner's responsibility to be familiar with these agencies and notify them when a project is planned. Most agencies encourage informal consultation early in the planning process so that the concerns of each party can be addressed and potential roadblocks can be kept to a minimum. For recommended revegetation projects included in this document, the CDFW and the Regional Water Quality Control Board should be consulted with prior to implementation. If planning to use herbicides, the Sonoma County Agricultural Commissioners Office should be consulted with as well.

4.2.1 Revegetation of Riparian and Wetland Habitat

Native plant revegetation projects within the riparian zones on the property are recommended to replace invasive species after control measures are implemented, and to aid in bank stabilization and erosion control. During the harvesting of the coast redwoods that once lined it, the riparian zone of Alpine creek was impacted by construction of skid and haul roads. While native vegetation, including redwood stump sprouts (secondary growth), has largely reclaimed the old roadbeds, the riparian zone could be enhanced by replanting coast redwood in ecologically appropriate areas in an effort to expand the current redwood population to historic levels.

After control measures are implemented, regardless of any permit requirements, the sites should be assessed for the need to replace the invasive plant species with desirable native species. The sites should be evaluated by a professional restoration ecologist for erosion potential following vegetation removal. In general, there should be signs of sufficient natural regeneration of native species within the riparian zone, and if not, a revegetation plan may be recommended if not already required by CDFW.

4.2.2 Revegetation of Upland Habitat

Recommended revegetation opportunities in upland habitats on the Preserve are intended to restore areas adversely impacted by prior land use practices, including road-related erosion and clearing of native trees and shrubs within the upper riparian zone.

A gully has been forming for some time in an upland drainage south of Weeks Creek. Previous land use managers have lined the gully with brush and debris as a primitive, low-tech, erosion control measure. Fuller's teasel, an invasive plant, is becoming established in the disturbed areas along the gully. Revegetation and biotechnical erosion control measures are recommended for this site. The open flat along the south bank of Weeks Creek, as it transitions into the riparian zone, has been identified as a potential area for revegetation. This area was likely cleared of trees in the past. Revegetation measures for this area should be incorporated into the riparian revegetation plan design.

Additional revegetation opportunities in upland areas may include some of the road-related erosion sites identified by PWA. After these sites are treated, the disturbed areas should be assessed for revegetation needs.

4.3 Buffer Zones for Sensitive Features

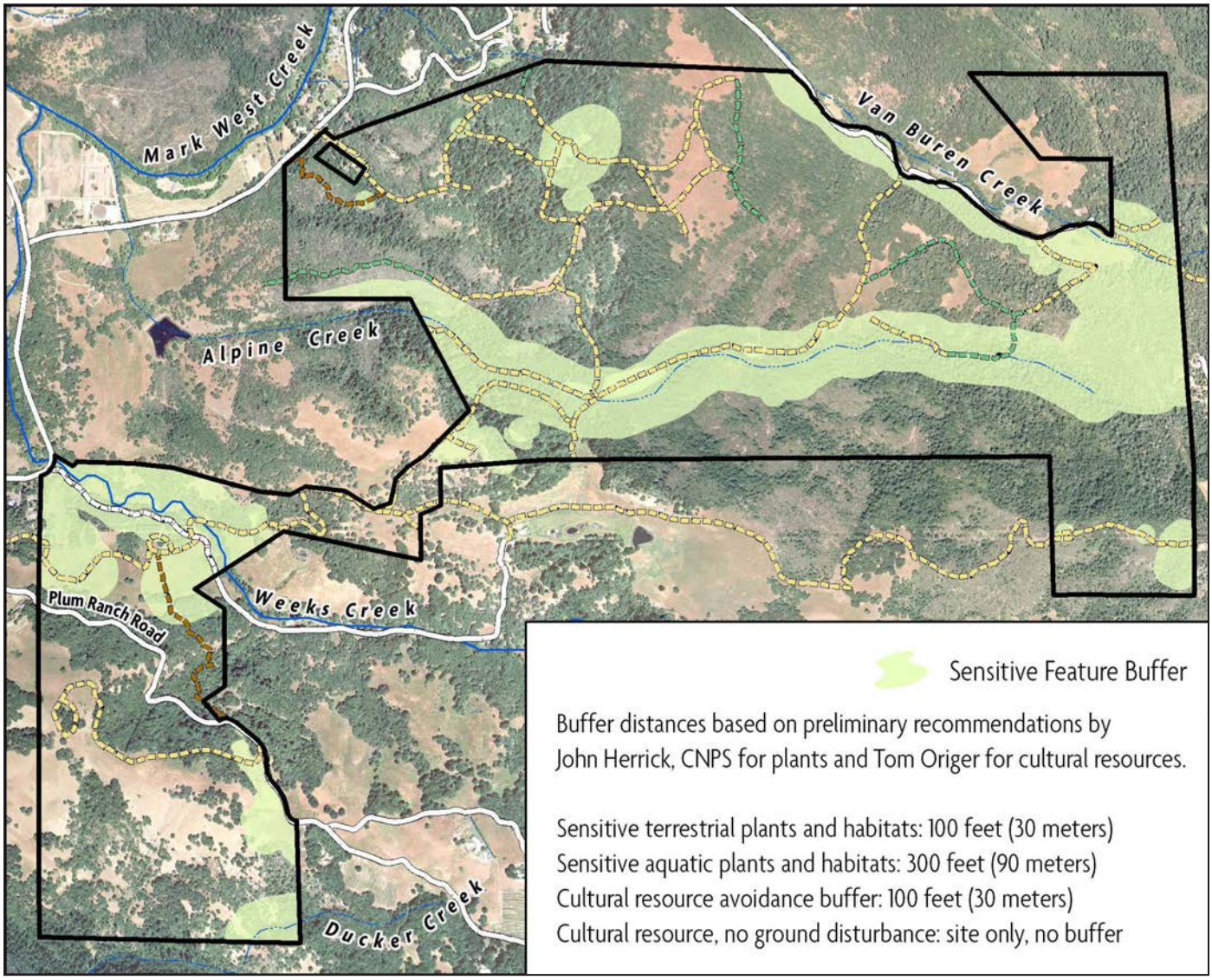

Figure 16. Sensitive Features Buffer Zone

The establishment of adequately-sized buffer zones around sensitive resources (e.g. habitats, species, archaeological sites, etc.) can be very effective for maintaining and enhancing these resources. Concentrated visitor use (e.g. picnic tables, etc.) and modification of the environment should be avoided within buffer areas. The size of buffer considered adequate to protect habitat function and species viability varies widely (e.g. 10 to 100+ meters to optimize a range of objectives for water quality, stability, habitat function, and wildlife habitat/ corridor; Burke and Gibbons 1995, Fischer and Fischenich 2000). For the purposes of this plan, initial recommendations for buffer set-backs are listed below to prevent direct damage to vegetation, as well as to protect water quality.

- At least 100 feet (30 meters) for terrestrial species and habitats (e.g. Closed cone Pine-Cypress and serpentine areas)
- At least 300 feet (90 meters) around/ along riparian zones, vernal pools, and other aquatic habitats (John Herrick, CNPS, pers. comm.)

4.4 Restoration of Landscape Disturbance Regimes

Grasslands that are not grazed, burned, or otherwise regularly disturbed to keep them open can be type converted to shrub communities. This process is evident in some areas at Saddle Mountain where coyote brush is invading grasslands at wood-

land margins. As well as increasing fire hazard, this conversion results in loss of grasslands, and thus loss of the species that occupy them.

Saddle Mountain grasslands have an unusually high proportion of native perennial grasses. Although the grassland flora also contains many non-native annual species, their density and biomass is much diminished compared with the same species growing on more productive sites. Many of the areas that support medusahead, which generally occurs on clay-rich soils, have a well-developed thatch layer that excludes most other annual species. In native grass-rich areas, this thatch layer has developed between the perennial bunchgrasses. Medusahead produces especially persistent and dense thatch, as its high silica content prevents dead plant matter from decomposing quickly. Disturbance or removal of excessive thatch is essential for germination and growth of some native species including popcornflowers (*Plagiobothrys* spp.), clovers (*Trifolium* spp.), owl's-clovers (*Castilleja* spp.), cream cups (*Platystemon californicus*), and red maids (*Calandrinia ciliata*) (Grey Hayes, pers. comm.). Thatch management and reduction of grassland canopy height to allow germination and growth of small-statured forbs may be achieved through grazing or burning, although these are considered experimental for the purposes of habitat enhancement (DiTomaso and Johnson, 2006). Mechanical removal may be preferable.

4.5 Management of Visitor Use Impacts

Recreational activities proposed to be allowed on the Preserve, including relatively low-impact activities such as hiking and limited horseback riding are well documented to have detrimental effects on a variety of habitats and individual species (e.g. Spahr 1990, Wilson and Seney 1994, Knight and Cole 1995, Liddle 1997, Maschinski et al. 1997, Yorks et al. 1997, Clark et al. 1998, Leung and Marion 2000, Marion and Leung 2001, Thurston and Reader 2001, Taylor and Knight 2003, Holmes and Geupel 2005, Marion and Olive 2006). Direct and indirect effects of visitor activities on the property's natural and cultural resources could include: trampling of plants and associated loss of plant population viability and vegetation cover; soil compaction and associated increased runoff from trails; alteration of vernal pool and other wetland bottoms' microtopography by people, horses, or bicycles moving off-trail; loss of local plant and animal diversity from deliberate collection of wildflowers and wildlife (e.g. tadpoles); increased displacement or disruption of native wildlife (including nesting endangered northern spotted owls); displacement of native plant species by exotic plant species (visitors and their animals act as vectors for invasive species); loss of vegetation and increased erosion associated with trail construction and expansion activities; littering and deliberate dumping of refuse; and vandalism (including intentional damage to trees).

4.5.1 Visitor Use

The relative impact of people traveling on foot (hikers, birdwatchers, and botanizers), horseback, and bicycle has been the subject of debate among experts in the field of recreational ecology. Impacts from recreational use of wildlands can be classified into four categories: trampling, erosion, wildlife disturbance, and spread of non-native plants. While all forms of recreation impact the environment, foot, wheel, and hoof traffic have different levels and scopes of impact and these impacts vary according to environmental conditions. For example, all types of use cause greater impacts during wet weather (Deluca et al. 1998). With respect to trampling, all user groups have been found to impact vegetation by trampling, with graminoids having the greatest resistance and recovery capacity and shrubs and trees experiencing the greatest long-term reductions in diversity (Yorks et al. 1997).

Hikers have been found to cause less erosional damage than other user groups; wheels apply both compaction and shearing forces to the ground and may be more prone to channelize soil and create gullies that exacerbate erosion processes (Lathrop 2003). The V-shaped ruts caused by bike tires can channel water and increase erosion as well as create barriers to wildlife movement by funneling small animals such as lizards and salamanders along the trail (Vandeman 2008). Comparisons between erosional impacts caused by horses and hikers showed that horses cause greater soil disturbance than hikers (Deluca et al. 1998, Cole and Spildie 1998, Wilson and Seney 1994). If trails are designed, constructed, and maintained to handle the demands of planned user groups, however, impacts should be minimal (Lathrop 2003).

Disturbance to wildlife has been found to occur with all recreational user groups and is more a function of distance than mode of travel (Taylor and Knight 2003), although a 2004 (Wisdom et al.) study found higher probability of elk movement from mountain bike activity than from hiking. Empirical evidence suggests that mortality to wildlife is greater from mountain bikes than hikers due to the speed with which bikes travel, their higher distance from the ground, and their concentration on negotiating the trail (Vandeman 2008).

All recreational users are potential vectors for the spread of non-native, invasive plants. Seeds can become lodged in clothing, bike mechanisms, accessories, and animal tails and fur and later be dropped along trails far from the point of origin, spreading non-native and potentially invasive plants throughout wildlands. Horses are likely to have a greater impact than other forms of travel. Since they often feed or graze in pastures containing non-native plants, horses can deposit these plants' seeds when they have bowel movements along the trail (Wells and Lauenroth 2007). The dung provides a nutrient-rich, moist growing medium favorable for seedling germination and establishment.

Although several studies have been conducted that conclude mountain biking has no more impact on wildlands than hiking (Chiu and Kriwoken 2003, Spahr 1990, Taylor and Knight 2003, Thurston and Reader 2001, Wilson and Seney 1994), these conclusions are disputed (Vandeman 2008). The largest impact of mountain bikers may have more to do with behavioral attributes than mechanical effects. Mountain bikers travel faster over longer distances than hikers, thus extending the range of impacts from a single user. Additionally, the manner of riding – including skidding, braking, acceleration, and turning – at accelerated speeds – may create greater erosion than that expected from moderate speeds used during experimental trials.

4.5.2 Low Impact Recreation

Ag + Open Space intends to enable recreational access on the Preserve that is compatible with preserving the conservation values of the property. Recreation will be permitted on the property only when consistent with resource management objectives. Activities which threaten or endanger visitors, the land or the environment will not be permitted. Allowable uses include hiking, wildlife observation and photography, picnicking, interpretive and educational activities, and botanizing. Equestrian use will be limited to property patrol by trained volunteers – currently residents of neighboring properties – who are familiar with the Preserve. The Volunteer Patrol will hike or ride trails on horseback to ensure that the site is being used in accordance with the management plan. They will identify any constrained parking conditions, vandalism, fences in need of repair, erosion along trails, adverse conditions to wildlife, environmental, or cultural resources, or any other conditions that warrant Ag + Open Space's attention. Horseback patrol will be restricted in sensitive habitats and where populations of sensitive plant species have been documented (see Figure 8, Sensitive Habitats Map, and Confidential Appendix 16, Sensitive Species Occurrences). Since the Preserve does not have safe access for horse trailers, equestrian use will be limited to those entering through neighboring properties where safe access is possible and who have completed an orientation and training program provided by Ag + Open Space representatives.

4.5.3 Trail Use

The primary purpose of the Preserve is to conserve Saddle Mountain's rich biodiversity and mosaic of complex habitats. Recreational use of the Preserve is appropriate only when and where it does not impact the conservation purpose of the acquisition. The Preserve provides habitat for several species of sensitive plants and animals and important cultural resources. To best protect the property's resources, roads and trails should be open only to hiking and limited horseback riding during those times of year when impacts are limited. Dogs are not allowed on the Preserve in order to prevent trampling of rare or sensitive plants and disturbance to wildlife and livestock utilized for vegetation management.

Select trail closures may be considered to protect sensitive habitat, sensitive plant and animals, and visitors. Traffic on trails that lead to or pass close to vernal pools should be restricted until the pools dry for the summer. Exceptions to trail closures may be made for volunteer patrol members; however, horse traffic should be restricted on steep slopes and within sensitive habitats during the winter months and volunteers should be instructed in proper SOD protocol to limit spread of the fungus.

4.5.4 Outreach and Public Engagement

Ag + Open Space provides regular outings, volunteer opportunities, and/or workdays, coordinated either by Ag + Open Space staff and/or with other partner organizations. A schedule of guided hikes is provided on the Ag + Open Space website. Ag + Open Space coordinates with other organizations to provide a wide range of appropriate activities and events that highlight the Preserve's natural resources. These events include bird watching, plant identification, cultural history tours, watershed education, and Preserve appreciation hikes.

Types of future outreach and public engagement on the Preserve may include the development of a docent program, which will be comprised of trained volunteers who are authorized to provide guided tours for hikers. Ag + Open Space may also plan and host public Open Space days that would offer hikes and tours to the public. Guided tours will be hosted by Ag + Open Space staff and partner organizations and will be limited to an appropriate number of visitors. Ag + Open Space staff will identi-

fy appropriate parking areas and establish a general route for the tours and outings. In addition to visitor information and public opportunities, Ag + Open Space will conduct outreach when preparing or updating management plans or other environmental documentation related to the preserve.

4.5.5 Low Impact Research

Appropriately reviewed and directed research of the Preserve's resources, natural processes, values, and uses by credentialed researchers and scholars or their students will be encouraged. Institutions fostering this research can include, but are not limited to, universities, colleges, foundations, other non-governmental organizations, federal, tribal, and state agencies, and Ag + Open Space staff. Results from research will be used to provide a scholarly basis for updates to this management plan, management activities, environmental education and interpretive activities. All data and information acquired through studies conducted on the Preserve will be retained by Ag + Open Space and made available to the public.

Research subjects that are considered highly appropriate on the Preserve include grazing regimes, serpentine plant communities, freshwater wetlands, Sudden Oak Death, grassland management, cultural resources, and other subjects that address management concerns or sensitive habitats. All research must be conducted to minimize impact to the Preserve's natural resources including the removal of equipment used to conduct the research. Removal of objects or specimens or other collections will be prohibited unless clearly necessary and in support of the property's conservation purpose. All research must be approved by the General Manager prior to initiation. Approval is subject to revocation if the research is subsequently determined to be detrimental to property resources or individuals conducting the research fail to act in a manner consistent with Ag + Open Space policies.

4.5.6 Environmental Education

Ag + Open Space will work with partner agencies and organizations to provide environmental education and interpretive activities on the Preserve. These activities could include classes for school children and a self-guided interpretive trail. Educational activities for school children and other youth groups will be conducted by Ag + Open Space partners and will cover topics approved by Ag + Open Space. Educational activities that support Preserve management such as wildlife and botanical surveys, invasive plant removal, and restoration projects will be a priority. The Preserve's cultural resources will be included as appropriate; however, locations of sensitive resources, sensitive animal habitat, and cultural resources will be protected.

Interpretive activities will reach out to a broader segment of the public and will include information about potential harm caused by off-trail hiking, and littering as well as information about the Preserve's natural resources and opportunities to participate in invasive species removal and restoration projects.

4.5.7 Avoiding Impacts to Sensitive Resources

All human recreational activities on the Preserve have the potential to cause damage to the property's sensitive resources (i.e. rare species, sensitive habitats, and cultural resources). However, there are a number of common-sense measures that have been suggested to manage potential visitor use impacts. Implementing these would go a long way toward preventing the degradation or outright loss of the property's sensitive habitats resources. Initial recommendations to ameliorate visitor use impacts include:

Limit visitor activities to established trails: Encourage use of existing trails to route visitors around or away from sensitive areas (e.g. individual rare plant occurrences, serpentine outcrops, and archaeological sites) to prevent direct trampling of plants and wetlands; to avoid flushing wildlife; and discourage collection of artifacts.

Properly maintain trails: Maintain trails to prevent excessive wear and erosion, reducing sediment input into nearby water bodies.

Limit types of visitor activities: Only relatively low-impact activities (hiking and limited horseback riding) should be allowed on the property, and the likely effect of each activity should be carefully evaluated before making a final determination about which activities are appropriate. Off-road vehicles, biking, hunting, and fishing should be actively prevented and restrictions enforced.

Establish buffers and prevent or limit access to particularly sensitive areas: Close portions of existing trails (seasonally or permanently) known or suspected to impinge on sensitive resources (e.g. rare plants and habitats, spotted owl nest sites, archaeological sites). If feasible, erect fenced exclosures around discrete habitats (e.g. vernal pools, serpentine outcrops) to prevent people and animals from trampling plants. Discourage visitor use of certain areas when impact potential is especially high, especially during the rainy winter season.

Prevent damage to and looting of archaeological sites: Any future facilities construction and improvements should be planned to avoid cultural resources. If trails and roads can be routed away from resources this will serve as mitigation on two levels; first the construction impact will be avoided, and second the foot traffic (and potential collectors) will be directed away from resources.

Modify visitor behavior: Post signs and/or construct kiosks to educate visitors about sensitive resources and direct them to behave appropriately (e.g. remain on trails, leave flowers unpicked, no dogs allowed on Preserve, pick up litter, etc.).

Limit factors favoring introduction of exotic plant species: Limit visitor access points (e.g. trailheads). People and domestic animals are excellent vectors for invasive species and trails are effective conduits of these species to backcountry areas. In fact, exotic species richness has been found to negatively correlate with distance from the trailhead (Benninger-Traux et al. 1992). Conduct trail-side monitoring and targeted plant removals where invasives are found.

4.5.8 Potential Access Roads and Trail Locations

To reduce the spread of non-native invasive plants, the number of access points should be limited. Currently, the most direct and safe access location for the majority of visitors is the Cleland Ranch Road entrance. Existing trail and road locations pass near sensitive plant populations and through sensitive habitat. Cleland Ranch Road is close to montane riparian habitat and two identified populations of Napa false indigo. The Erland-Cleland Tie Road passes through a cultural resource area that should not be exposed to any type of ground disturbance and the route also contains other cultural resources that should be protected from visitor traffic. This road and Alpine Creek Road pass through or close to sensitive plant habitat and montane riparian habitat. Erland Spur Road and Cabin and Cabin Spur 1 pass through sensitive plant habitat and Cabin, Cabin Spur 1 and Cabin Spur 4 pass through areas containing cultural resources. All of these roads have been identified as roads that will be maintained or upgraded for maintenance and visitor use when the Preserve is open to the public. Care must be taken during maintenance and upgrading to limit impacts to the Preserve's sensitive resources and if possible, they should be rerouted to less sensitive areas.

Alpine Creek Trail, which connects the Erland-Cleland Tie to the Erland Spur, and the lower half of the Upper Alpine Creek Trail will be closed. A road entering the eastern section of the northern parcel within sensitive plant habitat will be decommissioned.

4.5.9 Infrastructure Improvements

In keeping with the preservation goals of this management plan, infrastructure development will be kept to a minimum. Currently, Preserve visitors access from Cleland Ranch Road and park in a small mowed area about a half mile into the property. This parking area can accommodate approximately 15 cars; no improvement or expansion of this parking area is planned.

Ag + Open Space installed an electric gate at the entrance to the property at Cleland Ranch Road in July 2015. This greatly improves the security of the property, and ensures that access is only allowed to trained docents, volunteer patrollers, and those folks who have been given Ag + Open Space authorization to enter the Preserve.

4.6 Monitoring and Evaluation

To date, Ag + Open Space has not established a formal monitoring program of its fee properties. The following monitoring and evaluation recommendations are presented as potential future management strategies or as research opportunities.

4.6.1 Monitoring Protocols

Monitoring protocols should be designed to be able to determine whether specific objectives of this Plan are being met. The Society for Ecological Restoration (SER) recommends monitoring of a wide range of ecological properties, including vegetation diversity and structure, and other ecological processes that can include wildlife use of sites, herbivory on planted species, predation, and changes in soil processes (Stromberg, D'Antonio, Young and Kephart, 2007). Data should be collected and recorded, not only for the treated restoration site, but also for a comparable reference site. Photographic monitoring over time from fixed locations is a relatively simple, low-cost monitoring technique that can supplement quantitative data collection. Paired photographs from fixed locations can be useful tools in explaining complex changes over time.

Following are a number of regionally appropriate peer-reviewed protocol and guidance resources:

- California Salmonid Stream Habitat Restoration Manual, California Department of Fish and Wildlife. 1998. http://www.dfg.ca.gov/fish/Resources/HabitatManual.asp

- Photo-Monitoring for Better Land Use Planning and Assessment, Range Land Monitoring Series, Publication 8067, University of California Division of Agriculture and Natural Resources. 2003. http://anrcatalog.ucanr.edu/pdf/8067.pdf.
- Measuring and Monitoring Plant Populations. Bureau of Land Management. BLM Technical Reference 1730-1. BLM Technical Reference 1730-1. http://www.blm.gov/nstc/library/pdf/MeasAndMon.pdf
- California Native Plant Society Relevé Protocol. California Native Plant Society Vegetation Committee. Revised 2004. http://www.cnps.org/cnps/vegetation/pdf/cnps_releve_protocol_20070823.pdf.
- Morse, L.E., J.M. Randall, N. Benton, R. Hiebert, and S. Lu. 2004. An Invasive Species Assessment Protocol: Evaluating Non-Native Plants for Their Impact on Biodiversity. Version 1. NatureServe, Arlington, Virginia. http://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1536&context=govdocs
- Standard Operating Procedures for Collecting Benthic Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessment in California. State Water Resources Control Board. 2007. http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/phab_sopr6.pdf
- SWAMP - Clean Water Team Citizen Monitoring Program Guidance Compendium for Watershed Monitoring and Assessment. State Water Resources Control Board. http://www.swrcb.ca.gov/water_issues/programs/swamp/cwt_guidance.shtml.
- Grazing Handbook, A Guide for Resource Managers in Coastal California. Sonoma Resource Conservation District. http://sonomarcd.org/documents/Grazing-Handbook.pdf.
- Handbook for Forest and Ranch Roads. Pacific Watershed Associates. 2014. Available for download at Mendocino County Resource Conservation District website. http://www.mcrcd.org/.

Monitoring of Erosion Sites

Effective erosion management evaluation employs a road treatment-based monitoring strategy typically using standard photo points. These established annual photo points compare the treatment sites over time to observe visible erosion after the first year. Because it is very difficult to directly measure sediment savings on a single project or treatment site, repeated inspections are recommended, including inspections after significant storm events through the first winter or two, and annually thereafter.

Monitoring of Exotic/ Invasive Species

On-the-ground monitoring is an extremely important aspect to a successful invasive species management program. Monitoring does not necessarily require extensive data collection and analysis, unless the program is a research project. Simply visiting the treatment sites on a regular basis, keeping good records, and performing re-treatment at appropriate times can lead to a successful invasive plant control program. Documentation of methods used, timing, and other relevant factors is important so future land managers do not have to "re-invent the wheel." Monitoring results can be published or presented at conferences to expand the knowledge base within this relatively new field. Fully successful treatment requires an adaptive management approach (Section 4.7, Adaptive Management). Most treatment methods will cause some degree of disturbance that may create temporarily favorable conditions for other invasive species, so a revegetation program may also be an appropriate component of maintaining some sites. Follow-up treatments that utilize an additional/ supplementary control method may be the best approach for dealing with changing conditions over time.

4.6.2 Evaluation and Monitoring Indicators

The evaluation method is to be developed for each project according to the specifications of each project's goal(s) and the data indicators that are applicable for that project. Various methods can determine the success of the intended outcome of the implemented management strategy (Table 4.1). If the management strategy employed to remove the target species has unintended or undesirable results, the adaptive management framework described in Section 4.7 allows for the re-evaluation and modification of the management strategy.

Table 4.1 Data Indicators to Measure Progress toward Recommended Management Strategies

MANAGEMENT STRATEGY	MANAGEMENT ACTIVITY GOALS	DESIRED OUTCOMES	EVALUATION STRATEGY	INTERIM MILESTONES	QUANTIFICATION OF INDICATORS
Erosion Control/ Sediment Reduction/ Water Quality Maintenance	Improve road drainage features preventing road-related erosion	Reduce fine sediment sources from entering water ways and detrimentally affecting aquatic habitat	Monitoring road treatment sites using photo points; bioassessment and macroinvertebrate sampling to assess water quality and aquatic habitat condition changes; turbidity or suspended sediment measurements to assess changes in quality of runoff from improved roads	Minimal erosion on improved road networks and decreased suspended sediment and sediment deposition downstream of improved road networks	Prevention of 1,900 yards of sediment entering target drainages (Weeks, Alpine and/or Van Buren Creeks); no decrease in the baseline IBI score; decrease in turbidity or suspended sediment concentration
Exotic/ Invasive Species Management	Remove and reduce population viability of invasive plant species	1. Reduce target species numbers in treated areas 2. Increase native plant species	Comparison of infested areas receiving treatment over time using GPS vegetation mapping, coupled with random quadrat analysis for percent cover	Annual decrease of the area infested with target species based on removal and treatment and associated increase of non-invasive species	10% annual decrease areal coverage of target species
Sensitive Habitat Enhancement/ Native Plant Revegetation	Introduce native plant competition to reduce the re-colonization of invasive plants; Prevent erosion by stabilizing erosion-prone areas with the installation of native vegetation	1. Increase in native plant coverage 2. Decrease erosion and fine sediment delivery to aquatic habitats	Comparison of percent cover with native grasses and forbs in seeded areas; survival rates of installed plants; comparison of infested areas receiving treatment over time using GPS vegetation mapping	Increased ground cover with native plant species, decrease in areal coverage of bare ground	90% establishment of planted native species; a minimum survival rate of 65% a year after planting is implemented

4.6.3 Evaluation of Erosion Control and Sediment Reduction

Erosion management evaluation will employ a road treatment-based monitoring strategy using standard photo points. These established annual photo points will compare the treatment sites over time to observe visible erosion after the first year. Because it is very difficult to directly measure sediment savings on a single project or treatment site, PWA recommends repeated inspections, after significant storm events through the first winter or two, and annually thereafter. Due to the ground disturbance associated with the road improvement project, runoff from the first winter following implementation is expected to yield sediment as the treatment sites settle and adjust. Once this initial adjustment is completed, there is not expected to be any detectable road surface erosion at the treatment sites.

While ideally the success of an improved road network would be evaluated in terms of improvement to aquatic habitat, since the target watersheds (Weeks, Alpine and Van Buren) are not contained entirely within the Preserve, and consequently the sediment impacts are not limited to the road drainage networks on the Preserve, it is not possible to evaluate success of the road improvements on the Preserve entirely via creek conditions. While using bioassessment of benthic macroinvertebrate communities to evaluate improvements to water quality and stream habitat conditions could be one evaluation tool, it would need to be correlated with a road-based project assessment parameters.

Targeted turbidity measurements can be taken at road-related runoff outlet points, such as culvert outlets. In order to employ this method, baseline, or pre-project, turbidity measurements should be taken at comparable runoff outlet points so that the background conditions can be established against which to measure improvement. A measurable improvement in terms of turbidity would be a decrease in Nephelometric Turbidity Units (NTUs) or Suspended Sediment Concentration (SSC) volume contained in the runoff. When establishing runoff outlet monitoring points, it should be noted that hydrology of the road system will change through implementation, and thus some runoff outlet points may change as well. This level of monitoring would be time-intensive and expensive.

There has not been extensive water quality monitoring conducted on any of the creeks flowing through the Saddle Mountain, so baseline conditions of water quality (i.e. prior to erosion treatments or plant revegetation) are not determined for the property. Because environmental conditions vary within, between, and among years, a fully accurate depiction of stream conditions would require ongoing data collection over multiple years. Some traditional quality parameters (e.g. temperature, dissolved oxygen, pH, conductivity, stream height) can be measured continuously using *in situ* (on site) data loggers.

In 2008, continuous temperature monitoring data loggers were deployed at two locations on Weeks Creek as it runs through the Preserve. These loggers collected water temperature data every half hour from May to October of 2008. Continuation and expansion of this monitoring program should be considered on Van Buren, Alpine and Weeks Creeks in order to assess and evaluate aquatic conditions on the property. Additionally, benthic macroinvertebrates sampling (bioassessment) conducted in the spring and/or fall, along with an assessment of streamflow and channel conditions, could indicate changes in aquatic habitat quality parameters. A discussion and listing of various published monitoring resources that include monitoring data collected in the upper Mark West Creek watershed in the vicinity of the Preserve are summarized in Appendix 12, Water Quality and Habitat Assessments, Methods and Protocols.

4.6.4 Evaluation of Exotic/ Invasive Species Control

Evaluation of invasive plant control treatment will require a monitoring plan to be finalized once the treatment method(s) is finalized. A suite of invasive plant control methods are recommended for priority target species. The monitoring plan should address the major objectives of the invasive plant control treatment including detecting and quantifying the change in plant species composition of the treated areas and the decrease in areal coverage of target species in the infested area. Monitoring approaches could include boundary mapping, which is the annual mapping of the perimeter of a plant population to monitor change in the area occupied by the population, utilizing photo points to evaluate the extent of the plant population over time, and measurement of percent cover of target species. Each of these methods requires and Ag + Open Space policy states that the results of pest control activities should be "monitored and compared to a baseline to determine the effectiveness of the control action and describe unanticipated effects" (Ag + Open Space, 2008).

For all plant community monitoring, whether it be related to invasive plant removal or native plant installation, the scale and intensity of the monitoring must be determined based on the project goals. According to Elzinga, et al,

> "Clearly, as you increase the scale and intensity you will know more about the species and its trend and status, but the monitoring will be more expensive. With limited funds, you can monitor one or a few species at a large scale and high intensity, or more species at a more limited scale and lower intensity. The setting of priorities is the first step in determining the importance and number of species and/or populations that require attention, the monitoring resources that should be allocated to each, and the complexity of the objective for each species or population that can be monitored."

The general recommendation is that the most sensitive habitats and/or rarest plant species should be monitored most intensively (i.e. the vernal pools and/or Clara Hunt's milk-vetch), while the less sensitive habitats should be monitored less intensively at a larger spatial scale.

4.7 Adaptive Management

Adaptive management is a structured, iterative process of educated decision-making where results are evaluated and actions adjusted in order to improve future management based on what has been learned. Adaptive management aims to simultaneously maximize one or more resource objectives and accrue site-specific information needed to improve future management. Adaptive management is often characterized as "learning by doing" and can change throughout the course of a project.

Ag + Open Space's Open Space Preserve Policies (Ag + Open Space, 2008) point out that "management activities and monitoring are linked activities" and states that the employment of an adaptive management process "uses feedback from research and monitoring to evaluate the management actions; this enables the District to modify or continue to support management objectives and strategies."

4.7.1 Long Term Maintenance and Monitoring

Monitoring is a key component of adaptive management. Monitoring the outcomes of management actions provides the information necessary to adjust management strategies or implementation actions to achieve desired results. As monitoring data from individual project implementation are gathered and evaluated, direction toward stated goals and objectives will be evaluated. Where progress is being made toward goal achievement, long-term maintenance will be initiated, with monitoring and data analysis continuing to provide feedback into the management process. If monitoring data analysis indicates that project implementation is not creating or maintaining desired conditions, alternative strategies will be reviewed, and the optimal strategy or strategies will be implemented. Long-term monitoring will continue, with subsequent data analysis providing feedback to measure each subsequent implementation activity until progress towards objectives is achieved. See Appendix 14, Monitoring Approaches for Recommended Management Strategies, for a list of recommended monitoring protocols, suggested resources, and target outcomes.

4.7.2 Project Assessment and Evaluation

The establishment of a monitoring plan for the habitat enhancement projects recommended on the Preserve is necessary to assess the on-going management of the property, the success of projects implemented for habitat enhancement and the impacts of visitor use, as well as for compliance with the Open Space Preserve Policies (Ag + Open Space, 2008). The employment of an adaptive management strategy for the ongoing management and monitoring planning allows for the opportunity to reprioritize and/or improve management approaches in response to unforeseen conditions. Based on the Open Space Preserve Policies, "habitat monitoring will be the primary basis for evaluating the effectiveness of management actions," with the goal of managing preserve lands "primarily for biological integrity, ecosystem health, and biological diversity" (Ag + Open Space, 2008). This should be the guiding principal for evaluation and adaptation of ongoing enhancement and management activities. See Table 4.2 for a matrix of suggested adaptive management monitoring approaches for the priority strategies recommended in this plan and in Appendix 14, Monitoring Approaches for Recommended Management Strategies.

Table 4.2 Adaptive Management Approach to Monitor Recommended Management Strategies

MONITORING TYPE	PROTOCOL	RESOURCE HYPERLINK	IMPLEMENTATION TIME PERIOD	MONITORING OBJECTIVE	MANAGEMENT OUTCOMES	PRIORITY
STRATEGY: EROSION CONTROL AND SEDIMENT MANAGEMENT						
Culvert Assessment	Modified CDFW Upslope Inventory	http://www.dfg.ca.gov/fish/Resources/HabitatManual.asp	Fall, and after large storms that have mobilized debris, to inform necessary maintenance to avoid culvert failure and related erosion	Culvert and culvert plug condition	Culvert maintenance	High
Photo monitoring	Photo-Monitoring for Better Land Use Planning and Assessment	http://ucanr.edu/sites/UCCE_LR/files/180920.pdf	1. Before/after project implementation 2. Every spring	Erosion remediation monitoring	Erosion remediation of problem sites	High
Turbidity and/or Total Suspended Sediment Concentration	SWAMP - Clean Water Team Citizen Monitoring Program Guidance Compendium For Watershed Monitoring and Assessment	http://www.swrcb.ca.gov/water_issues/programs/swamp/cwt_guidance.shtml	Early winter after storms have mobilized debris	Trend analysis of sediment impacts to aquatic habitat over long-term	Assessing ongoing sediment impacts to aquatic habitat	Low
Aquatic Bioassessment	Standard Operating Procedures for Collecting Benthic Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessment in California	http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/swamp_sop_bio.pdf	1. Baseline prior to implementation 2. Every spring	Trend analysis of sediment impacts to aquatic habitat over long-term	Assessing ongoing sediment impacts to aquatic habitat	Medium
STRATEGY: EXOTIC/ INVASIVE PLANT SPECIES MANAGEMENT						
Invasive plant population boundary mapping	Measuring and Monitoring Plant Populations	http://www.blm.gov/nstc/library/pdf/MeasAndMon.pdf	1. Baseline prior to implementation of management strategies 2. Every Spring	Invasive plant population control monitoring	Assessing success/ response of invasive plant removal efforts on a macro-scale	High
Photo monitoring	Photo-Monitoring for Better Land Use Planning and Assessment	http://ucanr.edu/sites/UCCE_LR/files/180920.pdf	1. Before/after project implementation 2. Every spring	Invasive plant population control monitoring	Assessing success/ response of invasive plant removal efforts on a macro-scale	High

MONITORING TYPE	PROTOCOL	RESOURCE HYPERLINK	IMPLEMENTATION TIME PERIOD	MONITORING OBJECTIVE	MANAGEMENT OUTCOMES	PRIORITY
Percent cover estimates (1 m^2 quadrats)	Measuring and Monitoring Plant Populations	http://www.blm.gov/nstc/library/pdf/MeasAndMon.pdf	1. Baseline prior to implementation of management strategies 2. Every Spring	Plant species composition in treated areas	Evaluation of species composition response to invasive plant removal efforts	High
SOD monitoring	Diagnosis and Monitoring of SOD, University of California Cooperative Extension. Pest Alert 6.	https://www.npdn.org/system/files/GPDN%20Ramorum%20blight-diagnosis%20and%20monitoring%20March%202002.pdf	Every spring	Trend analysis of Sudden Oak Death spread	Assessing SOD occurrence	Low
STRATEGY: SENSITIVE HABITAT ENHANCEMENT						
Survival monitoring revegetation projects, direct counts	Measuring and Monitoring Plant Populations	http://www.blm.gov/nstc/library/pdf/MeasAndMon.pdf	Every spring	Percent survival and resulting density of installed riparian plants	Planting maintenance adjustment to ensure survival and/or replanting to augment loss	High
Photo monitoring	Measuring and Monitoring Plant Populations	http://ucanr.edu/sites/UCCE_LR/files/180920.pdf	1. Before/after project implementation 2. Every spring	Monitor changes in vegetation composition in sensitive habitats	Assessing success of native plant revegetation efforts	High
Percent cover estimates (1 m^2 quadrats)	Measuring and Monitoring Plant Populations	http://www.blm.gov/nstc/library/pdf/MeasAndMon.pdf	1. Baseline prior to implementation of management strategies 2. Every Spring	Total percent cover and plant species composition in treated areas	Assessing success of native forb and grass seeding efforts	High
STRATEGY: SOD AND FIRE MANAGEMENT						

MONITORING TYPE	PROTOCOL	RESOURCE HYPERLINK	IMPLEMENTATION TIME PERIOD	MONITORING OBJECTIVE	MANAGEMENT OUTCOMES	PRIORITY
SOD Monitoring	Diagnosis and Monitoring of Sudden Oak Death. University of California Cooperative Extension. Pest Alert 6.	https://www.npdn.org/system/files/GPDN%20Ramorum%20blight-diagnosis%20and%20monitoring%20March%202002.pdf	Spring	Trend analysis of Sudden Oak Death spread	Assessing SOD occurrence	Low
Fuel Load Monitoring	Fuel Load Sampling Method. US Forest Service	http://www.treesearch.fs.fed.us/pubs/24059	Late summer / Fall	Measure fuel potential: duff profile; dead debris & cover	Assessing fire risk	Medium
STRATEGY: WATER QUALITY MONITORING						
Continuous Temperature Monitoring	Forest Science Project Stream Temperature Protocol	http://www.waterboards.ca.gov/water_issues/programs/tmdl/records/region_1/2003/ref1761.pdf	Continuous temperature loggers deployed during low-flow summer and fall months when stream temperatures limit aquatic habitats	Trend analysis of water temperature as a gauge of aquatic condition	Assess success of sensitive habitat enhancement projects e.g. riparian revegetation	Medium
Biological Monitoring	Standard Operating Procedures for Collecting BMI Samples and Associated Physical and Chemical Data for Ambient Bioassessment in CA	http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/swamp_sop_bio.pdf	1. Baseline prior to implementation of management strategies 2. Every Spring	Trend analysis of biological integrity of aquatic habitat	Assess trends to aquatic habitat in response to Preserve management activities	Medium
Flow Monitoring	Standard Operating Procedure for Stream Flow Measurement	https://www.epa.gov/sites/production/files/2015-06/documents/module5.pdf	Continuous stage monitoring stations should be established year round and corresponding stream flow should be measured every 2-3 weeks throughout the year	Trend analysis of stream flow	Assess stream flow response to Preserve management activities	Medium

5. PRIORITY PROJECT IMPLEMENTATION

5.1 Erosion and Sediment Control Projects

Priority projects will focus on addressing issues that threaten the ecological integrity of the Preserve, as well as implementing public safety measures. Natural resource management issues that should be addressed in the immediate-term are (1) erosion from roads and other sources causing sediment delivery into the property's creeks, and (2) invasive plant species controls/ native plant community enhancement.

5.1.1 Erosion Remediation Projects

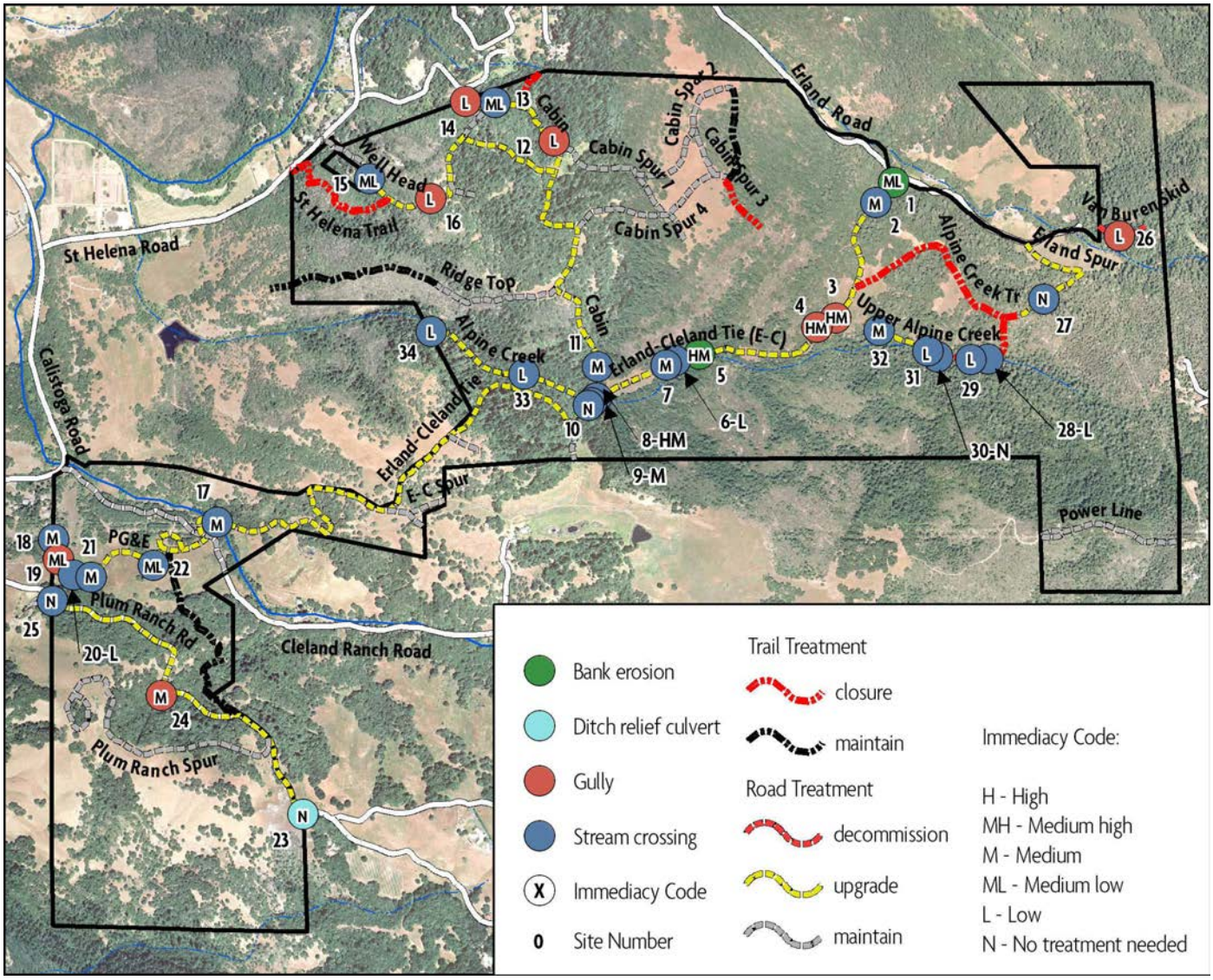

Figure 17. Road and Trail Treatment Areas

Recommendations from the PWA road assessment conducted on the Preserve in 2008 and reevaluated in 2015 include treating[9] 25 of the 36 identified road/trail sites and 3.10 miles of 3.35 hydrologically connected road/trail assessed for erosion control and erosion prevention. Individual road related treatment sites include 15 stream crossings located throughout the road network, six gullies on the Cabin, Erland-Cleland Tie, PG&E, and Wellhead roads, and two sites of bank erosion on the Erland-Cleland Tie Road. Due to access constraints, it is recommended that Alpine Creek Road, Alpine Creek Trail and Van Buren Skid be permanently closed and abandoned in place.

Stream crossing treatments are primarily implemented to reduce the risk of catastrophic failure and sediment delivery resulting from saturation of road fill or stream diversion along road surfaces. For the most part, armored fill crossings are prescribed throughout the project area because of the low volume of traffic and greater longevity. Armored fill crossings do not have the potential to plug like a culvert, and by design alleviate diversion potential. For the Preserve, it is recommended that one culvert be replaced on Plum Ranch Road and that 10 wet crossings (7 armored fill crossings and three fords) be constructed to minimize erosion potential. Approximately 90 cubic yards of rock armor will be required to build the 7 armored fill crossings.

Field measurements show that approximately 1,000 square feet of asphalt and 72 cubic yards of road rock will need to be replaced following treatment. An important final step to implementing the recommended erosion remediation for the Preserve will be replacing road pavement removed during installation of ditch relief culverts and culverts at stream crossings on Plum Ranch Road, as well as re-rocking the road surface on the northernmost section of the Erland-Cleland Tie Road. A summary of treatments advised for priority erosion sites at Saddle Mountain is presented below (Tables 5.1 and 5.2).

[9] All treatment prescriptions follow guidelines described in the Handbook for Forest, Ranch, and Rural Roads (Weaver, Weppner, and Hagans, 2014), as well as Parts IX and X of the California Department of Fish and Wildlife Salmonid Habitat Stream Restoration Manual (Taylor and Love, 2003; Weaver et al., 2006). Overviews of construction and installation techniques for the recommended erosion control and prevention treatments are provided in Appendix 7.

Table 5.1. Recommended treatments for sediment delivery sites and associated road segments, Saddle Mountain Road and Trail Erosion Assessment Project, Sonoma County, California.

TREATMENT TYPE			NO.	COMMENTS
SITE SPECIFIC TREATMENTS	Stream crossing treatments	Armor fill face	1	Armor the outboard fill face at site #1 using 2 yd^3 of riprap.
		Culvert (replace)	1	Replace an undersized, poorly installed, or worn out culvert (site #24).
		Trash rack	1	Install at culvert inlets to prevent plugging (site #24).
		Wet crossing	13	Construct 2 ford (site #11 and 15) and 11 armored fill crossings (site #2, 4, 7, 8, 13, 18, 20, 21, 22, 27, 34) using 80 yd^3 of rock armor.
		Critical dip	1	Install to prevent stream diversions (Site #24).
	Other	Soil excavation	18	At 18 sites, excavate and remove a total of 192 yd^3 of sediment, primarily at fillslopes and stream crossings (site #1, 2, 4, 7, 8, 11, 13, 15, 18, 20, 21, 22, 24, 26, 27, 31, 33, 34)

ROAD SURFACE TREATMENTS	Road drainage structures	Rolling dip	87	Install to improve road drainage.
		Cross road drain	2	Install to improve drainage on decommission roads
		Install ditch relief culvert	3	Install or replace ditch relief culverts to improve road surface drainage.
	Road shaping treatments	Outslope road and remove ditch	15	At 15 locations, outslope road and remove ditch for a total of 8,038 ft of road to improve road surface drainage
	Other	Paving	4	Repave a total of 900 ft^2 of road at 1 stream crossings, and 3 ditch relief culvert installations.
		Road rock (for road surfaces)	2	At 2 locations, use a total of 90 yd^3 of road rock to rock the road surface at 3 rolling dips and 520 ft of road outsloping.

Table 5.2. Recommended treatments for maintenance sites and associated road segments, Saddle Mountain Road and Trail Erosion Assessment Project, Sonoma County, California.

TREATMENT TYPE	NO.	COMMENTS
Clean culvert inlet	1	At Site #25, clean the inlet and outlet of the ditch relief culvert.
Rolling dip[1]	6	Install to improve road drainage.
Outslope road and remove ditch	1	At 1 location, outslope road and remove ditch for 150 ft of road to improve road surface drainage
Road rock (for road surfaces)	1	At 1 location, use a total of 15 yd^3 of road rock to surface the road at a location of road outsloping.

5.1.2 Water Quality Improvement Projects

Water quality is closely linked with erosion potential, and so is included herein. However, addressing "water quality" as a single issue is not a priority of this Plan. Water quality monitoring should be conducted in conjunction with sediment reduction efforts, to ensure efficacy of erosion control projects. Monitoring of indicators for three key attributes is advised: physio-chemical monitoring (e.g. turbidity), biological monitoring (e.g. benthic macroorganisms), and streamflow monitoring (e.g. stage gauges with continual data storage). A sample monitoring methodology is described in detail in Appendix 12, Water Quality and Habitat Assessment, Methods and Protocols.

5.1.3 Erosion Treatment Priorities and Needs

Treatment "immediacy" is a professional determination of the urgency of response necessary to alleviate a threat. Table 5.3 indicates that of the 25 inventoried sediment source sites recommended for treatment, six are assigned an immediacy rating of high-moderate, 12 are assigned an immediacy rating of moderate or moderate-low, and six are assigned an immediacy rating of low (includes maintenance site).

Table 5.3 ***Treatment immediacies and potential sediment delivery volumes for each recommended treatment site, Saddle Mountain Road and Trail Erosion Assessment Project, Sonoma County, California.***

SITE #	SITE TYPE	TREATMENT IMMEDIACY[A]	ESTIMATED FUTURE SEDIMENT DELIVERY FOR THE SITE (YD^3)[B]	LENGTH OF ADJACENT HYDROLOGICALLY CONNECTED ROAD (FT)[C]
1	Bank erosion	ML	5	220
2	Stream crossing	M	6	715
3	Gully	HM	24	1,800
4	Gully	HM	3	96
5	Bank erosion	HM	0	1,350
6	Stream crossing	L	0	289
7	Stream crossing	M	7	40
8	Stream crossing	HM	7	260
9	Stream crossing	M	0	2,380
11	Stream crossing	M	0	1,000
12	Gully	L	0	1,104
13	Stream crossing	ML	1	795
14	Gully (maintenance site)	L	-	-
15	Stream crossing	ML	17	1,420
16	Gully (maintenance site)	L	-	-
17	Stream crossing	M	0	1,246
18	Stream crossing	M	1	307
19	Gully (maintenance site)	L	-	-
20	Stream crossing	L	1	355
21	Stream crossing	M	7	25
22	Stream crossing	ML	4	60
24	Stream crossing	M	79	480
25	Ditch relief culvert (maintenance site)	L	-	-
26	Gully	L	1	200
27	Stream crossing	M	0	490
31	Stream crossing	L	4	90
32	Stream crossing	M	9	40
33	Stream crossing	L	0	100
34	Stream crossing	L	2	75

[a]H, high; HM, high-moderate; M, moderate; ML, moderate-low, L, low.

[b]Total sediment delivery for the site-specific problem. As shown above, most of the sediment delivery for the project area is from chronic erosion of hydrologically connected roads (1,710 yd^3).

[c]Includes hydrologically connected ditches, cutbanks, and road surfaces adjacent to the treatment site. Paved roads surfaces include ditches and cutbanks only.

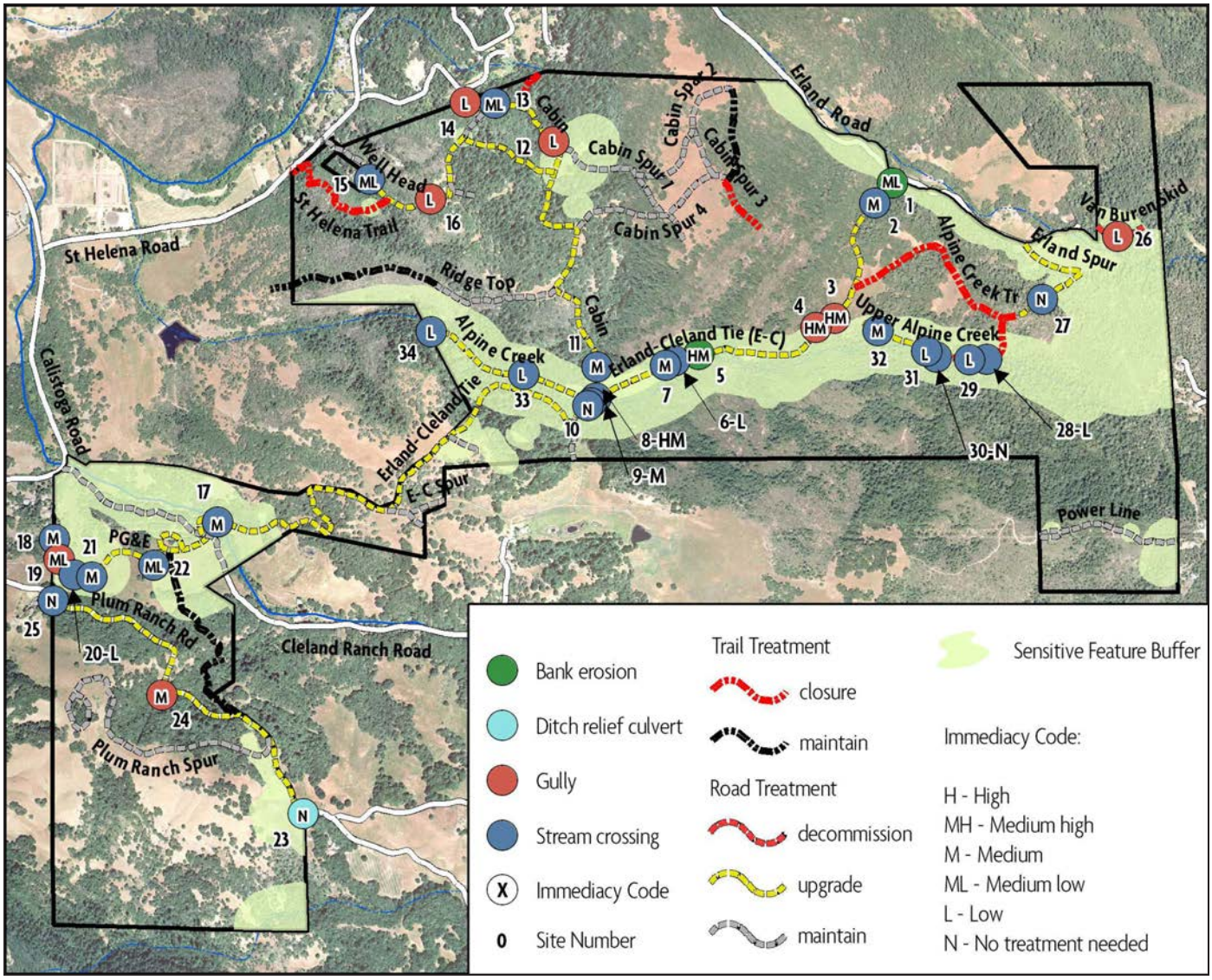

Figure 18. Road and Trail Treatment Analysis

Botanical and cultural resource surveys conducted in 2008/2009 identified a number of sensitive plant species and cultural features occurring along and in the vicinity of the Preserve roads and trails. Intensive road-related activities will avoid these areas. Table 5.4 lists roads inside buffer zones, sensitive features in their vicinity, and recommendations that afford protection while allowing for site maintenance.

Table 5.4 Road and Trail Treatment to Enhance Sensitive Features

ROAD / TRAIL NAME	SENSITIVE FEATURE	ROAD SURFACE TYPE	ROAD SITES IMPACTED BY SENSITIVE FEATURE BUFFER ZONE	TREATMENT RECOMMENDATION	TOTAL ROAD LENGTH (MI)
Alpine Creek Road	Riparian, Napa false indigo	Unsurfaced	2 stream crossings: #33, 34	Closure	0.37
Alpine Creek Trail	Riparian, Napa false indigo	Unsurfaced	2 stream crossings: #28, 29	Closure	0.6
Cabin Road	Riparian, FEW, Cultural	Unsurfaced	1 gully: #12	Upgrade/ Decommission	0.87
Cabin Spur 1	FEW, Cultural, Lobb's buttercup	Unsurfaced	None	None	0.26
Cleland Ranch Road	Riparian, Napa false indigo	Rock	None	None	0.42
Erland-Cleland Tie Road	Riparian, Cultural	Unsurfaced	6 stream crossings (#6, 7, 8, 9, 10, 17) 1 bank erosion (#5)	Upgrade	2.0
Erland-Cleland Tie Spur Roads 1	Riparian	Unsurfaced	None	None	0.1
Erland-Cleland Tie Spur Roads 2	Clara Hunt's milk-vetch	Unsurfaced	None	None	0.07
Erland Spur Road	Serpentine, Closed Cone Pine-Cypress Sonoma ceanothus	Unsurfaced	None	Upgrade	0.33
PGE Road	Serpentine, FEW, Wet Meadow	Unsurfaced	3 stream crossings (#18, 20, 21) 1 gully (#19)	Upgrade	0.51
Plum Ranch Road	Serpentine, Cultural, Napa false indigo	Pavement	1 DRC (#23)	Upgrade	0.78
Power Line Road	Closed Cone Pine-Cypress: Narrow-anthered brodiaea; Sonoma manzanita	Unsurfaced	None	None	0.34
St. Helena Trail	Napa false indigo	Unsurfaced	None	None	0.24
Upper Alpine Creek Road	Riparian	Unsurfaced	3 stream crossings (#30, 31, 32)	No treat, abandon in place	0.17
Van Buren Skid Road	Riparian	Unsurfaced	1 gully (#26)	No treat, abandon in place	0.10
Wellhead Road	Napa false indigo	Unsurfaced	None	Upgrade	0.5

5.2 Invasive Species Control Projects

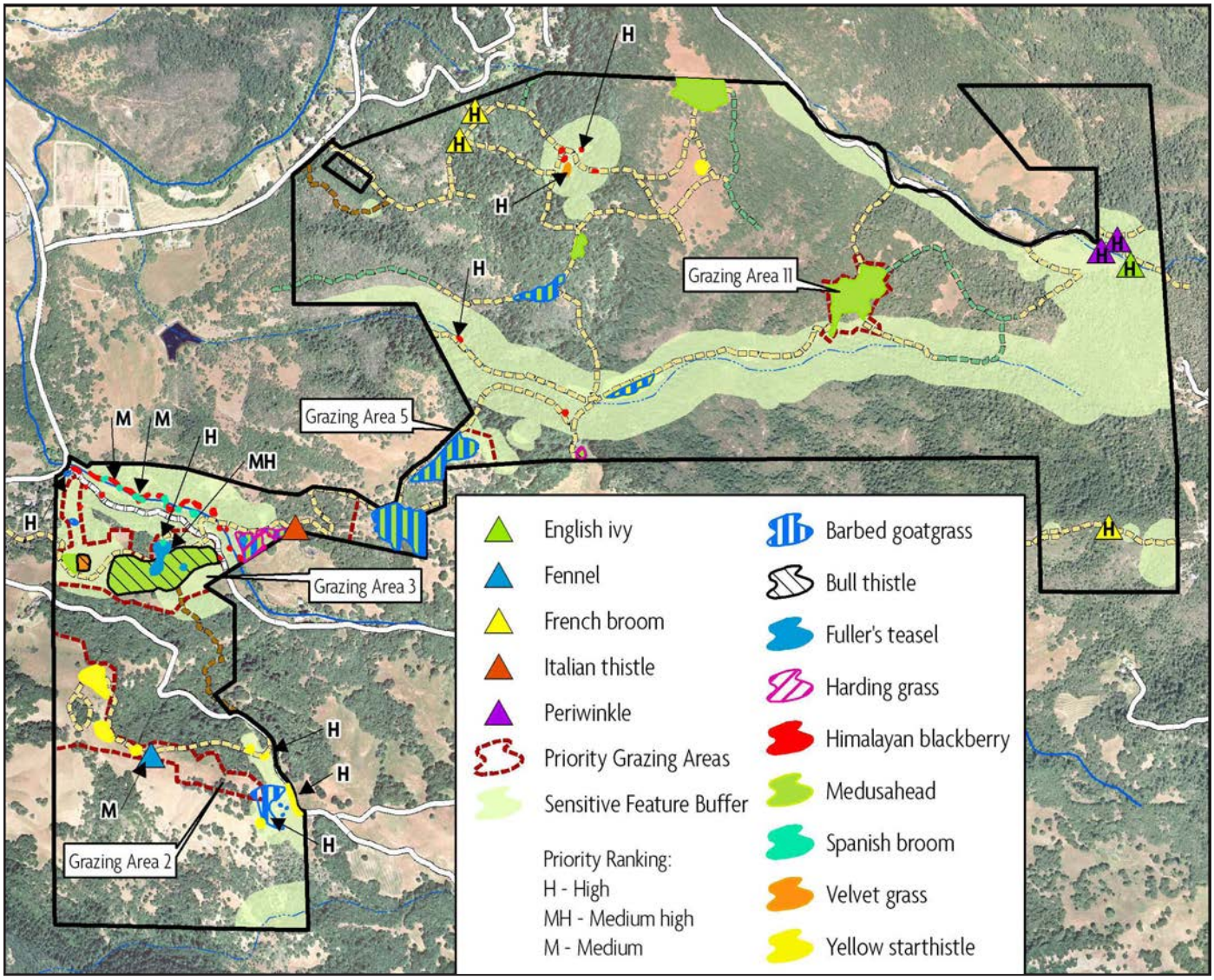

Figure 19. Invasive Plant Species Treatment Sites

Invasive species control programs within the sensitive areas on the property will be implemented as soon as possible. These areas include riparian zones, wetlands, serpentine chaparral and grasslands, and other grasslands that currently support significant concentrations of native perennial grasses. The highest priority projects are outlined below.

5.2.1 Priority Project Areas and Species

The focus of treatment efforts should be invasive plants listed as High and Moderate by Cal-IPC (Table 4.5, Priority Invasive Species to Control), and on the sensitive areas that are identified in this Plan as priority for protection. These include riparian zones; wetlands; serpentine grasslands; areas with suitable habitat for Sonoma ceanothus, narrow-anthered brodiaea, Napa false indigo, and Mt. St. Helena morning glory; and areas supporting other special status plant and animal species. In keeping with the Bradley method recommendation of prioritizing small satellite populations of invasive species, initial treatment areas should include the species at the sites specified in Table 5.6, Priority Areas for Treatment. On the other hand, significant stands of grassland invasives categorized by Cal-IPC as High or Medium (e.g. bull thistle, Italian thistle, medusahead, barbed goatgrass, hedgehog dogtail, velvet grass, and wild oat) occur within the Annual Grassland habitat type on the property, but they should be regarded as of lower priority for action, because infestations are fully established with widespread occurrences.

Table 5.6 Priority Areas for Treatment of Invasive Species

INVASIVE PLANT NAME	CAL-IPC RATING	LOCATION	SENSITIVE FEATURES BENEFITTED	SIZE OF AREA IMPACTED	TREATMENT PRIORITY	TARGET STATUS
Barbed goatgrass	High	Off Plum Ranch Road	Serpentine Bunchgrass	Small	High	10% annual decrease areal coverage
Barbed goatgrass	High	Near entrance to the Preserve off Cleland Ranch Road	Serpentine Bunchgrass	Small	High	10% annual decrease areal coverage
Bull thistle	Moderate	Uphill from the vernal pool near the hunting cabin	Valley Needlegrass Grassland	Small	High	100%
English ivy	High	Along Van Buren Creek in the northeast	Montane Riparian	Small	High	100% eradication
Fennel	High	Grassland near the "saddle" of Saddle Mountain		Few plants	Medium	100% eradication
French broom	High	Tower maintenance road in the southeastern portion of the Preserve	Serpentine Chaparral, Sonoma ceanothus & narrow-anthered brodiaea)	Small	High	100% eradication
French broom	High	Along several old roads east of St. Helena Road near the northern Preserve line	Napa false indigo	Small	High	100% eradication
Fuller's teasel	Moderate	Near the road on both sides of Weeks Creek	Fresh Emergent Marsh	Small	Medium High	100% eradication
Greater periwinkle	Moderate	Along Van Buren Creek downstream of English ivy	Montane Riparian	Small	High	100% eradication
Himalayan blackberry	High	Along Van Buren Creek	Montane Riparian	Small	High	100% eradication
Himalayan blackberry	High	Along Ducker Creek	Montane Riparian	Small	High	100% eradication
Himalayan blackberry	High	By the transmission lines north of Weeks Creek	Wetland	Small	High	100% eradication
Himalayan blackberry	High	Near the old hunting cabin in the northern portion of the Preserve		Small	High	100% eradication
Himalayan blackberry	High	Uphill from the vernal pool near the hunting cabin	Valley Needlegrass Grassland	Small	High	100% eradication
Himalayan Blackberry	High	Along Weeks Creek	Montane Riparian	Fairly large	Medium	10% annual decrease areal coverage
Pennyroyal	Moderate	Near the old hunting cabin in the northern portion of the Preserve	Vernal pool (including Lobb's buttercup)	Small	High	100% eradication
Spanish broom	High	Along the transmission line service road south of Cleland Ranch Road		One plant	High	100% eradication

INVASIVE PLANT NAME	CAL-IPC RATING	LOCATION	SENSITIVE FEATURES BENEFITTED	SIZE OF AREA IMPACTED	TREATMENT PRIORITY	TARGET STATUS
Spanish broom	High	Along Weeks Creek	Montane Riparian	Fairly large	Medium	10% annual decrease areal coverage
Velvet grass	Moderate	Uphill from the vernal pool near the hunting cabin	Valley Needlegrass Grassland	Small	High	100%
Yellow starthistle	High	Off Plum Ranch Road	Serpentine Bunchgrass	Small	High	10% annual decrease areal coverage

5.2.2 Protocols for Invasive Species Management

Methods recommended by Cal-IPC or The Nature Conservancy will be used to control priority invasive species found in the designated habitats of the Preserve[10]. A brief summary of recommended control methods is provided below for the priority invasive plants. Whichever control method is planned, implementation should be carefully managed by a qualified ecologist so that impacts to sensitive areas and special status species are kept to a minimum. If using herbicides, weed whackers, or mowers, the applicator or operator should be well trained and adept at identifying and distinguishing between native and non-native species. When using herbicides, the directions on the label should always be followed, and the applicator must know all state and local regulations. The Sonoma County Agricultural Commissioner's office is responsible for enforcing the regulations set by the California Department of Pesticide Regulation and is available for consultation. Section 6.4 presents a brief summary of applicable regulatory requirements for consideration. All project sites should be monitored by Ag + Open Space staff on an annual basis to assess the effectiveness of the control methods and need for retreatment.

Recommended Control Methods

Barbed goatgrass (*Aegilops triuncialis*): A single method usually does not give sustainable control of grassland weeds. A combination of methods is normally necessary to achieve the desired objective. Mowing can be an effective method of reducing seed production. However, the timing is critical. Mowing should occur after flowering, but before goatgrass seeds reach maturity. Late mowing will only spread viable seed. Hand pulling or hoeing small infestations is effective, if the roots are pulled and air-dried. The herbicide imazapic, not yet registered in California, has been effective experimentally on barbed goatgrass, without significantly injuring seedlings of many native grasses and forbs (Stromberg et al. 2007).

Medusahead (*Taeniatherum caput-medusae*): As with barbed goatgrass, a single method usually does not give sustainable control of grassland weeds. A combination of methods is normally necessary to achieve the desired objective. Thatch removal, performed by raking up thatch, can be effective in promoting more desirable species. The herbicide imazapic, not yet registered in California, has been effective experimentally on medusahead, without significantly injuring seedlings of many native grasses and forbs (Stromberg et al. 2007). Prescribed fire can be highly effective in reducing medusahead, with reductions up to 90% possible after a single-entry burn (S. Berleman, personal communication).

Yellow starthistle (*Centaurea solstitialis*): Yellow starthistle control requires a flexible and persistent adaptive weed management program, normally combining several control techniques. In established stands, any successful control strategy will require dramatic reduction or, preferably, elimination of new seed production and multiple years of follow-up treatment to prevent rapid reestablishment.

Properly timed mowing or weed-whacking can be an effective method of yellow starthistle management. Mowing should occur just when the plant has begun to flower and as close to the

[10] Additional information about various control methods and links to other resources can be found at: http://www.cal-ipc.org/ip/management/plant_profiles/index.php http://www.imapinvasives.org/ http://www.cdfa.ca.gov/plant/ipc/weedinfo/winfo_photogal-frameset.htm

soil level as possible. Mowing too early will stimulate more vigorous growth and higher seed production, and mowing too late, when the plant is in full flower will not prevent seed production. Results should be repeatedly monitored, as follow-up mowing may be necessary.

Herbicides are often used to treat yellow starthistle. Spot eradication is the least expensive and most effective method of preventing establishment of yellow starthistle (Bossard et al, 2000). Glyphosate can be effective when sprayed after natives have set seed but before the yellow starthistle produces viable seed, usually in May-June. Clopyralid (Transline®) provides excellent control with applications from December through April. A relatively new herbicide to California, aminopyralid (Milestone®) is reportedly very effective on yellow starthistle, as well as other thistles and broadleaf invasives (J. M. DiTomaso, personal communication, 2008).

Prescribed fire can be an effective means of control, if burns are conducted in the spring. Typically burning must be done for at least two consecutive years in order to deplete the seedbank (UC ANR, 2007).

Fennel (*Foeniculum vulgare*): The plant can be dug up with picks and/or shovels, preferably when the soil is moist so the roots can be more easily dug up intact. Cutting alone will not kill fennel as the deep taproot and bulb store the plant's energy. An alternative method used for controlling fennel is cutting and then spraying the bushy resprouts with glyphosate herbicide, or by spraying the new growth in the spring prior to bolting (The Watershed Council, California Invasive Plant Council. 2004). Repeated treatment during the next few years will likely be necessary.

English ivy (*Hedera helix*): Control of English ivy has not received sufficient attention or research. Research in the past has focused on establishing new cultivars rather than on controlling or eliminating the plant (Bossard et al, 2000). The best method for controlling English ivy may be pulling the plants up from the forest floor by hand and cutting the vines growing up trees at the base. Removing and killing vines that spread up into trees is especially important because the fertile branches grow primarily on upright portions of the vine. If vines are cut at the base of the tree the upper portions will die quickly but may persist on the tree for some time; vines on the ground around the tree should also be removed to prevent regrowth up the tree. Pulled plants should not be left on the ground as they may root and reinfest the area. Care should be taken to minimize disturbance during removal. If the forest floor becomes disrupted, appropriate native species should be planted on the site to inhibit reinfestation by English ivy or another invader (Bossard et al, 2000). Repeated treatment during the following 3-4 years will likely be necessary. A wax layer on the leaves often prevents herbicides, especially hydrophilic compounds such as glyphosate, from permeating the leaves.

Himalayan blackberry (*Rubus armeniacus*): Removing rootstocks by hand digging is a slow but effective way of destroying Himalayan blackberry, which resprouts from roots. The work must be thorough to be effective because every piece of root that breaks off and remains in the soil may produce a new plant. This technique is suitable only for small infestations and around trees and shrubs where other methods are not practical.

Most mechanical control techniques, such as cutting or using a weed wrench, are suitable for Himalayan blackberry. Care should be taken to prevent vegetative reproduction from cuttings. Burning slash piles at appropriate times of the year when wildfires are not a hazard is an effective method of biomass disposal. An advantage of cane removal over use of foliar herbicides is that cane removal does not stimulate sucker formation on lateral roots. However, removal of canes alone is insufficient to control Himalayan blackberry, as root crowns will resprout and produce more canes within weeks after the initial cut. Herbicides should be applied to the stump sprouts and new growth within one to two months after cutting, following the directions on the label. Herbicide should be applied before the above ground biomass becomes too tall to responsibly spray, minimizing herbicide drift onto adjacent native vegetation. Repeated treatment during the next few months will likely be necessary, until the underground rhizomes exhaust their reserve food supply.

An alternative method is to apply herbicide directly to the cambial area around the edges of freshly cut stumps. It must be applied within 5 minutes of cutting to ensure effectiveness. Fall is the recommended time of the year, as the herbicide is more likely to be translocated into the roots. Repeated treatment during the next few years will likely be necessary.

French broom (*Genista monspessulana*): When the ground is sufficiently moist, generally between January and April, plants can be pulled by hand or with a weed wrench. Large broom plants that cannot be pulled can be cut with a brush

cutter, saw or loppers approximately 2 inches above the ground level, roughing up the bark of the remaining stumps, to reduce resprouting. Soil disturbance should be kept to a minimum, as it exposes bare soil which is very conducive to broom seedling establishment. Many public parks and preserves use volunteer labor to perform physical control. An alternative method for initial treatment of French broom is spot spraying with glyphosate herbicide, following the directions on the herbicide label.

Dead standing biomass is a fire hazard and should be cut and removed from the site. If biomass from the removed plants is minimal, it can be placed in piles for wildlife habitat. If substantial, it should be chipped and hauled away. Broom removal after the seed has set is not recommended.

Repeated treatment during the next few years will likely be necessary. The density of the seedlings the following year is likely to be extensive and too small to effectively hand pull. The recommended treatment for these seedlings, generally several inches tall, is weed-whacking, cutting them as close to ground level as possible. An alternative treatment is spraying the seedlings with glyphosate herbicide, following the directions on the label. Another option for treatment of young seedlings several inches tall is to use a propane torch during the early spring months when fire is not a risk. A brief, single pass with a torch will wilt and kill the seedlings. If fire spread is a concern, this treatment can be done during a rain event.

Spanish broom (*Spartium junceum*): Manually operated tools such as brush cutters, machetes, or chain saws can be used to cut Spanish broom. Cutting the aboveground portion before the seeds are set and leaving the root intact is only partially successful; about half the remaining roots will resprout. If biomass from the removed plants is minimal, it can be placed in piles for wildlife habitat. If substantial, it should be chipped and hauled away. Broom removal after the seed has set is not recommended.

Soil disturbance should be kept to a minimum as it provides bare soil, which is very conducive to broom seedling establishment. Broom plants usually require several cuttings before the underground parts exhaust their reserve food supply. If only a single cutting can be made, the best time is when the plants begin to flower. At this stage, the reserve food supply in the roots has been nearly exhausted, and new seeds have not yet been produced. The stump sprouts can then be treated with glyphosate herbicide, following the directions on the label.

An alternative method is to apply herbicide directly to the cambial area around the edges of freshly cut stumps. The herbicide must be applied within 5 minutes of cutting to ensure effectiveness. This method is the most successful in late spring. In early spring, sap may flow to the surface of the cut and rinse the chemical off. At other times of the year, translocation is too poor to adequately distribute the chemical.

The density of the seedlings the following year is likely to be extensive and too small to effectively hand pull. The recommended treatment for these seedlings, generally several inches tall, is weed-whacking, cutting them as close to ground level as possible. An alternative treatment is spraying the seedlings with glyphosate herbicide, following the directions on the label. A single pass with a propane torch when fire is not a risk is another option for treatment of young seedlings.

Greater periwinkle (*Vinca major*): Control methods for greater periwinkle have not been well documented. Persistent manual removal can control the species (DiTomaso et al, 2007). Known as a Pierce disease host, some local wineries have used glyphosate (5%) mixed with a penetrating agent, so that the herbicide can penetrate the waxy cuticle of the leaves.

Fuller's teasel (*Dipsacus sativus*): Small infestations of Fullers teasel can be effectively controlled by manual removal of plant and root crown before flowering. Larger populations have been kept in check by mowing the flowering stems before seed development.

Pennyroyal (*Mentha pulegium*): There is a shortage of scientific literature about pennyroyal control (Bossard et al, 2000). Pennyroyal's brittle stems and propensity for resprouting probably rule out soil tilling or hand pulling as effective control methods. Late spring or early summer mowing, repeated over several years, may weaken plants by depleting photosynthetic reserves. Mature plants can be killed with label-recommended concentrations of glyphosate. However, herbicides pose hazards to non-target species in wetlands, including desirable plants, animals, and microorganisms. Cut-stem applications would be extremely labor-intensive. Flaming dense stands of pennyroyal with a propane torch may be an option.

Harding grass (*Phalaris aquatica*): Close mowing or clipping late in the growing season can greatly reduce the vigor of Harding grass. Mowing should be done when plants are still green but seasonal soil moisture is almost exhausted. Prescribed burns

made after mid-January were injurious to this species. Recovery from fire was slow.

Tarping is another control method that can be used on small patches. The plant is covered with black plastic or landscape fabric for at least 6 months to prevent it from photosynthesizing. Spot treatment with glyphosate applied as a foliar spray to actively growing plants has been effectively used to control Harding grass (Bossard et al, 2000). Ideal timing for this treatment is either at the early heading stage of development (mid- to late spring) or in early fall.

Bull thistle (*Cirsium arvense*): Bull thistle can be controlled by mowing, weed-whacking, or hand-pulling before plants flower; however, the uneven flowering times may make more than one treatment necessary. If cut too early in the season, plants are likely to resprout and flower. Even if some plants resprout, manual control may reduce bull thistle populations by limiting seed production. It should be noted that cut flower heads still develop viable seed (DiTomaso et al, 2007). Bull thistle is relatively easily controlled with herbicides (Bossard et al, 2000). Autumn or spring application is recommended to control rosettes.

Italian thistle (*Carduus pycnocephalus*): An integrated, long-term plan with persistent follow-up and twice-yearly monitoring is needed to eliminate this thistle (Bossard et al, 2000). Mowing or cutting Italian thistle is not reliable because plants often continue to grow and still produce seed. Repeated mowing may control Italian thistle somewhat by reducing the energy reserves (The Watershed Council, California Invasive Plant Council. 2004). Grazing management with sheep or goats demonstrated some promising results in control of Italian thistle populations in Australia (Bossard et al, 2000). The herbicide, Clopyralid (Transline®) at label-recommended concentrations has been effective in controlling Italian thistle in trials in Australia (Bossard et al, 2000). A relatively new herbicide to California, aminopyralid (Milestone®) is reportedly very effective on thistles (J. M. DiTomaso, personal communication, 2008).

Douglas-fir (*Pseudotsuga menziesii*): Douglas-fir can be controlled by cutting saplings down and girdling larger trees. When cuttings saplings down, the cuts should be made as close to the ground as possible to prevent new shoots from developing form the stumps and eventually growing into trees. When girdling, the chainsaw cuts need to be made deep enough to sever the cambium layer. If chainsaw cuts are deep enough, herbicide use is unnecessary. An alternative method is to make shallow cuts with a chainsaw, and apply herbicide to the cambium layer where the cut was made. All Douglas-fir trees should be treated in a given area, as the area is likely to be re-populated by seed production from trees left standing. The great majority of seed falls within 330 feet (100 meters) from the mother tree, but can range as far as 1.2 miles of greater (US Dept. of Agriculture, 1965).

5.3 Sensitive Habitat Enhancement Projects

The high priority projects for sensitive habitat enhancement overlap to a significant degree with those for invasive species and erosion treatment. In sensitive habitats, projects should focus on removal and population reduction of plant species that are encroaching on sensitive habitats and the revegetation of gully sites to stem the erosion and fine sediment delivery to adjacent streams. The potential impacts of removing vegetation prior to or in accordance with (i.e. thinning) sensitive habitat enhancement are related to increased erosion due to ground disturbance. Evaluation of erosion associated with plant removal should employ standard photo point monitoring strategy, particularly after storm events.

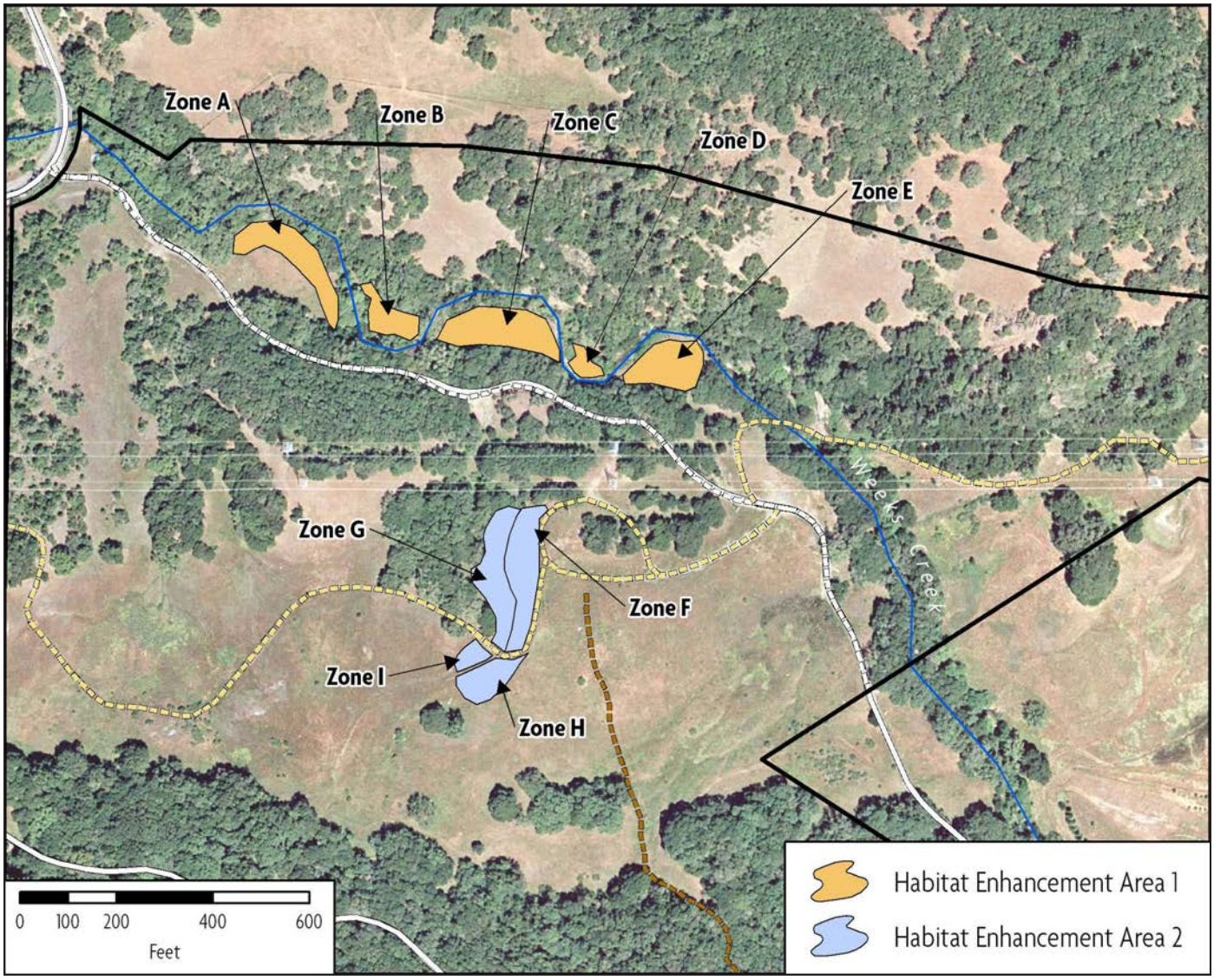

Figure 20. Habitat Enhancement Area Zone

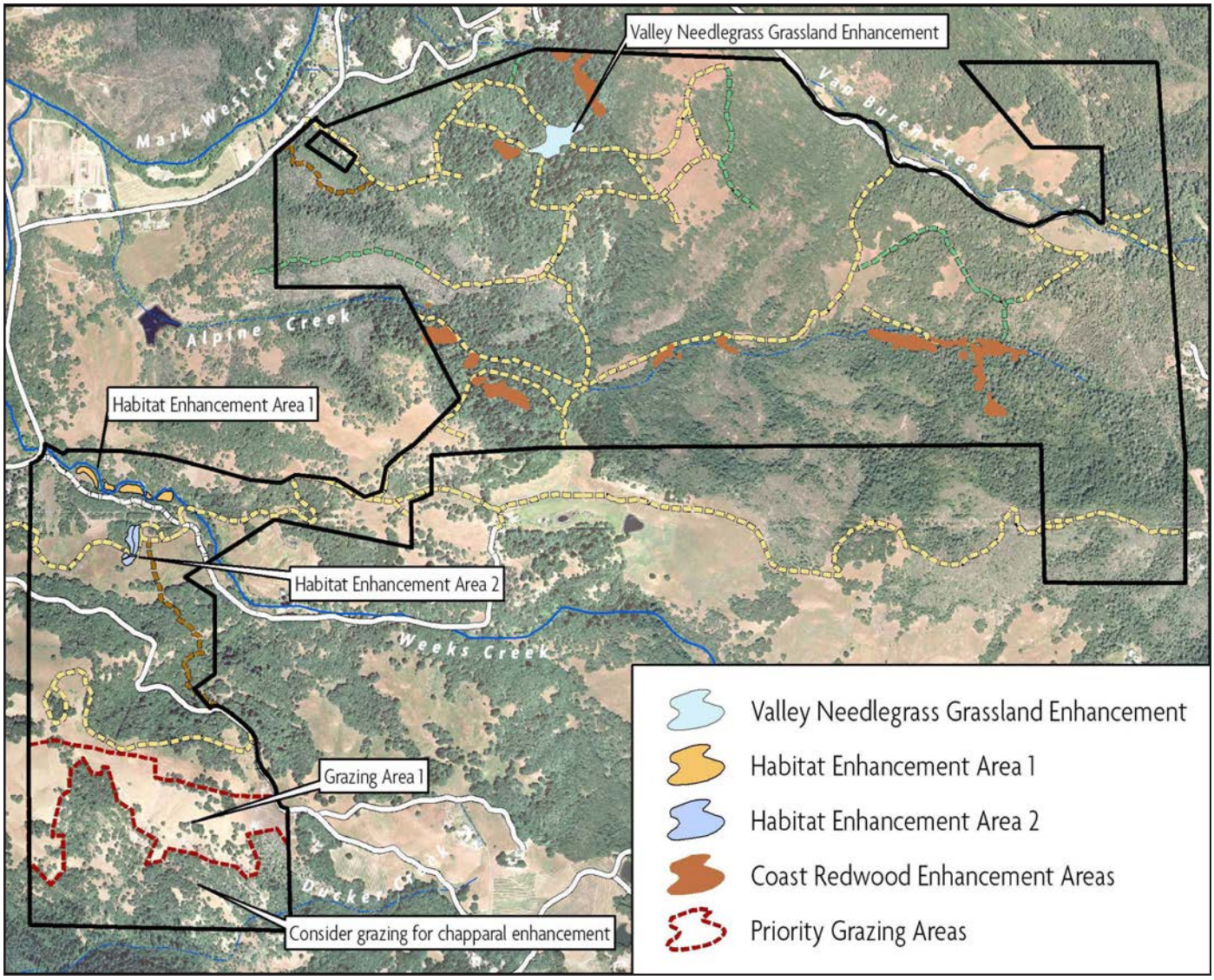

Figure 21. Habitat Enhancement Areas

Projects proposed as described below would benefit both erosion and invasive species control efforts. The location and distribution of these five projects is illustrated in Figure 21.

5.3.1 Habitat Enhancement Area 1: Weeks Creek

The stretch of Weeks Creek recommended for revegetation on the Preserve contains a fairly extensive amount of invasive species, including Spanish broom and Himalayan blackberry. In addition, the channel is incised, with several segments of the bank nearly vertical and highly susceptible to bank erosion and contributing fine sediment into the creek. The upper bank on the south side of Weeks Creek transitions into an open area that was most likely cleared of trees for agricultural use in the past. In Zone A, the intent of the revegetation design is primarily to widen the riparian corridor to approximately 50 feet from top of bank, leaving much of the existing Annual Grassland habitat intact. The open areas that include Zones B-E are much smaller and narrower. It is recommended that these open areas, consisting primarily of non-native grasses and forbs, be revegetated with drought tolerant tree species to expand the riparian corridor, provide habitat, and aid in bank stabilization (Appendix 13, Habitat Restoration Area 1: Details and Notes). These upper riparian zones would transition into existing upland habitat.

5.3.2 Habitat Enhancement Area 2: PG&E Road

A gully has been forming near the PG&E Road for some time in an upland drainage south of Cleland Road and Weeks Creek. Fuller's teasel, an invasive plant, is becoming established in the disturbed areas along the gully. Revegetation and biotechnical erosion control measures are recommended for this site. The intention of the revegetation effort is to provide restored habitat after the invasive Fuller's teasel is controlled, and to aid in bank

stabilization (Appendix 13, Habitat Restoration Area 2: Details and Notes). In an effort to minimize further erosion and curtail the delivery of fine sediment into Weeks Creek, installing brush check dams along the channel bottom is recommended, per methods in Gray and Leister (1989).

5.3.3 Coast Redwood Enhancement Area

The remnant stands of coast redwood along Alpine Creek would benefit from the thinning of Douglas-fir and bay-laurel saplings. The redwoods in this area consist primarily of scattered, sizeable second-growth stands that have stump-sprouted after being logged. There are a considerable amount of small saplings in between the established stands that would benefit from decreased competition for nutrients and light from neighboring Douglas-fir and bay-laurel saplings. Encouraging these coast redwood saplings to thrive should be a management priority.

5.3.4 Valley Needlegrass Grassland Enhancement Area

The Valley Needlegrass Grassland occurs just uphill from the Vernal Pool (Northen 1992). The grassland contains native bunchgrasses such as purple needlegrass (*Nassella pulchra*) and California oatgrass (*Danthonia californica*). It is being threatened by coyote brush encroachment as well as invasive species including, velvetgrass, Himalayan blackberry, and bull thistle.

5.4 Fire and Fuel Management

5.4.1 Mechanical Treatment

Mechanical treatment of vegetation and fuels, such as forest thinning, can serve as a valuable tool to manage, maintain, and enhance natural ecosystems on the Preserve. Many of the natural communities on the Preserve were historically shaped by relatively frequent fire, as well as other natural cycles such as periods of wet and dry conditions. When natural disturbance processes are halted, as through the policy of fire suppression during the past century, natural communities change, often leading to increased tree density in forests and dominance by shade-tolerant, late-successional species. These changes may result in a loss of both species and structural diversity and inhibit the establishment of certain native plant species, potentially reducing ecosystem benefits and habitat values for a wide range of wildlife. The increased vegetation and fuel density will tend to increase the risk of high-severity fire across the landscape, posing a hazard both to ecosystem health and community safety.

With fire having been long absent from the Preserve, Ag + Open Space could use mechanical management techniques to address the resultant habitat changes to improve the structure and composition of forest vegetation and decrease fire danger across the Preserve. Mechanical treatments may include targeted mowing in grasslands or mechanical thinning to improve forest conditions and to meet other management objectives across the Preserve. Ag + Open Space may use mowing to manage invasive species in grasslands. Mechanical forest thinning would involve selectively removing trees from an area to restore stand structure to an ecologically appropriate range, improve species and habitat diversity, reduce ladder fuels, and ensure health and resiliency across the forested landscape. Ag + Open Space may use mowing and mechanical thinning in conjunction with other techniques, such as prescribed fire (see below) or herbicide use for invasive species, to achieve vegetation and habitat management goals.

Habitat enhancement, forest health improvements, and fuel reduction opportunities may exist within the Douglas fir Forest, Mixed Hardwood-Conifer, and Coastal Oak Woodland habitat types on the Preserve. Ag + Open Space will evaluate vegetation management opportunities across approximately 780 acres of forested habitats, including some areas where coyote brush is encroaching into grasslands. Ag + Open Space will evaluate forest conditions to determine if mechanical treatment is necessary to thin overcrowded, even-aged Douglas fir and mixed hardwood conifer habitats, and along select corridors to establish shaded fuel breaks (see Shaded Fuel Breaks, below).

As part of the vegetation management analysis across the Preserve, Ag + Open Space will develop a Forest Management Plan to guide overall forest management and the use of mechanical removal of trees to improve forest health and reduce fire risk. The Forest Management Plan will be developed in cooperation with registered professional foresters, natural resource specialists, ecologists, and/or wildlife biologists to identify and describe the objectives of forest thinning, the specific locations proposed for thinning, the prescription to achieve the desired forest condition, and the target vegetation conditions, including species composition and basal area. Thinned trees may be pile burned or chipped on-site or lopped and scattered to retain material and nutrients within the vegetation community while also reducing fire hazards. The Forest Management Plan will guide fuels treatment following mechanical treatment activities.

Ag + Open Space will secure the appropriate authorizations from CalFire and other regulatory agencies before implementing proposed forest thinning opportunities.

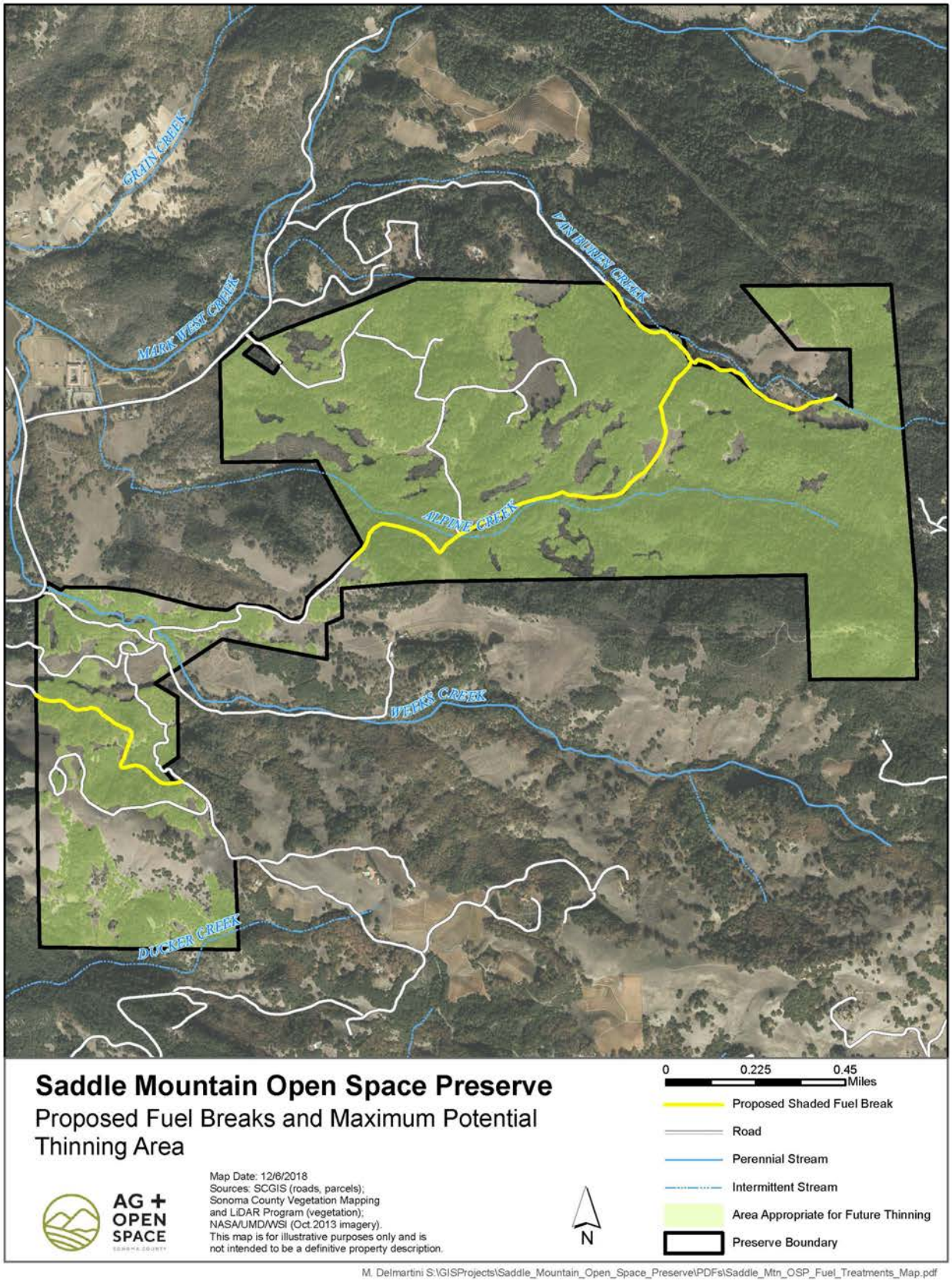

Figure 22. Proposed Fuel Breaks and Maximum Potential Thinning Area

5.4.2 Shaded Fuel Breaks

A shaded fuel break is a forest management strategy used to facilitate emergency access and establish safe locations for fire suppression activities in areas where natural fire regimes have been suppressed and where combustible vegetation has built up. Shaded fuel breaks provide an opportunity to reduce, modify, and manage fuels along designated corridors to enhance wildland fire protection and to inhibit the spread of wildfire in key areas across the landscape. Shaded fuel breaks are designed to meet the following goals:

- Modify fire behavior by reducing ladder fuels and increasing tree spacing
- Treat ground fuels
- Facilitate fire suppression efforts

By reducing and modifying vegetation to reduce fire rate of spread and intensity, shaded fuel breaks can provide a defensible location that can be used by firefighters to help suppress oncoming wildfires. Fuels within a shaded fuel break are reduced in volume through thinning or pruning, and the fuel breaks are generally constructed to protect both wildlands and neighboring communities and to facilitate safe ingress/egress along travel routes. They are commonly located along ridgelines and/or existing roads where firefighters often implement fire control efforts. The ideal location and design of shaded fuel breaks is determined after considering fuels, topography, weather, exposures, and other constructed or planned improvements. Soil stabilization, erosion prevention measures, and long-term maintenance requirements are considered during planning and construction phases.

Ag + Open Space has worked with CalFire to identify opportunities to create shaded fuel breaks across the Preserve along portions of Erland-Cleland Tie Road, the property frontage road along Erland Road, and a portion of Plum Ranch Road as shown on Figure 22. The shaded fuel break will be implemented as a short-term management activity on the Preserve.

The proposed shaded fuel breaks will be 2.43 miles long and approximately 50-200 feet wide, depending on terrain. Ag + Open Space will use mechanical thinning and pruning within an approximately 43-acre area to create the shaded fuel break, following a vegetation management prescription developed in conjunction with CalFire or a Registered Professional Forester. Mechanical treatments will be implemented to thin understory vegetation through the removal of shrubs and saplings; trim mature trees to reduce ladder fuels; and, in areas where forest stands are particularly dense, remove trees to open the canopy and reduce ladder fuels. Woody material will be lopped and scattered or chipped and left in place to form a mulch to protect the soil from compaction and erosion. Some larger woody material may be piled and burned on site.

In the long term, Ag + Open Space will re-treat the shaded fuel break every several years as needed to maintain reduced tree and fuel density.

Ag + Open Space may identify other shaded fuel break locations in the future, as further forest management reviews are conducted.

5.4.3 Prescribed Fire

Prescribed fire can be a valuable management tool both to protect and enhance natural resources and to reduce the risk of catastrophic wildfire. Carefully managed burns can help control invasive species, reduce fuel loads, and promote regeneration of fire-dependent species and maintenance of other desired habitat conditions. On the Preserve, Ag + Open Space plans to use prescribed fire in the short term for management of invasive species in grassland settings. In the long term, Ag + Open Space may also use fire for fuel reduction and management of woody habitats on the Preserve. A site-specific burn plan will be developed for individual prescribed fire projects. Burn planning will be conducted in cooperation with CalFire and local fire agencies, and burn operations will be conducted by CalFire and/or other qualified fire personnel.

Appendix 15 provides an overview of how each of the Preserve's vegetation types would be expected to respond to fire. Estimated typical fire return intervals are also provided. While California fire ecology is a topic of growing interest, scientific understanding of the effects of specific fire regimes on specific vegetation types is limited. Fire impacts are further complicated by ongoing changes to background conditions via climate change and other human-driven trends, such as habitat fragmentation and species invasions. Fire return intervals shown in the table generally reflect best estimates of pre-European settlement ranges. Prior to European settlement, North Bay grasslands and oak woodlands near human habitation were intentionally burned at relatively high frequencies; elsewhere they burned infrequently as a result of rare lightning strikes. Ranges shown are not necessarily recommended return intervals for the Preserve but provide a baseline for understanding the frequency of fire with which each vegetation type has persisted in the past. Target plant species'

modes of post-fire regeneration and timing to reproductive maturity are crucial considerations in planning prescribed fire regimes. Fire that is too frequent can preclude native species recovery and encourage invasive species. Wildlife needs, changing climate, understory fuel loads, adjacent vegetation types, soil and water protection needs, and risk to nearby human infrastructure will all influence prescribed burn location and seasonality and desirable fire return intervals for the Preserve in the future.

In general, fire has potential to provide the following benefits on the Preserve:

- Forest settings
    - reduce density of juvenile Douglas firs to encourage development of larger individual trees and/or facilitate other species (redwood, oak) to maintain on-site habitat diversity
    - reduce density of Douglas firs or other species contributing to high fuel loads that may pose a threat to human infrastructure or safety
    - reduce woody surface fuels and ladder fuels to reduce fire intensity
    - support natural regeneration of fire-dependent Sargent cypress forest species
- Woodland settings
    - reduce density of juvenile Douglas firs to facilitate oaks and maintain on-site habitat diversity
    - reduce high fuel loads that may pose a threat to human infrastructure or safety
- Shrubland settings
    - support natural regeneration of chaparral species
    - temporarily reduce high fuel loads that may pose a threat to human infrastructure or safety
- Herbaceous settings
    - reduce cover of invasive species and other non-native annuals
    - reduce high fuel loads that may pose a threat to human infrastructure or safety
    - maintain open character of meadows and reduce shrub and tree encroachment and succession

Coordination with Local Agencies

Ag + Open Space anticipates partnering with CalFire and local non-profit programs to conduct initial, small-scale burns on the Preserve. Ag + Open Space will coordinate with CalFire to explore the possibility of participating in CalFire's Vegetation Management Program (VMP)[11] or its potential future Vegetation Treatment Program (VTP). Ag + Open Space may also explore partnerships with the Prescribed Fire Training Exchange (TREX), which is a nationwide cooperative burning and collaborative fire training program designed to develop, and assist others to develop, burn plans and fire management plans. Participation in these programs will provide guidance for short- and long-term management of habitat and vegetation on the Preserve, including both mechanical and prescribed fire treatments, while also providing for further specific planning and resource review for each individual prescribed burn on the Preserve to evaluate potential site-specific impacts and to identify means to reduce or avoid them. Ag + Open Space will not develop individual burn plans without a commitment from CalFire, TREX, or other professional organization to implement prescribed burns on the Preserve.

Burn Plans and Smoke Plans

Once prescribed burn units are identified, the burn objectives are set, and Ag + Open Space is prepared to implement an individual prescribed fire, a burn plan will be developed for each specific prescribed fire project on the Preserve in coordination with CalFire. The burn plan will be developed by a qualified prescribed fire specialist and will include:

- a description of the burn area
- an analysis of the site-specific environmental setting and potentially affected resources
- a burn prescription designed to meet project objectives and protect resources
- fire behavior predictions
- contingency and medical plans

CalFire may require a site-specific cultural resources survey and botanical survey prior to approval of a prescribed burn plan. If a burn were to take place near sensitive resources, the burn plan will be subject to appropriate resource review, such as consultation with relevant agencies. Conditions and environmental protection measures may be included in the burn plan as a result of this environmental review process.

[11] CalFire Vegetation Management Program (VMP) is a cost-sharing program that allows public and private landowners to participate in wildland fuel reduction projects. The program focuses on the use of prescribed fire and some mechanical means, for addressing wildland fire fuel hazards and other resource management issues on State Responsibility Area (SRA) lands.

Typically, prescribed burns will be conducted in spring and fall, and potentially during winter if fuel moistures are low enough to carry fire. Required pre-burn actions may include construction of firelines, removal of ladder fuels, and/or thinning of brush as appropriate to reduce fire intensity and the risk of fire spreading outside the burn unit. When needed, measures will be taken to prevent erosion following burns, including rehabilitating firelines.

In addition to the burn plan, a smoke management plan will be developed for each prescribed fire project in accordance with Bay Area Air Quality Management District regulations and current smoke management guidelines for prescribed fire. The smoke management plan will include:

- emissions estimates
- wind prescriptions
- identification of smoke-sensitive areas
- any necessary mitigations or burn plan changes to reduce impacts on smoke-sensitive areas
- contingency plans
- public notification and complaint procedures

Finally, a "Go/No Go Checklist" will be developed for each prescribed fire project to confirm that all the conditions necessary for implementing a burn are met.

Prescribed Fire Public Outreach

After working with CalFire and others to identify conceptual burn units, ideal burn conditions, and the timeframes to achieve prescribed fire objectives, Ag + Open Space will engage with neighboring community members and other stakeholders to share Ag + Open Space's plans and objectives, solicit input, answer questions, and address concerns about proposed burning and smoke management. Ag + Open Space will initiate public outreach months in advance of any proposed burn and will continue coordinating with the public throughout the entire process of burn planning, implementation, and evaluation. Key target audiences will include property owners adjacent to the Preserve, public health officials, local elected officials, and members of the public. Ag + Open Space will provide the public with information regarding the goals and objectives of the proposed prescribed burn, predicted smoke emissions, and measures to minimize impacts and protect public health. Ag + Open Space will consider public comments in burn planning and smoke management decisions.

Prescribed Burning in the Short Term: Grassland Management

In the short term, prescribed fire will be used on a small scale within the Preserve's annual grassland habitats to manage invasive species and encourage native perennial grasses. Prescribed fire will specifically be used to treat populations of medusahead and barbed goatgrass, which can otherwise be difficult to control through traditional means once well established within annual grassland habitats. Burns in grasslands would ideally be conducted in late May and early June, when weather conditions are suitable and after the seeds for native grasses have dropped, but while the seeds for barbed goatgrass and medusahead are ripe but not yet dispersed (Berlemen et al. 2016). While medusahead can sometimes be substantially controlled with one burn, significant barbed goatgrass control typically requires two burns in consecutive years (DiTomaso et al. 2001). However, follow-up control of barbed goatgrass within the Preserve's annual grasslands may be accomplished with hoeing or hand pulling after the population is substantially reduced by initial burning.

Figure 23, Areas for Future Analysis and Planning of Prescribed Fire, below, shows the grassland and forest areas where prescribed burns could potentially be conducted in the short and long-term. The grassland areas encompass 117 acres of the total 131 acres of grassland on the Preserve. They represent the maximum spatial extent of grasslands that could be included in future planned burn units, not actual burn units or prescribed fire projects. Not all of these grasslands may be appropriate for prescribed fire use. The areas mapped in Figure 23 exclude some grassland areas due to characteristics such as the presence of listed vegetation species, difficulty of access, or very small vegetation patch size that would not be economical or efficient to burn, as well as extensive chaparral areas where Ag + Open Space does not plan to introduce fire. Invasive treatment needs, safety, terrain, fuel levels, neighboring properties, smoke dispersal, and other resource considerations will be considered when selecting individual burn areas through further analysis, planning, and consultation with CalFire and community residents. Individual burn units will be small scale, most likely not to exceed twenty acres per unit, although more than one burn unit may be burned in a single day if it is efficient and appropriate to do so. Each of these individual prescribed fire projects will be subject to the process described above, with development of specific burn and smoke management plans and associated review.

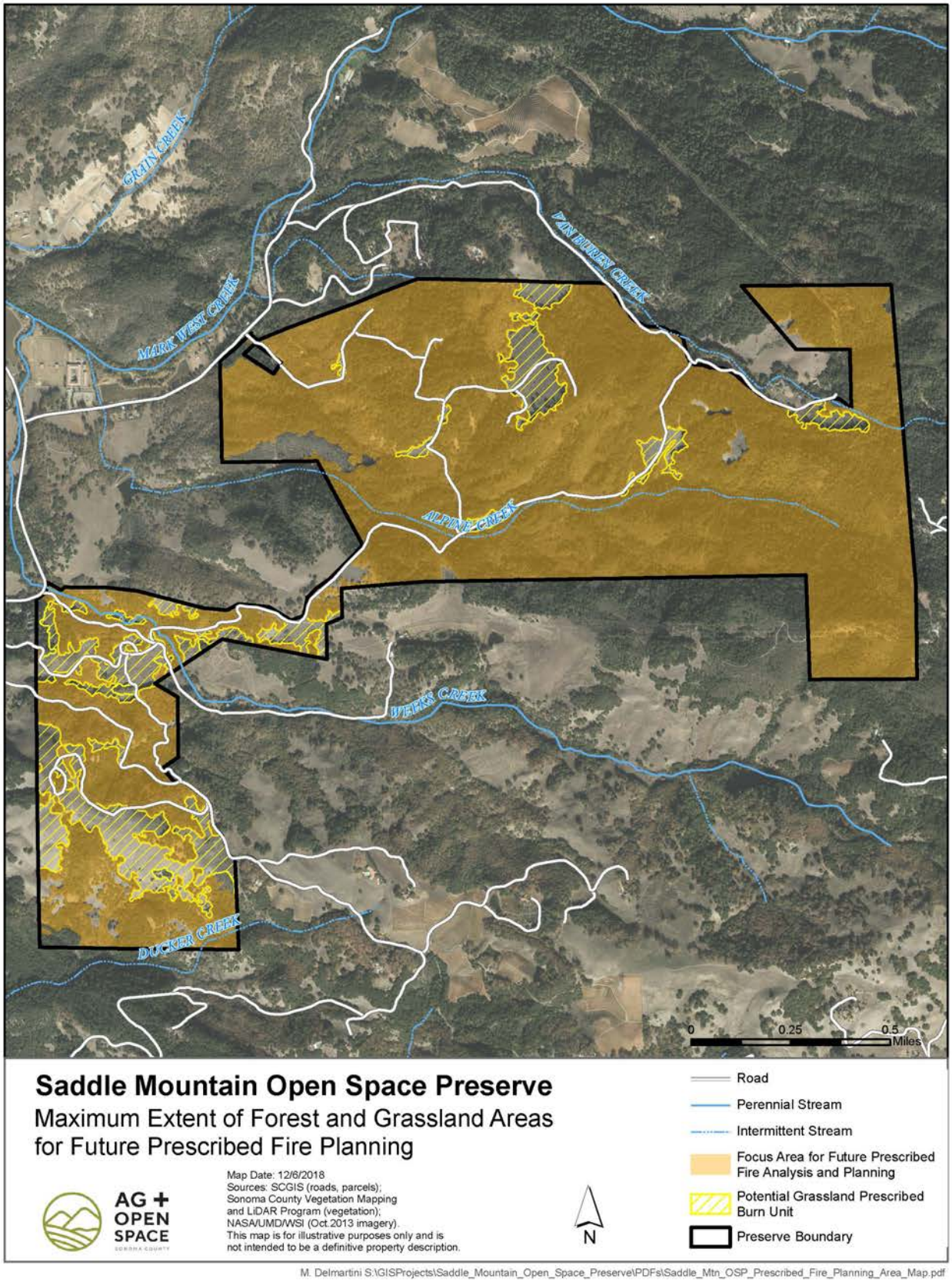

Figure 23. Areas for Future Analysis and Planning of Prescribed Fire.

Control lines will be established around individual burn units prior to conducting prescribed fire activities and natural firebreaks will be used whenever possible to control the spread of fire. Constructed control lines will be rehabilitated after the burn to restore original soil conditions including surface contours and soil cover. Erosion-control measures will be put in place where needed, and disturbed areas will be re-seeded with site-appropriate native species. Following rehabilitation, control lines should be monitored to ensure successful restoration.

Prescribed Burning in the Long Term: Grassland, Forest and Woodland Management

Ag + Open Space will explore the use of prescribed burns to address long-term habitat management needs by developing a formal Forest Management Plan (FMP); although if money becomes available, development of a Forest Management Plan may be completed in the short-term. This long-term plan could include continued burning in grasslands as described above, as well as burns in woody habitats to reduce ladder fuels, control encroachment of undesired species, and promote other desired habitat conditions. Prescribed burning in woody habitats will require additional steps, which will be addressed in the FMP. These may include mechanical fuel load reduction prior to burns and greater coordination with neighboring landowners and the public to address smoke concerns, as burning in woody habitats tends to generate more smoke than in grassland.

5.5 Regulatory Framework

California Government Code 65562 directs local governments to prepare and carry out open space plans. The Open Space Element of the 1989 Sonoma County General Plan called for the formation of an Open Space District to acquire and administer open space lands. In 1990, the passage of Measure A led to the formation of the Sonoma County Agricultural Preservation and Open Space District, while the passage of Measure C provided funding for the district through sales tax. This funding was renewed in 2006 through the passage of Measure F. The expenditure plan approved as part of this funding renewal gives Ag + Open Space the authority to spend funds on management of open space land holdings. Many of the management activities that may be undertaken by Ag + Open Space such as road and trail building and maintenance, invasive plant removal and streambank erosion control are subject to regulatory oversight. Below is an overview of permit requirements for land management activities related to erosion remediation, vegetation management, sensitive resources, and water quality.

Erosion Remediation

In order to implement the road-related erosion site treatments recommended for the property, the following permits might be required:

- US Army Corps of Engineers 404 Permit (enroll in Nationwide Permit 14 for Linear Transportation Projects) may trigger ESA Section 7 consultation
- Department of Fish and Wildlife 1600 Permit may trigger California Environmental Quality Act (CEQA) Environmental Review Requirements
- Regional Water Quality Control Board 401 Certification
- Sonoma County PRMD Grading Permit (request exemption for resource conservation, restoration, and enhancement projects)
- Sonoma County PRMD Roiling Permit

Exotic/ Invasive Plant Species Control

Recommended measures for regulatory compliance are described below for four common exotic/ invasive species control methods.

- ***Herbicide Application****:* The California Department of Pesticide Regulation (DPR) is responsible for the protection of human health and the environment through the regulation of pesticide sales and use. For the use of restricted pesticides, and for the use of pesticides by professional applicators, the applicator must be licensed by DPR. Additionally, for the use of herbicides in aquatic areas, the State Water Resources Control Board requires coverage under a National Pollutant Discharge Elimination System (NPDES) permit. Enrollment in the Statewide General Permit for weed control is recommended prior to application of herbicides in aquatic environments.
- ***Invasive Plant Root Removal****:* If the removal of plant roots will result in disturbance of soil in a riparian area where sediment could be delivered to a stream channel, these activities are subject to the following permit requirements: (1) US Army Corps of Engineers 404 Permit (use Nationwide Permit 27); (2) Department of Fish and Wildlife 1600 Permit (e.g. small habitat restoration project exemption); and (3) Regional Water Quality Control Board 401 Certification (waiver if project has been declared exempt from CEQA).
- ***Livestock Grazing****:* Sonoma County does not require permits or design review for wire fences six feet or less in height. However, the statewide Food and Agricultural Code sets "lawful" livestock fence requirements.

California law requires that livestock be kept from public roads by the person who owns or controls them: "16902. Permitting livestock on highway. A person that owns or controls the possession of any livestock shall not willfully or negligently permit any of the livestock to stray upon, or remain unaccompanied by a person in charge or control of the livestock upon, a public highway, if both sides of the highway are adjoined by property which is separated from the highway by a fence, wall, hedge, sidewalk, curb, lawn, or building." Development of new groundwater wells (to supplement grazing livestock) is subject to permitting requirements of Sonoma County PRMD. Sonoma County PRMD does not have permitting requirements for spring development. Development of springs is not subject to water rights permitting through DWR if the spring has no natural outlet. If the spring contributes to a flowing stream, either by surface of subterranean means, then riparian rights are necessary for spring development.

- ***Prescribed Fire***: The Preserve is located within the Bay Area Air Quality Management District (BAAQMD). Open burning is generally prohibited within BAAQMD district, with some exceptions. Section 5-110.3 of the BAAQMD regulations exempts the following practice from regulation "The use of flame cultivation when the burning is performed with LPG or natural gas-fired burners designed and used to kill seedling grass and weeds and the growth is such that the combustion will not continue without the burner." Section 5-401.15 states that the following practice is allowable when the conditions of 5-111 et seq. are met "Wildland Vegetation Management: Prescribed burning by a state or federal agency, or through a cooperative agreement or contract involving the state or federal agency, conducted on land predominately covered with chaparral, trees, grass, coastal scrub, or standing brush. Any person seeking to set fires under this provision shall comply with the requirements of Section 5-408 and receive written approval of the smoke management plan by the APCO prior to any burn." Section 5-111 et seq. sets forth requirements for type and quantity of materials, time of day, wind velocity, material drying time, and ignition material and methods. BAAQMD and the local office of the California Department of Forestry and Fire Protection should be contacted prior to burning to verify that it is a permissible burn day. Consultation with Sonoma County PRMD should be undertaken to ensure that the updated fire management plan is consistent with zoning requirements. Fuel-load reduction activities may require permits.

Sensitive Resources Management

Saddle Mountain Open Space Preserve is documented to host several protected species and sensitive plant communities/habitats (Table 2.3, Rare Plant Species Documented in 2009). All management activities should be designed and implemented to minimize potential adverse impacts to these sensitive resources. The California Environmental Quality Act requires that impacts to biological communities be considered when assessing the environmental impacts of a project. For any project that is subject to CEQA, a survey of the project area should be performed to identify any sensitive plant resources present. If sensitive plants are found to be present in the project area, spatial and temporal mitigations must be incorporated in order to avoid, reduce, or compensate for negative impacts on these plants. The US Environmental Protection Agency (EPA) does not require special permits (e.g. Incidental Take Permit) for plant species. However, potential direct impacts to certain animal species (e.g. spotted owl, salmonids) can prompt regulatory requirements in egregious cases.

Water Quality Improvement

The Clean Water Act, under section 303 (d), gives the EPA and the State Water Resources Control Board the authority to establish Total Maximum Daily Loads (TMDLs). The process starts with listing of water bodies whose beneficial uses (such as cold water fish habitat, drinking water and recreation) are impaired by the presence of excessive pollutants. TMDLs are developed to address these water quality impairments by identifying the maximum amount of a pollutant that can be discharged into the water body without causing impairment (loading capacity). This maximum amount of pollutant is then budgeted out to different sources within the watershed (load allocation). These components are included in a technical support document, generally written by Regional Water Board staff. This document is then forwarded to the EPA who develops the official TMDL. Once the TMDL has been adopted, Regional Water Board staff is charged with the task of developing a strategy for achieving the goals of the TMDL. Implementation strategies generally include regulatory actions that can be taken by the Regional Water Board and/or other regulatory agencies, voluntary actions on the part of dischargers, and a monitoring plan to assess the success to TMDL implementation. The Regional Water Board and State Water Board adopt the implementation strategy, once completed.

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