Interim Adaptive Management and Monitoring Plan for the Los Osos Habitat Conservation Plan Preserve System

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1 Introduction

This Interim Adaptive Management and Monitoring Plan (IAMMP) will guide work by the County of San Luis Obispo (County) to restore habitat within the Morro Dunes Ecological Reserve (MDER) during the initial five-year period of implementation of the Los Osos Habitat Conservation Plan (LOHCP; McGraw 2020). During that period, the MDER will be enrolled into the LOHCP Preserve System—a network of protected habitat that will be restored, managed, and monitored to promote the covered species. Habitat in the MDER that has been degraded by invasive plants and incompatible recreation will be restored to promote populations of LOHCP covered species. Once specific performance criteria for the restoration have been achieved, the restoration will generate mitigation credits that will offset the impacts of development, public infrastructure, and other covered activities in Los Osos on the covered species.

This section of the IAMMP provides an overview of the LOHCP and its conservation program, the LOHCP Preserve System, and the adaptive management and monitoring plan that will be developed to manage it; it also describes the role of this IAMMP and outlines its contents. Additional information about the LOHCP can be found in the sections of that document that are referenced below.

1.1 Los Osos Habitat Conservation Plan

The County of San Luis Obispo prepared a habitat conservation plan (HCP) for the 3,644-acre area centered on the unincorporated community of Los Osos, in central coastal California (Figure 1; LOHCP Section 1.3) McGraw 2020). The Los Osos HCP covers anticipated incidental take[1]/impacts to four threatened or endangered species (Box 1) that is anticipated to result from private development, public and private utility and infrastructure projects, and community wildfire protection (LOHCP Section 2). The incidental take permit issued based on the LOHCP will cover take within a 3,209-acre permit area, which includes all land within the LOHCP Area except for State Parks lands other than those within the Community Wildfire Protection Plan fuel break area (LOHCP Section 1.3). These and other covered activities implemented during plan's 25-year permit term, which will begin following issuance of the incidental take permit, are anticipated to impact up to 621 acres of habitat for the covered species (LOHCP Section 2).

Box 1: LOHCP Covered Species

Morro shoulderband snail (FE)
(*Helminthoglypta walkeriana*)

Morro Bay kangaroo rat (FE, CE, FP)
(*Dipodomys heermanni morroensis*)

Morro manzanita (FT)
(*Arctostaphylos morroensis*)

Indian Knob mountainbalm (FE, CE)
(*Eriodictyon altissimum*)

FE: Federally Endangered
FT: Federally Threatened
CE: California Endangered
FP: California Fully Protected Species

[1] "Take" under the federal ESA does not apply to listed plant species. For purposes of the LOHCP and the federal permit, "take" when applied to the covered plant species refers to impacts to the species. The Plan features conservation measures to protect these species, which are included as covered species, so that the USFWS will extend "no surprises" assurances for them.

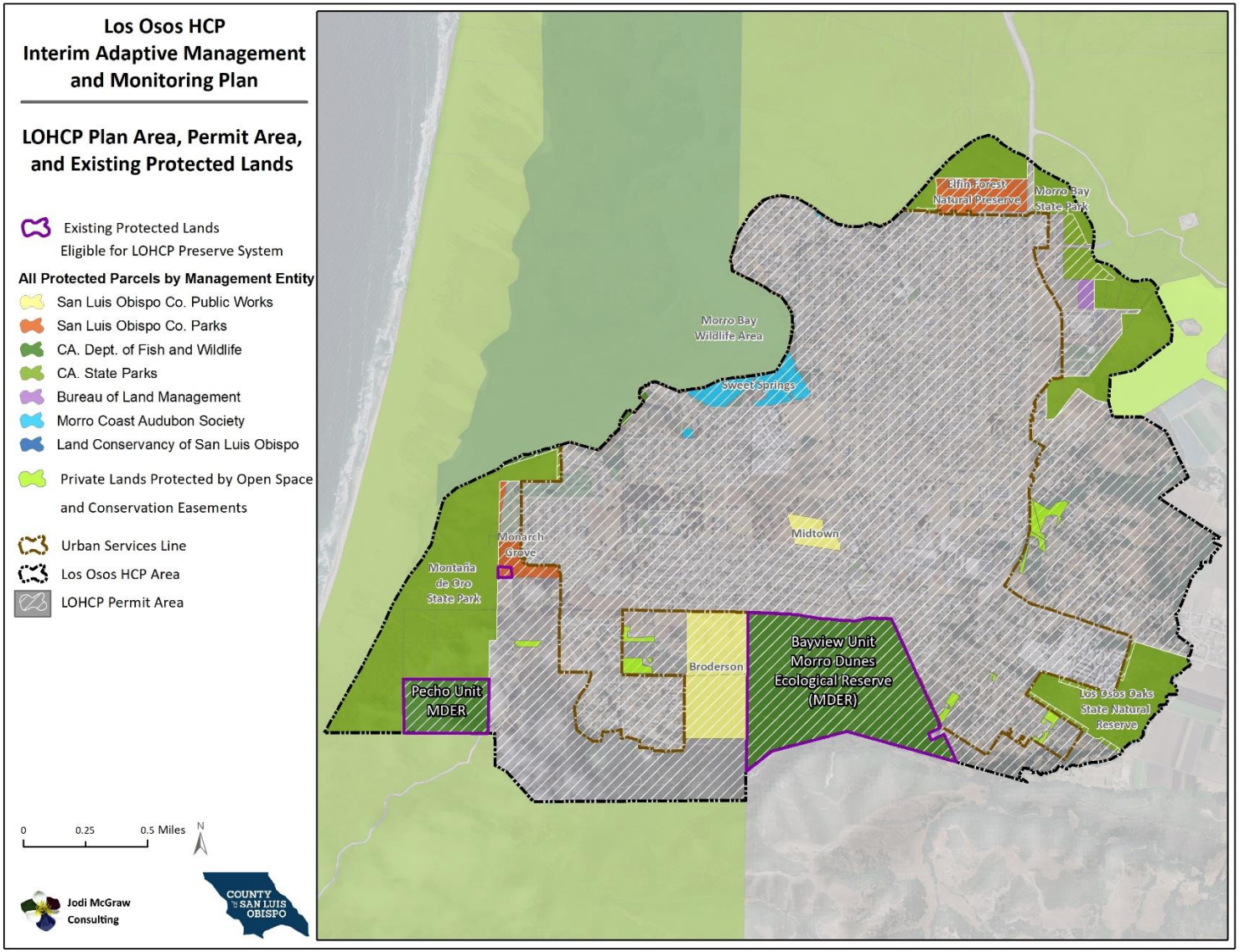


Figure 1: Los Osos Habitat Conservation Plan Area showing Existing Protected Lands including those Eligible for Inclusion in the LOHCP Preserve System

1.2 LOHCP Conservation Program

To mitigate the effects of the covered activities on the covered species, the County will implement the LOHCP conservation program—a suite of actions to avoid, minimize, and mitigate the impacts of the covered activities to a level that is commensurate with the impacts of the taking and will contribute to species recovery by addressing threats to survival to ensure long-term persistence (Box 2; LOHCP Section 5). The County intends to delegate specific responsibilities to implement aspects of the plan through contracts for services with an Implementing Entity—an existing or newly created non-profit conservation organization (e.g., land trust or conservancy) approved by the USFWS and CDFW (wildlife agencies), that will provide expertise in land conservation and management for endangered species, among other skills necessary to implement the delegated Plan tasks (LOHCP Section 6.1).

Box 2: LOHCP Conservation Program Elements

Biological Goals and Objectives which identify the desired future condition for the covered species, communities, and ecosystem in which they occur

Avoidance and minimization measures that will be implemented to reduce the negative effects of the covered activities on the covered species

Habitat Protection to safeguard remaining habitat and expand and connect existing protected lands

Habitat Restoration to recreate suitable habitat for the covered species where it has been substantially degraded by anthropogenic factors

Habitat Management ongoing efforts to maintain or enhance habitat conditions and promote population viability by addressing factors that degrade habitat

Monitoring to track the status and trends of the covered species populations and their respective habitats

Adaptive Management framework to adjust the conservation program elements over time to achieve the goals and objectives

1.3 LOHCP Preserve System

The LOHCP conservation program includes establishment and management of the LOHCP Preserve System—a network of protected habitat that will be restored, managed, and monitored to promote the covered species. The LOHCP Preserve System will include land acquired during implementation of the LOHCP , as well as selected existing parks and ecological reserves that will be enrolled in the LOHCP Preserve System to ensure that the habitat of greatest long-term conservation value for the covered species is benefited by the Preserve System activities (LOHCP Section 5.3).

The LOHCP identified two properties as eligible for inclusion in the LOHCP Preserve System (LOHCP Section 5.3.3.1; Figure 1):

1. The 278.7-acre Morro Dunes Ecological Reserve (MDER), which is managed by the California Department of Fish and Wildlife; and
2. An approximately 2.4-acre portion of the Monarch Grove Natural Area, which is managed by the County of San Luis Obispo Parks and Recreation Department.

The LOHCP anticipates enrolling the MDER into the Preserve System at the outset of LOHCP implementation. Conducting restoration and management activities in that preserve is designed to 'jump start' the LOHCP conservation strategy by providing mitigation credits that can be used to offset the impacts of covered activities in the first three years of LOHCP implementation (LOHCP Section 6.2.3.1). Monarch Grove Natural Area can be enrolled into the LOHCP Preserve System at a later date, as part of the phased approach to assembling the LOHCP Preserve System as covered activities are conducted so that mitigation balances the project impacts (LOHCP Section 5.3.3). The Monarch Grove Natural Area as well as new lands acquired through the LOHCP will be managed based on the Adaptive Management and Monitoring Plan for the LOHCP Preserve System, which will also guide management

and monitoring of the MDER following the initial phase of restoration outlined in this IAMMP.

1.4 Adaptive Management and Monitoring Plan

The LOHCP Preserve System will be managed, restored, and monitored as outlined in the LOHCP Preserve System Adaptive Management and Monitoring Plan (AMMP). The AMMP will be developed during the first three years of implementation of the LOHCP based on initial surveys that will be used to establish baseline information about habitat conditions and covered species populations and to inform the development of restoration and management strategies (LOHCP Section 5.3.3.2).

The AMMP will be developed based on the framework and information provided in the LOHCP, including (LOHCP Section 5.3.3.2): 1) biological goals and objectives; 2) information about the covered species ecology and conservation needs; 3) scientific information about the three main management issues for the covered species—exotic plants, incompatible recreation, and fire—and approaches to their management; and 4) monitoring protocols for the covered species, communities, and habitat conditions (e.g. exotic plants). The AMMP will establish success criteria that habitat protection, restoration, and management actions must achieve to be credited as mitigation for the take of/impacts from the covered activities on the covered species through this Plan. The AMMP will be subject to approval by the United States Fish and Wildlife Service, which will issue the incidental take permit, and the California Department of Fish and Wildlife, which protects listed species and also manages the MDER.

1.5 Interim Adaptive Management and Monitoring Plan

This Interim Adaptive Management and Monitoring Plan (IAMMP) was developed to:

1. guide initial habitat management, restoration, and monitoring within the MDER that will be conducted as the compensatory mitigation for the LOHCP during the first five years, until the AMMP is approved and can begin to be implemented; and
2. serve as the initial 'mitigation plan' in the Memorandum of Understanding (MOU) between the County of San Luis Obispo (County) and CDFW, which will enable the County to conduct restoration, management, and monitoring within the MDER and enroll the MDER into the LOHCP Preserve System.

The IAMMP was developed based on the following:

1. existing information about the MDER, including documents and spatial data, to characterize the abiotic and biotic conditions as well as anthropogenic factors influencing them;
2. information about CDFW's existing management activities and commitments (Section 2.8), which were used to identify the additional restoration and management needs;
3. reconnaissance-level site visits to assess habitat conditions and identify high-priority restoration and management projects; and
4. coordination with the USFWS and CDFW to ensure the document meets the planning objectives outlined above, including that the IAMMP is consistent with CDFW's policies and plans for management of the MDER.

The restoration projects outlined in this IAMMP were developed based on the following criteria:

1. The project is known or very likely to promote one or more of the biological goals for the LOHCP (LOHCP Section 5.1) including by increasing the distribution and abundance of the covered species populations by restoring degraded habitat or addressing anthropogenic factors that degrade habitat; and
2. The project will promote the effectiveness of future management under the AMMP by preventing further degradation of habitat which would occur if the project is not implemented.

This priority restoration activities as well as associated management and monitoring outlined in this document will be implemented by the County in the MDER during the first five years of LOHCP implementation, while the AMMP is being developed (LOHCP Section 5.3.3.2). The County will implement these actions directly or through a contract with the Implementing Entity, such as a land trust or land conservancy, that specializes in the management and restoration of sensitive habitat supporting endangered species (LOHCP Section 6.1).

1.6 IAMMP Contents

This plan provides the following information to develop and implement high-priority habitat restoration, and associated management and monitoring:

1. **Existing Conditions (Section 2):** This section provides an overview of the existing conditions of the MDER including the physical environment, land use, plant communities, sensitive species, covered species, and stressors, as well as the CDFW's existing management and commitments. It provides background information for the restoration, management, and monitoring work that will be conducted as part of this plan.
2. **Restoration (Section 3):** This section describes general restoration approaches used in the IAMMP, the initial restoration and management actions proposed for the Preserve, and the species protection measures that will be implemented to reduce the short-term negative impacts of the restoration projects on the covered species in order to maximize their long-term benefits and conservation.
3. **Monitoring and Adaptive Management (Section 4):** This section describes how the restoration treatment areas will be monitored to inform the need for follow-up treatments and remedial actions as part of the adaptive management framework. It also describes how restoration performance will be evaluated to determine whether it is successful and if so, how the mitigation area and credits will be calculated as compensatory mitigation for the LOHCP (LOHCP Section 5.7.2).
4. **Fuel Reduction (Section 5).** This section describes how a fuel break can be created within the MDER using methods that are consistent with the LOHCP and the Community Wildfire Protection Plan (SLOCCFSC 2009), which is a covered activity in the LOHCP (LOHCP Section 2.2.7). This description of the fuel break prescription and associated species protection measures is provided in this IAMMP to help ensure that work to reduce the risk of fire in the MDER is compatible with broader management of the property, and that it will protect the covered species and restore their habitat as it is within the LOHCP Preserve System. Fuel reduction is not a restoration activity in this IAMMP and is not being used as mitigation.

5. **Implementation (Section 6):** This section outlines the steps and anticipated timeframe for implementation of the IAMMP consistent with the LOHCP and MOU.

Additional information is available in the Los Osos Habitat Conservation Plan (McGraw 2020), for which specific section references are provided in this IAMMP.

2 Existing Conditions

This section describes aspects of the Morro Dunes Ecological Reserve that are relevant to initial, high-priority habitat restoration and management. Specifically, it provides overview of the physical environment and biology of the reserve, including current known and likely stresses for the covered species that can be addressed through active restoration and management. It also describes the existing management and commitments of CDFW (Section 2.8), which provides the basis for defining the enhanced management and restoration that can be credited as compensatory mitigation for the LOHCP. A more detailed analysis of the MDER as well as future LOHCP Preserves will provided in the AMMP, which will be developed following a comprehensive inventory of the MDER and other LOHCP Preserves, and which will provide more detailed information about the sensitive species and communities in the Preserve (Section 1.4).

2.1 Overview

The CDFW owns and manages the 278.7-acre MDER[2], which is located in the south-central portion of the LOHCP Area (Figure 1). The eastern 231-acre Bayview Unit of the MDER supports a mosaic of coastal sage scrub, central maritime chaparral, and coast live oak woodland. The Pecho Unit is a disjunct 48-acre parcel located in the southwest portion of the LOHCP Area, which supports coastal sage scrub and central maritime chaparral.

The MDER contains habitat that is of exceptional conservation value for the LOHCP covered species. The Bayview Unit of the Morro Dunes Ecological Reserve features populations of, or habitat for, all four covered species. It is deemed to have the greatest probability of supporting the critically endangered Morro Bay kangaroo rat (USFWS 1999). The Bayview Unit also supports the only known remaining populations of Indian Knob mountainbalm in the LOHCP Area (Kofron et al. 2019). Persistence of the dense stands of Morro manzanita that occur on the southern portion of the unit is deemed very important for conservation and recovery of the endangered shrub (Tyler and Odion 1996), which also inhabits the southeastern portion of the Pecho Unit. Both units of the reserve feature extensive coastal sage scrub habitat that is designated critical habitat for Morro shoulderband snail (USFWS 2001).

Ecological reserves are established under California law to protect rare, threatened, or endangered native plants, wildlife, aquatic organisms and specialized terrestrial or aquatic habitat types (Fish and Game Code 1580). They are managed to conserve biodiversity, while providing opportunities for education, research, and compatible recreation, as outlined in the California Code of Regulations, Title 14, sections 550 and 630. A management plan was prepared for the MDER in 1982, when it featured only the 48-acre Pecho Unit located west of Pecho Valley Road (CDFW 1982).

The existing management of the MDER is primarily limited to reconnaissance-level site visits by CDFW Environmental Scientists and law enforcement actions conducted by CDFW Wardens in response to illegal activities detected by CDFW staff or reported by the public (Section 2.8). The LOHCP identified enhanced management and restoration of habitat for the covered species in the MDER as an important

[2] Acreages presented in this plan are based on GIS analyses and differ slightly from those used by CDFW, which states that the Bayview Unit is 236 acres and the Pecho Unit is 48 acres (CDFW 2020b). GIS acres, rather than acreages reported on title reports or other sources, are used to facilitate spatial analyses and to track actions.

element of the conservation program that was developed to achieve the LOHCP Biological Goals and Objectives (LOHCP Section 5.3.1). During the initial phase of management described in this plan, efforts to control exotic plants and restore areas that have been denuded by recreation can restore the coastal sage scrub and maritime chaparral habitat in the MDER and in doing so, promote populations of the covered species all of which have current or historic occurrences within the site. Longer-term management of the MDER can address fire, erosion, and other factors that can further restore and enhance habitat, as will be described in the AMMP. An analysis presented in Appendix G of the LOHCP determined that such efforts, which are above and beyond CDFW's existing responsibility for management of the ecological reserve, are consistent with the CDFW's mitigation policy (CDFW 2012), supporting enhanced management and restoration of the MDER as compensatory mitigation for the LOHCP (McGraw 2020).

2.2 Location

The 278.7-acre MDER consists of two units: the Pecho Unit and the Bayview Unit. The Pecho Unit is a 47.8-acre unit in the southern half of the northeast quarter of Section 23, Township 30S, Range 10E of Mount Diablo Baseline and Meridian (MDBM). Comprised of a single assessor's parcel (APN: 074-011-011), the unit is west of Pecho Valley Road near Nokomis Court and adjoins residential development on its eastern border. The other three sides that surround the Pecho Unit are protected within the Montaña Del Oro State Park (Figure 1).

The Bayview Unit consists of 230.9 acres in the northwestern portion of Section 19, Township 30S, Range 11E of the MDBM. It consists of three parcels (APNs: 074-023-004, 074-023-005, and -067-131-006) which are south of Highland Drive, east of Broderson Avenue, west of Bayview Heights Drive and Calle Cordoniz Road, and north of the Hazard Canyon region. The unit adjoins open space on the west and south and residential development on the north; it is separated by residential development on the eastern boundary by a street (Figure 1).

2.3 Physical Environment

2.3.1 Geology

The MDER is underlain by rock of the Franciscan Complex, which is a mixture of igneous, metamorphic, and sedimentary rocks formed 120 to 180 million years ago during the Jurassic and Cretaceous Periods. Overlaying the Franciscan formation are sediments of the Paso Robles formation, an ancient dune complex formed during the Pleistocene and Holocene (Chipping 1987). This dune complex greatly influences the soils and thus biology of the MDER, as described below.

2.3.2 Soils

The ancient dunes of the Paso Robles Formation have given rise to the Baywood Fine Sands soil, which is mapped within all of the Pecho Unit, and all but 25 acres in the south of the Bayview Unit. Due to their coarse texture, Baywood Fine Sands soils are somewhat excessively drained (i.e., have low soil moisture). Gradual accumulation of organic matter has led to some clay synthesis, and in some places, the soil is loamy sand. Oxidation of iron minerals gives the surface soil a reddish color. While the surface layer is slightly acidic, the subhorizons are often strongly acidic (USDA 1984).

Located just north of the steep canyon at the headwaters of Los Osos Creek, the Bayview Unit also contains 25 acres of Santa Lucia Shaly Clay Loam soil on 50-75% slopes. This moderately deep, well-drained soil was formed from the weathering of shale and sandstone and the surface layer is a dark gray shaly clay loam. Due to the higher clay content compared to the Baywood Fine Sands, the Santa Lucia shaly clay loam has moderate water holding capacity. Surface runoff on this soil is rapid, and thus on steep, denuded slopes, erosion can be a problem (USDA 1984).

Within these soil types, differences in topography, microclimate, and plant cover result in soils that differ in depth, texture, and color. These soils create different conditions for plant growth, and thus contribute to the observed variability in plant community composition observed in the MDER.

2.3.3 Topography

The Bayview Unit is on a gently sloped, north-facing hillside. Elevation ranges between 180 feet above mean sea level (amsl) at the northern border near Highland Drive, and 580 feet amsl on the southern border, which features a ridge above the steep canyon containing the headwaters of Los Osos Creek. The overall slope of the site is 12%, though it is shallower in the northern half (10%) and steeper in the southern half (14%).

The Pecho Unit slopes downward from the southeast corner near Pecho Valley Road where elevation is approximately 335 feet amsl, to the northwest where elevation is approximately 125 feet amsl. As in the Bayview Unit, land is more gently sloping in the northern portion and steeper in the southern portion.

2.3.4 Climate

2.3.4.1 Current

Los Osos features a Mediterranean climate characterized by relatively warm, dry summers and cool, wet winters. Due to its proximity to the coast, Los Osos experiences moderate temperatures; mean high temperatures in July are just 66 ºF while mean low temperatures in January are 41 ºF (PRISM 2011). Dense morning fog is frequent during the summer and helps moderate temperatures and reduce plant desiccation stress. Los Osos receives an average of 18 inches of precipitation, which occurs as rain that falls primarily between November and March. There is a slight precipitation gradient within the LOHCP Area, with the coast receiving an average of 17 inches of rainfall and the higher elevation areas further inland receiving 19 inches (PRISM 2011).

Interannual variability in weather, particularly precipitation, is high and can have important implications for biological systems. Over the 53-year period of record for which daily rainfall was measured at the Morro Bay Fire Station Coop weather station north of Los Osos (WRCC 2013), mean rainfall was 16.6 inches; the standard deviation of the mean was 7.7, reflecting the high variability. In 21 of the years, precipitation was less than 75% of normal, and there were four periods of two or more years of such low rainfall, which constitute a drought: 1960 - 1961, 1984 - 1985, 1989 - 1990, and 2007 - 2009. Given the low water-holding capacity of the Baywood fine sand soil, drought can have important implications for plant and animal populations and habitat conditions.

2.3.4.2 Anticipated Changes

Mean annual temperature in San Luis Obispo County is projected to increase by 2.1 to 3.9 ºF by 2045 and 4.1 and 7.6 ºF by 2085, with summer temperature increases larger than those in winter (Koopman et al. 2010). Some of the models evaluated predict that temperature increases will be lower on the coast including in the Plan Area, than in inland portions of the county, while others do not (Koopman et al. 2010).Though precipitation projections varied across three models evaluated in a local study, a statewide analysis found consensus between six models that Central California would be drier (Westerling et al. 2009).

Unless global climate change brings substantial increases in precipitation, increased temperatures will reduce soil moisture by increasing evapotranspiration. This climatic water deficit may be exacerbated by continuation of a trend of 33% reduction in the frequency of summer fog in coastal California (Johnstone and Dawson 2010).

The hotter and likely drier climate could affect natural biological systems within the MDER and broader LOHCP Area through a variety of mechanisms, including by:

- shifting plant and animal distributions into regions with currently cooler climatic envelopes, thus increasing or reducing plant and animal species within their current range (Parmesan 1996, Schneider and Root 2001, Loarie et al. 2008);
- causing changes in vegetation structure (i.e., forests transition to shrublands, shrublands transition to grasslands, or potentially new plant communities emerge as a result of novel climates (Ackerly et al 2010);
- altering plant and animal phenologies (Stenseth and Mysterud 2002, Parmesan and Hanley 2015);
- increasing fire frequency, potentially promoting fire-adapted species and reducing fire-sensitive species (Lenihan et al. 2003, Halofsky et al. 2020);
- increasing pest and pathogen outbreaks due to drought-stress (Kurz et al. 2008); and
- promoting the spread of exotic species, due in part to increased fire (Walter et al. 2009).

Habitat restoration and enhanced management can play an important role in increasing the resiliency of the landscape to climate change by increasing the area of suitable habitat thus promoting their population persistence (Heller and Zavaleta 2009).

2.4 Land Use

2.4.1 Acquisition History

The Pecho Unit was acquired by the Department of Fish and Wildlife on July 12, 1978 using funds from a federal Endangered Species Act grant-in-aid. It was purchased to protect Morro Bay kangaroo rat, Morro shoulderband snail, and endemic plants (CDFW 1982). Land within the Pecho Unit was designated as part of the Morro Dunes Ecological Reserve in 1983 (CDFW 2020b).

Lands within the disjunct Bayview Unit were acquired through multiple acquisitions. Located in the southwestern corner of the unit, the 30.0-acre Pacey Property (APN: 067-131-006) was acquired in 2003 using Section 6, Proposition 50, as well as NOAA funds. The remaining 200.9 acres were acquired in November 2000 using general funds.

2.4.2 Historical Land Use

Historical aerial photographs of the region show that, sometime between 1937 and 1949, vegetation within the Bayview Unit was removed (Figure 2b). The cleared area largely conforms to the parcel lines and there is no sign of the trunks and branches of large shrubs and trees ("skeletons") that often remain after wildfire; these observations suggest that plant cover was mechanically cleared. The plant communities have become re-established over the subsequent 70 years or more, during which there has been no sign of widespread clearing or fire (Figure 2c), though the site features a network of dirt roads and trails likely created by off-highway vehicles (OHVs) as well as equestrians and pedestrians.

The Pecho Unit was used by the US Army and Navy as an impact area in World War II. In 1956, a bulldozer operation was used to remove unexploded ordinance, thus removing established plant cover (CDFW 1982). Prior to its acquisition by CDFW, the site was also subject to use by OHVs, which along with pedestrians and equestrians have created trails as in the Bayview Unit.

2.4.3 Current Land Use

Current uses of the MDER include the following:

1. **Research**: The site has been used for research into the endangered species, including surveys for Morro Bay kangaroo rat.
2. **Recreation**: Hiking, dog walking, and wildlife viewing are allowed activities within the Reserve, and occur via a network of trails in both units. The trails are also currently being used by equestrians and occasionally mountain bikes, both of which are not allowed under the regulations that govern management of the Reserve (Section 2.8).
3. **Vegetation Management**: The Los Osos Community Wildfire Protection Plan called for construction of a shaded fuel break on the eastern and northern sides of the Bayview Unit (SLOCCFSC 2009). In 2018, vegetation management was initiated in the western portion of the northern shaded fuel break (Section 5).

Section 2.8 describes State regulations and CDFW's management of the reserve.

2.4.4 Anthropogenic Features

2.4.4.1 Roads and Trails

The Bayview Unit features a network of historic dirt roads and trails along with some patchy denuded areas adjacent to trails (e.g., at trail intersections). First observed in the 1964 aerial photograph, four dirt roads were created to traverse the present-day Bayview Unit. By 1973, all roads appear to have been largely abandoned by vehicles except one the "Broderson Road extension" or "Old Broderson Road." This ~3,600-foot-long largely dirt road is partly on the Bayview Unit and partly on the Broderson parcel to the west, which is owned by the County. As a result of its largely straight trajectory

a)

b)

c)

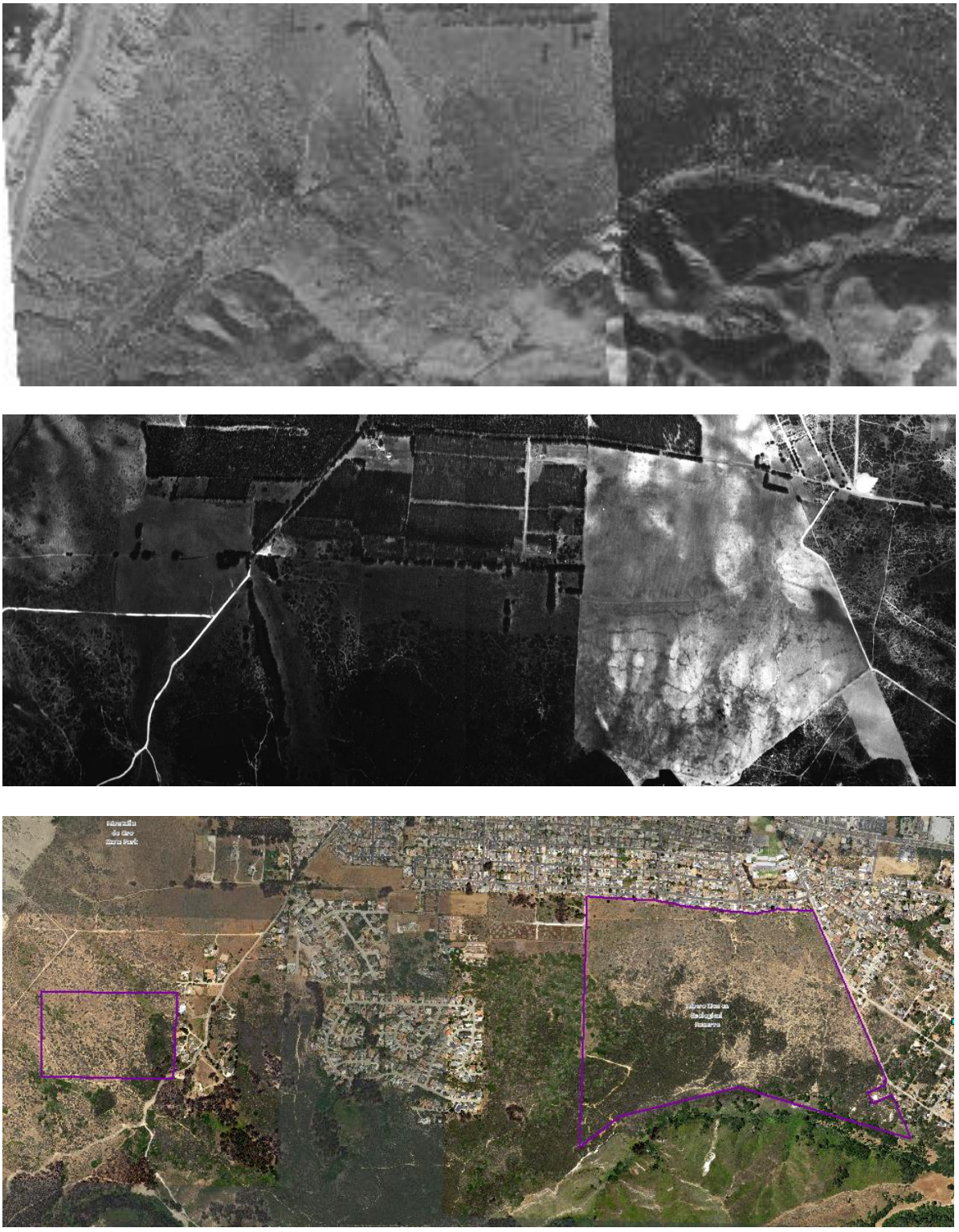


Figure 2: Aerial Images of the MDER, showing: a) largely intact habitat in 1937, b) 1949, following clearing of much of the Bayview Unit, and c) 2016.

perpendicular to a steep slope, the Old Broderson Road has experienced erosion. Between 1964 and 1973, the road segment located on the former Pacey parcel in the southern tip of the Bayview Unit changed its trajectory, perhaps because erosion rendered the original road impassable.

The northern section of the Broderson Road is currently used by vehicles to maintain the leach field on the County's Broderson property. The remainder of the old road is used as a trail. In total, the Bayview Unit features an estimated 11.8 miles of trails. These include 6.0 miles of primary trails and an additional 5.8 miles of access routes that crisscross the reserve (Figure 3). Figure 3 also depicts 0.5 miles of trails just south of the Bayview Unit.

The Pecho Unit does not feature any current roads, nor are any historic roads visible in analysis of historical aerial imagery. The unit features two primary trails (Figure 4). A 0.15-mile-long segment of the West Rim Trail that connects Pecho Valley Road to the ocean via Sand Spit Road crosses the southwestern portion of the Pecho Unit (Figure 4). In addition, a 0.28-mile long trail connects the West Rim Trail south of the Pecho Unit to a trail to its north near Costal Azul Road (Figure 4). The Pecho Unit also features 0.75 miles of secondary trails (Figure 4).

2.4.4.2 Other Features

Utility lines traverse the southeastern corner of the Pecho Unit, which features a single power pole (Figure 4). There are no known other anthropogenic features including infrastructure within the MDER, though additional features may be identified through more thorough examination of the site.

2.5 Plant Communities

The MDER supports three native plant communities: coastal scrub, central maritime chaparral, and woodlands. These communities were mapped and classified into seven series, along with two types of modified land cover (Table 1), as described in Section 3.1.5 of the LOHCP. Table 1 provides a crosswalk between the community types mapped for the LOHCP and those in the California Manual of Vegetation (Sawyer et al. 2009), which is CDFW's preferred vegetation classification system.

The natural communities and other land cover occur as a mosaic within the MDER where they reflect variations in soil conditions, microclimate, and disturbance history, including prior land use (Figures 5 and 6).The following sections describe the plant communities within the MDER to provide ecological context for management and restoration of habitat for the covered species. The descriptions were adapted based on those provided in the LOHCP (Section 3.1.5).

2.5.1 Coastal Sage Scrub

Approximately 67 acres (24%) of the MDER features coastal sage scrub: a shrubland dominated by short to medium height, soft-woody shrubs. When compared to the shrubs dominating central maritime chaparral, the other shrubland in the reserve, coastal sage scrub features shrubs that are shorter-statured, less woody, and form a discontinuous canopy.

Coastal sage scrub occurs primarily on relatively flat terraces adjacent to the Pacific Ocean. Within the Los Osos region, coastal sage scrub dominates the middle-aged dunes; it also occurs as a mosaic with central maritime chaparral and woodlands found on the older dunes. Within the MDER, coastal sage

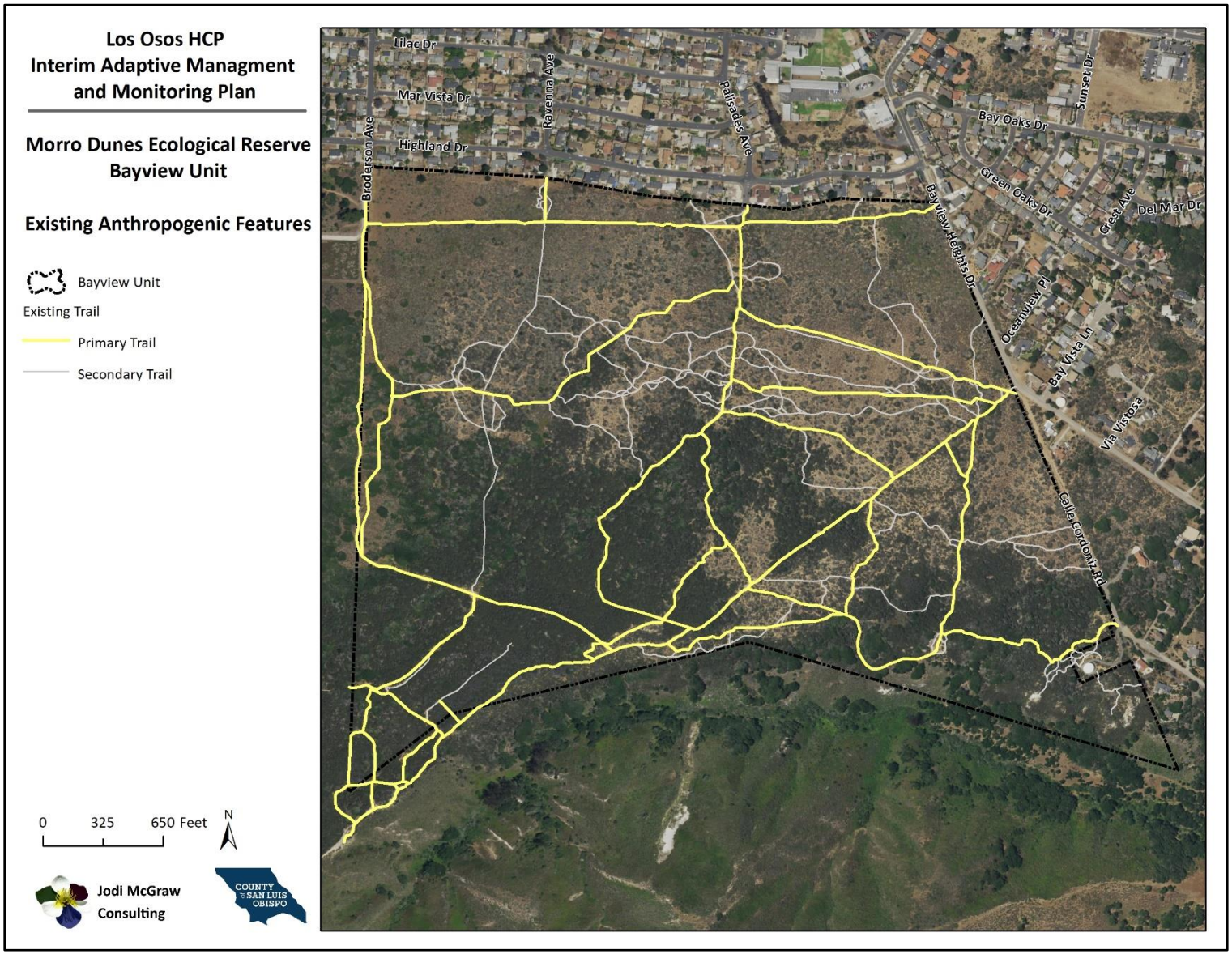


Figure 3: Existing Anthropogenic Features in the Bayview Unit of the Morro Dunes Ecological Reserve

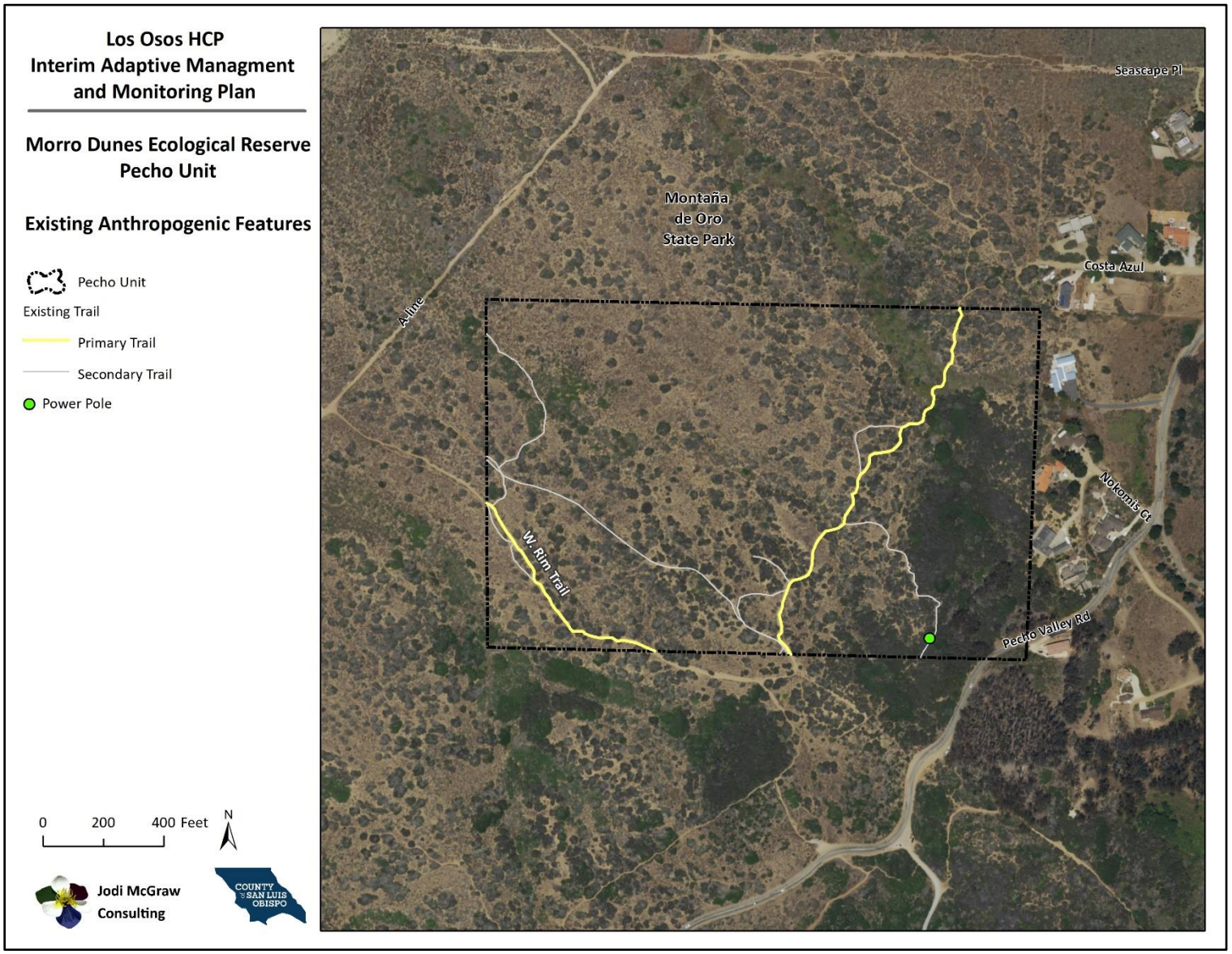


Figure 4: Existing Anthropogenic Features in the Pecho Unit of the Morro Dunes Ecological Reserve

Table 1: Plant communities of the Morro Dunes Ecological Reserve (MDER) showing acres and percent of total in the Bayview and Pecho units and overall[1]

Community Type and Series	California Manual of Vegetation Alliance (Sawyer et al. 2009)	Bayview		Pecho		Total	
		Acres	%	Acres	%	Acres	%
Coastal Sage Scrub							
California Sagebrush – Black Sage Series	*Salvia mellifera* Shrubland	57.1	25%	10.1	21%	67.2	24%
California Sagebrush – Black Sage Series Disturbed	*Salvia mellifera* Shrubland	0.001	<0.01%	0.11	0.23%	0.11	0.04%
		57.1	**25%**	**10.2**	**21%**	**67.3**	**24%**
Central Maritime Chaparral							
Morro Manzanita California Sagebrush Series	*Arctostaphylos morroensis* Shrubland	34.4	15%		0%	34.4	12%
Morro Manzanita Wedgeleaf Ceanothus Series	*Arctostaphylos morroensis* Shrubland	33.8	15%	29.4	61%	63.1	23%
Morro Manzanita Series	*Arctostaphylos morroensis* Shrubland	101.7	44%	8.2	17%	109.9	39%
		169.9	**74%**	**37.6**	**78%**	**207.5**	**74%**
Woodlands							
Bishop Pine Series	*Pinus muricata* Forest	3.4	1.5%		0%	3.4	1.2%
Coast Live Oak Series	*Quercus agrifolia* Woodland	0.4	0.2%		0%	0.4	0.1%
		3.8	**2%**		**0%**	**3.8**	**1.3%**
Other Land Cover							
Developed		0.03	0%	0.11	0.2%	0.14	0.05%
Largely Developed		0.02	0%		0%	0.02	0.01%
		0.06	**0.03%**	**0.11**	**0.2%**	**0.17**	**0.06%**
		230.9	**100%**	**47.9**	**100%**	**278.7**	**100%**

[1] Based on vegetation mapping conducted for all of Los Osos (CMCA 2004) and may not precisely delineate vegetation at the site level. Notably, the existing map and data may overstate the area occupied by Bishop pine and it does not include the area of blue gum.

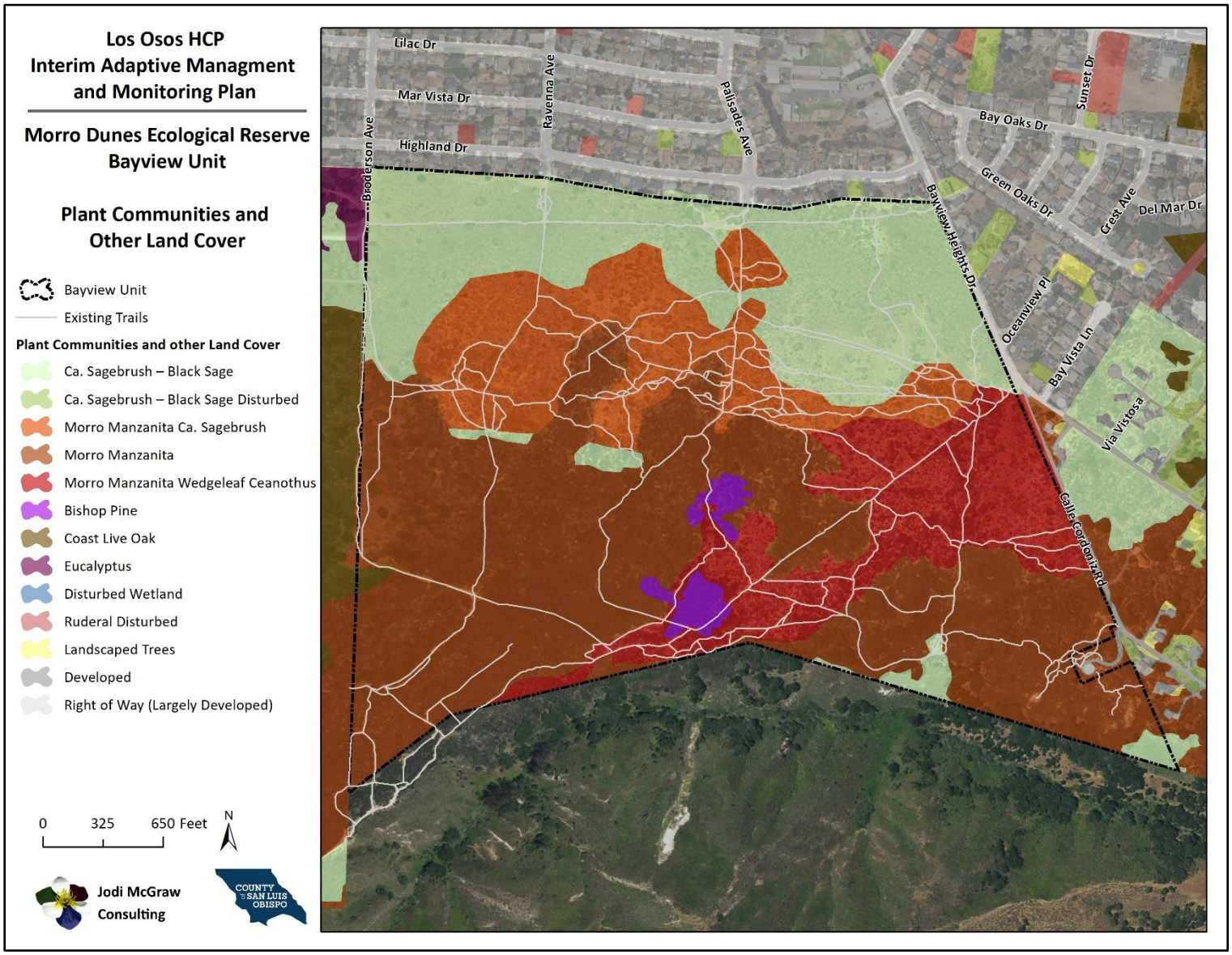


Figure 5: Plant Communities of the Bayview Unit of the Morro Dunes Ecological Reserve

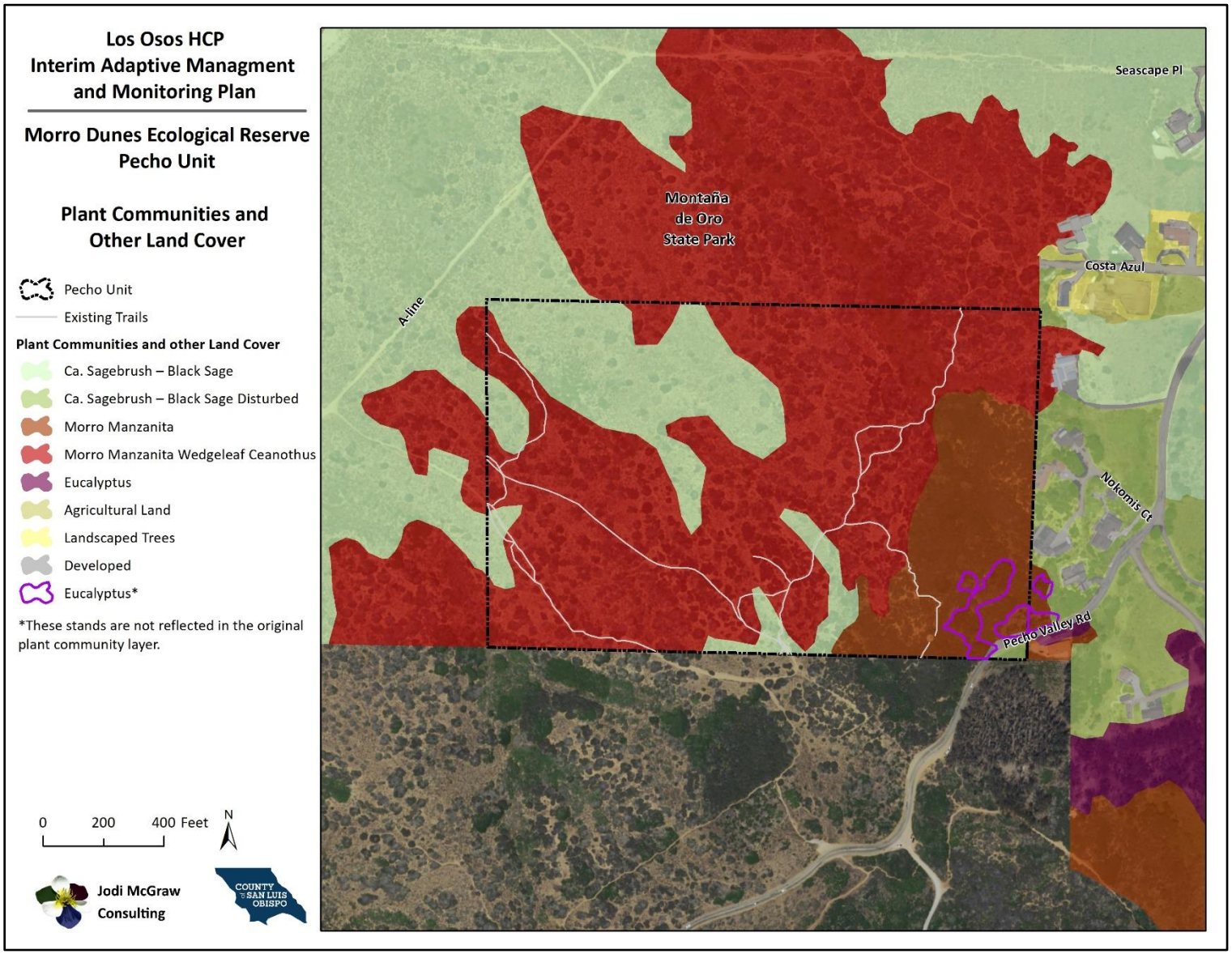


Figure 6: Plant Communities of the Pecho Unit of the Morro Dunes Ecological Reserve

scrub occurs primarily in the lower elevation, more gently sloping terrain located in the northern portions of each unit.

Coastal sage scrub is dominated by several shrubs including black sage (*Salvia mellifera*), California sagebrush (*Artemisia californica*), coyote brush (*Baccharis pilularis*), California goldenbush (Ericameria ericoides), silver lupine (*Lupinus albifrons*), dune (or sand) almond (*Prunus fasciculata* var. *punctata*), dune bush lupine (*Lupinus chamissonis*), and deer weed (*Acmispon glaber*). Herbaceous plants occur between shrubs, with common species including California croton (*Croton californicus*), wedgeleaf horkelia (*Horkelia cuneata*), rush rose (*Crocanthemum scoparium*), and common sandaster (*Corethrogyne filaginifolia*).

Areas of coastal sage scrub have been modified by prior land use, including clearing and road and trail development. These activities remove shrub cover and facilitate the invasion and spread of exotic plant species such as perennial veldt grass (*Ehrharta calycina*), freeway iceplant (*Carpobrotus edulis*), narrow leaved ice plant (*Conicosia pugioniformis*), wild oats (*Avena* spp.), rip-gut brome (*Bromus diandrus*), and red brome (*Bromus madritensis* ssp. *rubens*; Section 2.7.1).

Within the MDER, two coastal sage scrub community types (series) have been mapped; they are distinguished by their dominant shrubs and level of invasion by exotic plants (Table 1, Figures 5 and 6).

California Sagebrush – Black Sage: An estimated 67.2 acres, or 24% of the MDER, supports this community, which features a 2- to 5-foot-tall, continuous or intermittent canopy of California sagebrush and black sage with deer weed, mock heather, and dune bush lupine.

California Sagebrush – Black Sage Disturbed: The MDER also supports 0.11 acres (0.04% of total) of coastal sagebrush-black sage habitat that has been disturbed by land use. This includes primarily a ~0.011-acre patch in the southeast corner of the Pecho Unit, on the south side of Pecho Valley Road (Figure 6), as well as a 0.001-acre patch near the access road to the water tank in the southwest corner of the Bayview Unit (Figure 5). These areas feature a greater cover of exotic plants which are promoted by disturbance.

2.5.2 Maritime Chaparral

Central maritime chaparral occurs on approximately 207.5 acres (74%) of the MDER. It is dominated by sclerophyllous (hard-leaved) shrubs and features scattered trees. Due to the low light and deep leaf litter in the understory, herbaceous plant cover is primarily limited to gaps in the shrub canopy.

Central maritime chaparral occurs in coastal areas of central California that are within reach of the summer fog. Within the MDER and broader Los Osos region, central maritime chaparral occurs primarily on the older dunes (i.e., farther inland), on the southern hillsides and on the north-facing slopes of the marine terraces just south of Los Osos Creek in the southern portion of the Plan Area. Within the MDER, the central maritime chaparral occurs in the steeper, southern portion of the units, with the Pecho Unit also featuring this community on the eastern portion of the unit which also features steeper terrain (Figures 5 and 6).

Within the MDER and broader Los Osos region, central maritime chaparral is dominated by Morro manzanita, which is endemic to the Los Osos Baywood Fine Sands ecosystem. Other common species include chamise (*Adenostoma fasciculatum*), wedge-leaf ceanothus, sticky monkeyflower (*Diplacus aurantiacus*), and coast live oak. Canopy gaps support a variety of shrubs including California goldenbush and deer weed, as well as herbs such as wedgeleaf horkelia, seacliff buckwheat (*Eriogonum parvifolium*), California croton, and golden yarrow (*Eriophyllum confertiflorum*).

Central maritime chaparral forms a mosaic with coastal sage scrub and woodland communities. Though it occurs primarily on the Baywood fine sand, central maritime chaparral is also supported by the Santa Lucia shaly clay loam in the southern portion of the Bayview Unit. When compared with the coastal sage scrub, central maritime chaparral occurs on the steeper slopes. This may reflect the dominant shrubs' requirements for more developed soils that occur on the older dunes farther inland. Alternatively, it may result because the gentler slopes (2-9%) have been more recently cleared (Tyler and Odion 1996).

Central maritime chaparral is a fire-adapted community. Though precise aspects of the fire regime are unknown, long fire-free periods (i.e., 100 years) are thought to be necessary for the dominant Morro manzanita to accumulate a sufficient seed bank to regenerate (Odion and Tyler 2002).

Based on their variability in dominant species, three types of central maritime chaparral have been mapped within the MDER (Table 1, Figures 5 and 6).

Morro Manzanita - California Sagebrush: This community consists of Morro manzanita and California sagebrush as co-dominant species creating a sparse canopy that is approximately 3 to 6 feet tall. California buckwheat, deer weed, wedgeleaf ceanothus, sticky monkeyflower, and black sage may also be present. It occurs on 34.4 acres (12% of the MDER) within the northern half of the Bayview Unit, at the transition between middle-aged dunes and older dunes and in areas that have been cleared relatively recently.

Morro Manzanita - Wedgeleaf Ceanothus: This community occurs on 63.1 acres (23% of the MDER), with approximately half of the acreage occuring in each unit (Table 1). It features Morro manzanita and wedgeleaf ceanothus as co-dominant species creating a dense shrub canopy that is 3 to 6 feet tall. California sagebrush, black sage, and sticky monkey flower may be present in this community, which appears transitional between coastal sage scrub and Morro manzanita chaparral

Morro Manzanita: Found on 109.9 acres (39% of the MDER), the Morro manzanita community is characterized by dense cover of Morro manzanita, with coast live oak, wedgeleaf ceanothus, and sticky monkey flower, with black sage also present in a 4-12-foot tall canopy. Morro Manzanita chaparral occurs primarily on the older dunes and on steeper slopes in the southern portion of the Bayview Unit (Figure 5) and southeastern corner of the Pecho Unit (Figure 6).

2.5.3 Woodlands

Approximately 3.8 acres (1.3%) of the MDER supports woodlands: upland communities characterized by a largely continuous canopy of trees, with variable understory featuring primarily shade-tolerant herbs and shrubs (Table 1). These small patches of native woodlands occur primarily on the older dunes in the southern portion of the Bayview Unit (Figure 5), on more developed soils featuring higher nutrient availability and water-holding capacity of the more developed soils found there.

The woodland communities are mapped as one of two types: coast live oak and bishop pine (Pinus muricata) woodland (Table 1, Figures 5 and 6).

Coast Live Oak: Approximately 0.4 acres (0.1%) of the MDER features an intermittent or continuous canopy dominated by coast live oak, which typically range from 20 to 45 feet in height. The understory can feature Morro manzanita, wedgeleaf ceanothus, coffee berry, poison oak, and herbaceous species including exotic annual grasses. As noted above, the central maritime chaparral features emergent oaks as well, which may overtop the chaparral shrubs as part of succession over time.

Bishop Pine: The Bayview Unit features two stands of bishop pine that were mapped in 2004 as totaling 3.4 acres (1.2% of the MDER). Examination of the stands in 2020 indicates that they occupy a much smaller area (~0.5 acres total) and feature just a few living trees (< 10 trees), with several snags (dead standing trees). The surrounding area mapped as bishop pine is actually Morro manzanita chaparral (J. McGraw, pers. obs.).

This community features bishop pine trees that are 20 to 35 feet in height, and have shrubs in their understory. Located on soils derived from older dunes in the southern portion of the Plan Area, the bishop pine woodland occurs as pockets within Morro manzanita chaparral. More widespread in the Irish Hills, the isolated stands, which are visible in aerial photographs from 1949, may be restricted by unique soil conditions or lack of fire; like other closed-cone conifers, bishop pine establishes primarily following fire, which releases seeds from their serotinous cones and creates an open canopy and bare-mineral soil conditions that facilitate seedling establishment. As noted above, the several of the bishop pines in the Bayview Unit are dead with remaining live trees appearing senescent (J. McGraw, pers. obs.).

The southeastern portion of the Pecho Unit features an approximately 0.84-acre stand of blue gum (*Eucalyptus globulus*), referred to here as eucalyptus. In the vegetation map used for the Los Osos HCP, the stand was not mapped separately from the Morro manzanita chaparral from which it is emerging (Figure 6); therefore, the acreage is not reflected in Table 1. Section 2.7.1.2.4 describes this stand in greater detail.

2.5.4 Other Land Cover

The MDER features 0.17 acres (0.06% of total land) that has been classified as developed (0.14 acres or 0.05%) or largely developed (0.02 acres or 0.01%; Table 1). These areas include the 0.11-acre area in the southeastern corner of the Pecho Unit that is traversed by Pecho Valley Road (Figure 6), and 0.06 acres along the southeastern portion of the Bayview Unit where Calle Cordoniz Road is mapped within the reserve (Figure 5). Land surveys may reveal that one or both of these roads are located outside of the MDER units, such that the developed acreage, which was calculated in GIS based on remote-sensing data and the County cadastral data layer, does not, in fact, occur in the reserve.

2.6 Covered Species

The MDER provides habitat for all four covered species of the LOHCP (Box 1) and also supports suitable habitat for and occurrences of other sensitive species (Table 2). Additional rare species may be identified during the course of more detailed surveys of the property to develop the full LOHCP AMMP. The following sections provide an overview of the covered species and available information about their distribution within the MDER.

Table 2: Sensitive species known or likely to occur in the MDER

Species	Common Name	Status[1]	Occurrence in the MDER
Plants			
Arctostaphylos morroensis	Morro manzanita	FE, CRPR IB	Present
Cladonia firma	firm cup lichen	CNDDB G4/S1	
Eriodictyon altissimum	Indian Knob mountainbalm	FE, CRPR1B	Present
Erigeron blochmaniae	Blochman's leaf daisy	CRPR 1B	Present
Erigeron sanctarum	Saint's daisy	CRPR 4	
Erysimum capitatum ssp. *lompocense*	San Luis Obispo wallflower	CRPR 4	Present
Monardella undulata	curly leafed monardella	CRPR 4	
Prunus fasciculata var. *punctata*	sand almond	CRPR 4	Present
Sulcaria isidifera	splitting yarn lichen	CNDDB G1/S1.1	
Animals			
Helminthoglypta walkeriana	Morro shoulderband snail	FE	Present
Bombus crotchii	Crotch's bumblebee	CE	
Icaria icarioides morroensis	Morro blue butterfly		Present
Anniella pulchra	California legless lizard	SSC	
Phyrnosoma blainvillii	coast horned lizard	SSC	
Circus cyaneus	northern harrier	SSC	Present
Dipodomys heermanni morroensis	Morro Bay kangaroo rat	FE, SE	

[1] Status Designations

CNDDB G1/S1.1: CA Natural Diversity Database: limited distribution and abundance; very threatened

CNDDB G4/S1: Apparently Secure globally but critically imperiled in CA

CRPR IB: list of most endangered plants by the California Native Plant Society

CRPR 4: 'Watch list' compiled by the California Native Plant Society

SSC: CA Dept. of Fish and Wildlife Species of Special Concern

FE: Federally listed endangered species

SE: State-listed endangered species

CE: Candidate for state-listing as endangered

2.6.1 Indian Knob Mountainbalm

2.6.1.1 Species Background

Indian Knob mountainbalm (*Eriodictyon altissimum*) is a shrub in the borage family (Boraginaceae) that is both state and federally-listed as an endangered (USFWS 1994); it is also has a California Rare Plant Rank of 1B.1, which signifies that it is rare, threatened, or endangered in California and elsewhere (CNPS 2020a).

Indian Knob mountainbalm is known from just seven occurrences in western San Luis Obispo County of which six are thought to be extant. There are two extant occurrences on Indian Knob, a rock outcrop area south of San Luis Obispo and north of Pismo Beach approximately 13 miles east of Los Osos, two occurrences represented by a total of four, disjunct stands are in Hazard Canyon within Montaña de Oro State Park south of the LOHCP Area (USFWS 2013a), and two occurrences are within the Bayview Unit (Section 2.6.1.2). Indian Knob mountainbalm was not detected during a survey of the Broderson property just west of the Bayview Unit, suggesting the previously documented occurrences there may be extirpated (USFWS 2016, Kofron et al. 2019).

Though Indian Knob mountainbalm populations have not been comprehensively censused throughout the species' range, they are estimated to total fewer than 600 plants, with most of those (~500) located within the two extant Indian Knob occurrences (USFWS 2013a, Kofron et al. 2019).

Indian Knob mountainbalm occurs on sandy soils derived from marine sandstone at Indian Knob, and Pleistocene older and partly cemented aeolian deposits (i.e., the Baywood fine sand soils) in Los Osos. In both areas, the species occurs in a mosaic of chaparral and oak woodland vegetation. Within these communities, the species' distribution is very limited. While the microhabitat characteristics of the endangered shrub have not yet been examined, the stands are thought to be remnants of once larger occurrences that have contracted over time as a result of succession, which creates less favorable conditions for this early successional species that is promoted by fire (USFWS 2013a).

Indian Knob mountainbalm can reproduce vegetatively by establishing clones from rhizomes (Wells 1962). Individuals may survive fire by resprouting from belowground tissues. Fire may be required to stimulate seed germination and create open canopy, bare soil conditions conducive to seedling establishment and survival (USFWS 2013a).

As part of the most recent five-year review, persistence of Indian Knob mountainbalm was deemed threatened by fire exclusion, exotic plants, climate change, and demographic and environmental stochasticity (randomness; USFWS 2013a). Within the MDER, occurrences are also threatened by trail clearing conducted by people seeking to maintain trail access for recreation (Kofron et al. 2019).

2.6.1.2 Occurrence within the MDER

As noted above, the Bayview Unit supports two occurrences of Indian Knob mountainbalm: one just north of the water tank in the southeastern corner of the reserve (Occurrence 6), and the other near the center of the reserve by the Bishop pines (Occurrence 4). These occurrences were censused in April 2016 and found to contain a total of 46 ramets: 22 within a 63 m^2 area in Occurrence 6 and 23 within a 40 m wide area in Occurrence 4 (USFWS 2016, Kofron et al. 2019). Central maritime chaparral

communities elsewhere in the Bayview Unit and in the Pecho Unit, which cover 2008 acres or 74% of the MDER (Table 1), could provide suitable habitat for this species, particularly following fire or other disturbances that open up the shrub and tree canopy.

2.6.2 Morro Manzanita

2.6.2.1 Species Background

Morro manzanita (*Arctostaphylos morroensis*) is a large, evergreen shrub in the heath family (Ericaceae) that is federally listed as a threatened species (USFWS 1994). Though not state listed under CESA, Morro manzanita has a California Rare Plant Rank of 1B.1, which is used for plants that are rare, threatened, or endangered in California and elsewhere (CNPS 2020a).

Morro manzanita is endemic to the Los Osos region where it occurs primarily on Baywood fine sand soils. Based on the likely historic distribution of these soils, Morro manzanita may have covered between 2,000 and 2,700 acres (McGuire and Morey 1992). The current range of Morro manzanita is approximately 890 acres (LSA Associates 1992). Within that area, Morro manzanita covers approximately 350 acres (Tyler and Odion 1996).

Morro manzanita primarily occurs within central maritime chaparral communities; it is the dominant species (i.e., in terms of canopy cover) within the Morro manzanita chaparral and co-dominates with wedgeleaf ceanothus and California sagebrush. Morro manzanita also occurs at low abundance in the coast live oak woodland, in the understory or canopy gaps of coast live oak. Scattered Morro manzanita may also be found in other communities including within the developed areas.

Morro manzanita is a long-lived shrub (>50-year life span) that is adapted to recurring fire, which is an important component of the disturbance region within the Baywood fine sands ecosystem. Fire kills adult Morro manzanita, which lack a burl from which to resprout; however, it also promotes seed germination and establishment, and therefore regeneration (Tyler et al. 2000). Effective fire management will likely be essential to the species' long-term persistence. Too-frequent fire may decrease populations by killing adults prior to accumulation of sufficient viable seed to replace them (Odion and Tyler 2002). At the same time, fire exclusion may present a 'senescence risk': as adult shrubs senesce and die, seed production decreases and at some point, seed availability could be reduced to a level below which seedling establishment following an eventual fire is insufficient to replace the stand.

As a narrow endemic species, Morro manzanita persistence is also threatened by habitat loss, including land conversion. Persistence is also threatened by habitat degradation, including exotic plants and incompatible recreational uses, which can impact Morro manzanita directly through shrub removal or pruning that reduces survivorship and reproduction, as well as by causing erosion (USFWS 2008). Morro manzanita may also be impacted by vegetation management, including fire hazard abatement on private lands; the Community Wildfire Protection Plan avoids removing this species (SLOCCFSC 2009). Although individual Morro manzanita are typically trimmed rather than removed in most hazard abatement activities, as noted above, the species does not resprout from a burl when cut, and in the absence of fire, seedling establishment is very limited (Tyler et al. 1998).

2.6.2.2 Occurrence within the MDER

Morro manzanita occurs at relatively high density in the southern portion of the Bayview Unit and in the southeastern portion of the Pecho Unit in the central maritime chaparral community. Morro manzanita also occurs at lower frequency and abundance including as isolated, typically smaller shrubs in the coastal scrub communities within the reserve. The reserve features an estimated 211 acres (76% of the reserve) of suitable habitat for this species (Table 3), based on the vegetation mapping and classification in which all of the central maritime chaparral series as well as the Bishop pine and coast live oak woodland were considered suitable habitat (Figures 7 and 8; McGraw 2020). Mapping surveys for this species within the reserve will be conducted as part of implementation of the LOHCP and will increase understanding of the species distribution and areal extent (LOHCP Section E.3).

Table 3: Acres of Morro shoulderband snail and Morro manzanita habitat within the MDER based on regional plant community mapping (Table 1, Figures 5 and 6; McGraw 2020)

	Bayview		Pecho		Total	
Species and Habitat	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
Morro Manzanita Habitat[1]	173.7	62%	37.6	13%	211.3	76%
Morro Shoulderband Snail Habitat						
Primary Habitat[2]	91.5	40%	10.2	21%	101.7	36%
Secondary Habitat[3]	33.8	15%	29.5	62%	63.3	23%
Total	**125.3**	**54%**	**39.7**	**83%**	**165.0**	**59%**

[1] Includes all maritime chaparral communities as well as coast live oak and Bishop pine woodlands

[2] Includes all coastal sage scrub as well as Morro manzanita California Sagebrush and Wedgeleaf Ceanothus-California sagebrush

[3] Includes Morro manzanita Wedgeleaf Ceanothus and Developed Areas, which can feature suitable habitat

2.6.3 Morro Shoulderband Snail

2.6.3.1 Species Background

The Morro shoulderband snail (*Helminthoglypta walkeriana*), is a federally listed endangered terrestrial mollusk endemic to the area immediately north and south of Morro Bay in coastal San Luis Obispo County (Roth and Tupen 2004). When listed by the USFWS in 1994, the taxon, which was also known as the banded dune snail, was comprised of two subspecies, *H. w. walkeriana*, and *H. w. morroensis* (USFWS 1994). These taxa have since been recognized as two separate species:
Morro shoulderband snail (*H. walkeriana*) and Chorro shoulderband snail (*H. morroensis*; Roth and Tupen 2004).

The current known range of Morro shoulderband snail is estimated to encompass approximately 7,700 acres (Roth and Tupen 2004). Most of the area is centered on Los Osos north of Hazard Canyon, west of Los Osos Creek, and south of Morro Bay; however, it also includes a narrow strip of coastal dunes north of Morro Bay in Morro Strand State Park (Roth and Tupen 2004, USFWS 2006). Within this geographic area, native habitat occupied by the species includes coastal sage scrub along the immediate coast, and coastal sage scrub and open central maritime chaparral communities on stabilized dunes further inland. Within these areas, Morro shoulderband snail is often found in areas featuring dense plant cover comprised of shrubs or mat-forming species (e.g., iceplant) where plant cover including branches is in

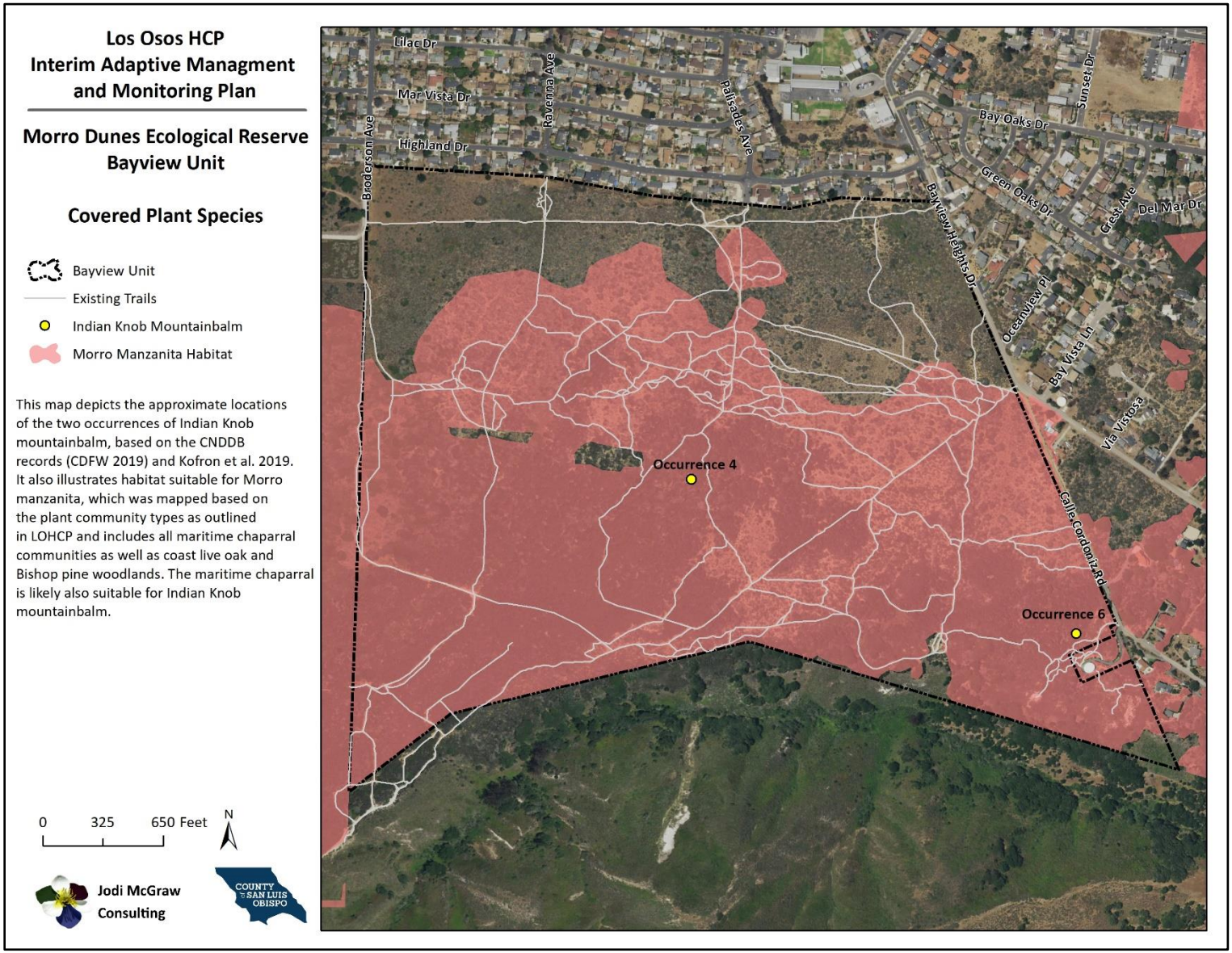


Figure 7: Covered plants in the Bayview Unit of the Morro Dunes Ecological Reserve

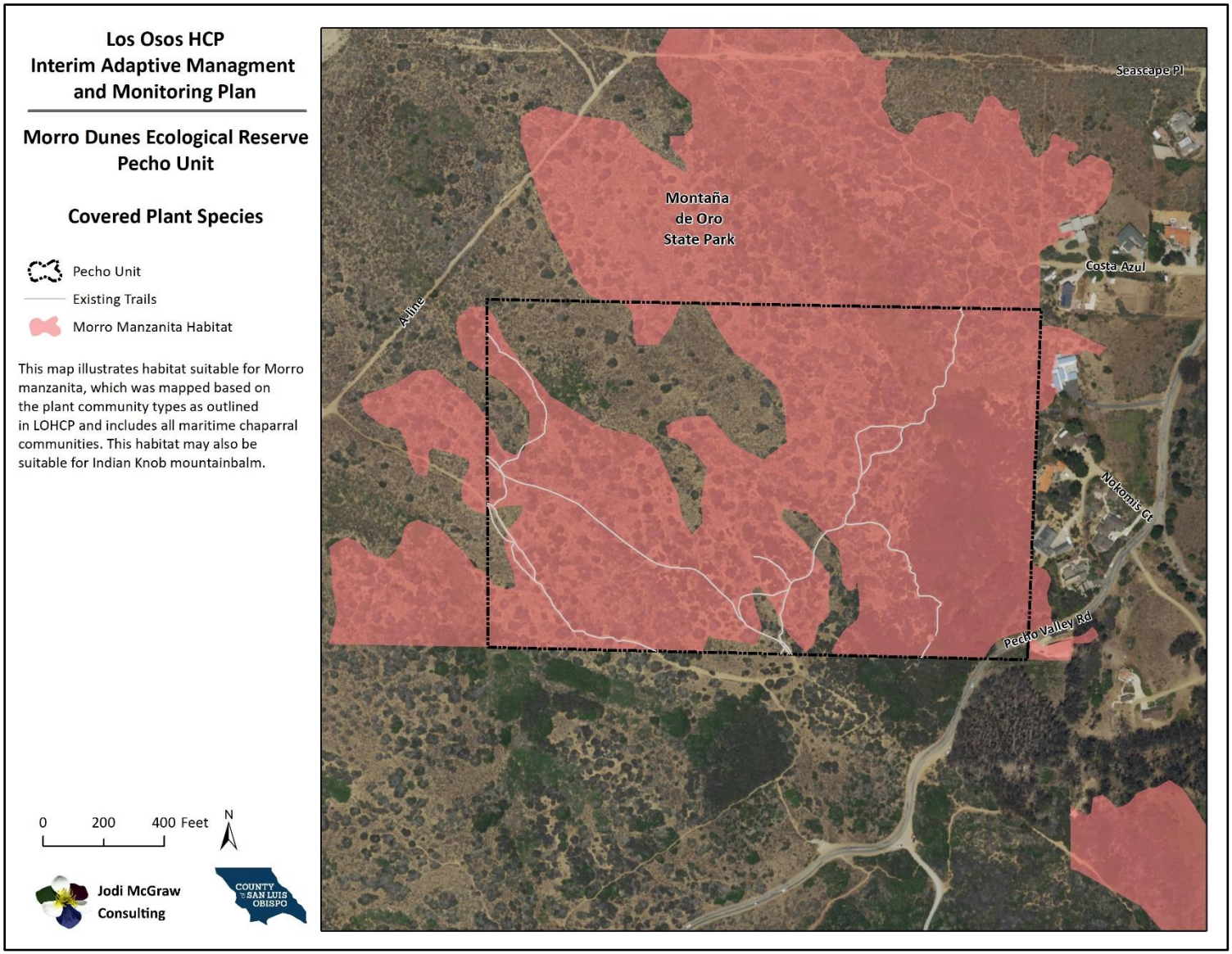


Figure 8: Covered plants in the Pecho Unit of the Morro Dunes Ecological Reserve

contact with the ground (USFWS 1998). Individuals are typically patchily dispersed and observed in clumps of coastal sage scrubs or clumps of veldt grass (SWCA 2014).

Though intact habitat for Morro shoulderband snail includes primarily coastal sage scrub, and open central maritime chaparral, the species can also occur, sometimes in high abundance, in areas of degraded habitat, including areas invaded by dense exotic plants, such as veldt grass, fennel (*Foeniculum vulgare*), and iceplant (SWCA 2013). However, the species distribution is negatively associated with exotic eucalyptus (Walgren and Andreano 2012). Morro shoulderband snails are also found in association with a variety of anthropogenically disturbed habitat areas, including areas where coastal sage scrub has been converted to non-native grassland due to vegetation clearing and mowing, areas covered by veldt grass and iceplant, landscaping and ornamental plantings, woodpiles, and other habitats within developed areas and rights-of-way (SWCA 2013, 2014, 2015, 2016, and 2017). Indeed, Morro shoulderband snail is found within a range of habitat conditions in existing developed areas as well as remaining intact habitat.

Morro shoulderband snail is also often found in litter that accumulates on the soil surface, and under piles of rock, downed wood, or other debris (SWCA 2013). These microsites provide moist, sheltered environments of reduced desiccation stress that are required by the terrestrial mollusk (Roth 1985). The species is occasionally observed in shallow (less than ½ inch) depressions within the soil (Belt 2016). Morro shoulderband snails can be attracted to and found in water puddles, where they can be drowned (SWCA 2013).

Morro shoulderband snails feed on decaying matter and fungal mycelia that grow on decaying matter and plant roots. The species is most active during periods of moist conditions, including during and after rain, as well as when there is heavy fog or morning dew. Feeding, reproduction, and growth occur primarily during the rainy season (i.e., October to April; Roth 1985). During periods of drought, Morro shoulderband snails are typically inactive, and may aestivate (Roth 1985).

Morro shoulderband snail is threated by loss of habitat due to development, and degradation of habitat as a result of exotic plants, recreational activities, and senescence of dune vegetation (USFWS 2001). When originally listed as federally-endangered in 1994, additional threats to Morro shoulderband snail included competition from non-native snails such as the European garden snail (*Helix aspersa*) and parasitism by sarcophagid flies (USFWS 1994); however, the most recent five-year review of the status of the species found no evidence for the effects of the former, and the latter threat was deemed unlikely to threaten the species' persistence (USFWS 2006).

2.6.3.2 Occurrence within the MDER

Morro shoulderband snail has been observed within the Bayview Unit of the MDER as part of surveys conducted during creation of the fuel break in 2020 (D. Hacker, pers. comm. 2020). The coastal sage scrub and wedgeleaf ceanothus-California sagebrush communities, which together cover a total of 102 acres (36%) of the MDER, are considered to provide primary habitat for Morro shoulderband snail (McGraw 2020). These communities largely occur in the northern portion of the Bayview Unit, and western portion of the Pecho Unit. The Morro manzanita-wedgeleaf ceanothus community, which covers an additional 63 acres (23%) of the MDER, is considered secondary habitat for Morro shoulderband snail, which is anticipated to occur there at lower frequency and/or abundance than in the primary habitat. This habitat extends south into the Bayview Unit (Figure 9) and occurs throughout

all but the southeastern corner of the Pecho Unit (Figure 10). The northern portion of the Bayview Unit was identified as critical habitat for the endangered mollusk (USFWS 2001).

2.6.4 Morro Bay Kangaroo Rat

2.6.4.1 Species Background

The Morro Bay kangaroo rat (*Dipodomys heermanni morroensis*) is a small, nocturnal, fossorial rodent endemic to the Baywood fine sands ecosystem centered on the community of Los Osos. Within its range, which was estimated at less than five square miles, habitat for the species includes compacted sandy soils with slopes of less than 15 degrees, supporting a range of vegetation types (Gambs and Holland 1988).

Optimal habitat for Morro Bay kangaroo rat appears to be early-successional stages of coastal sage scrub, which are characterized by scattered subshrubs and shrubs less than three feet tall, interspersed with herbaceous plants and bare ground. Characteristic plant species of Morro Bay kangaroo rat habitat include sandcarpet (*Cardionema ramosissimum*), wedgeleaf ceanothus, western thistle (*Cirsium occidentale*), California croton (*Croton californicus*), seacliff buckwheat, wedgeleaf horkelia, deer weed, and grasses (Roest 1973, Gambs and Holland 1988).

Morro Bay kangaroo rats are solitary, and inhabit burrow systems that they use for nesting, escape, and caching seeds, which constitute their primary food source. Predators likely include snakes, owls, bobcat (*Lynx rufus*), coyote (*Canis latrans*), domestic cat (*Felis catus*) and domestic dog (*Canis lupus familiaris*); the domestic animals enter habitat from adjacent residential areas (USFWS 2011b).

Morro Bay kangaroo rat is listed as endangered under the CESA and the ESA; the species is also fully protected under the California Fish and Game Code. Listed as federally endangered in 1970 (USFWS 1970), Morro bay kangaroo rat has not been observed in the wild since 1986 despite several surveys. The last observed occurrence was within habitat currently within the Bayview Unit of the Morro Dunes Ecological Reserve (USFWS 2011b). The species may still be present below detectable levels; alternatively, it may have gone extinct (USFWS 2011b). Observations of potential signs that may be evidence of the species (e.g., burrow entrance shaped like an upside down “U” with a runway, tail drag mark, surface seed pit cache) from 2008 to 2011 suggest that some isolated colonies may persist in pockets of suitable habitat (USFWS 2011b). The species may persist on several large, privately owned parcels featuring potentially suitable habitat, including two where the species previously occurred, where surveys could not be conducted (USFWS 2011b).

Declines in the population of this species are attributed to habitat loss, degradation, and fragmentation caused primarily by development within the Los Osos and Baywood Park communities; habitat has also been degraded and fragmented by fire exclusion, which converts early-successional coastal sage scrub habitat to later successional communities that lack the preferred food plants and perhaps other important structural components of their habitat. Declines may have also resulted from predation by domestic cats and use of rodenticides (USFWS 1999, USFWS 2011b).

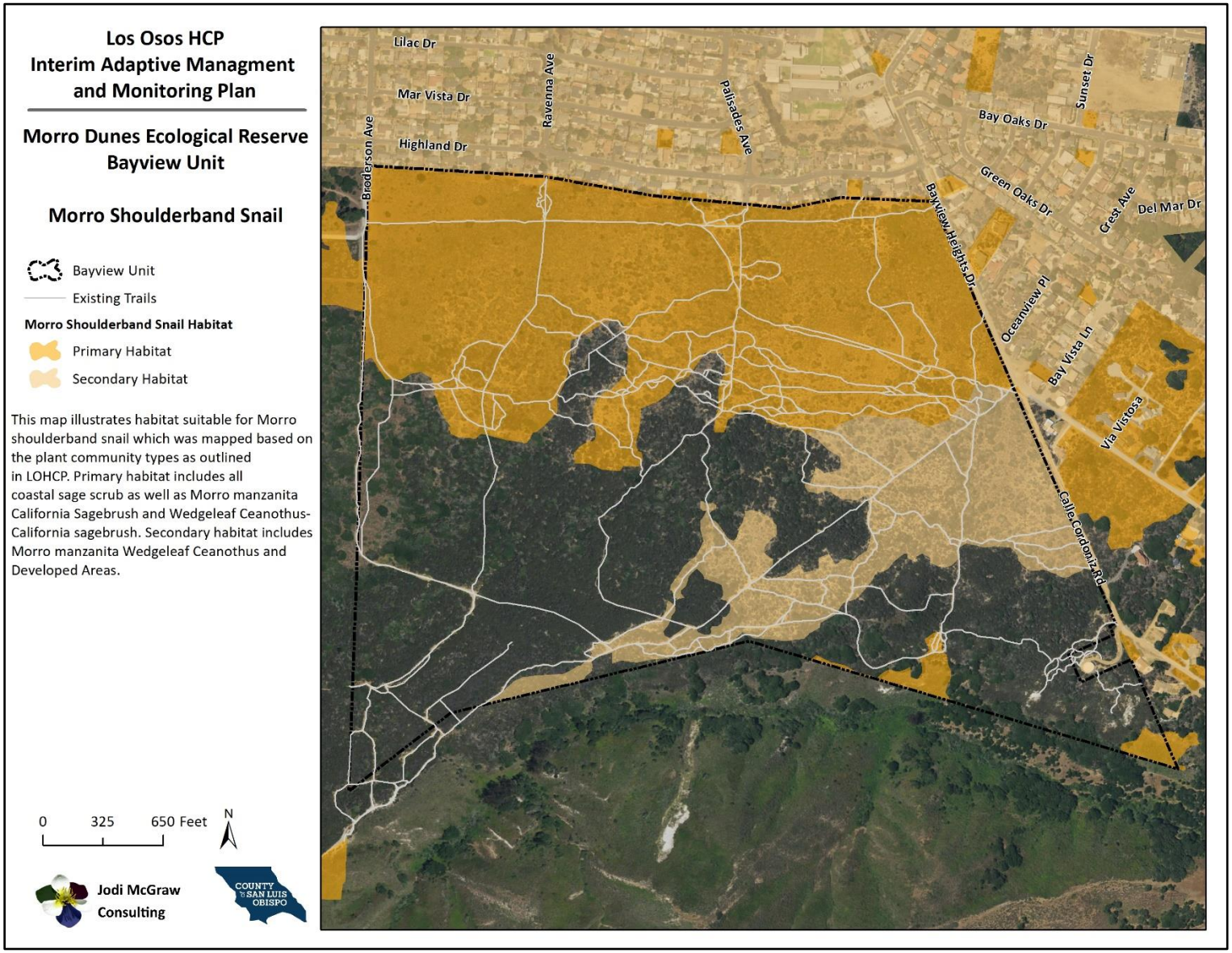


Figure 9: Morro shoulderband snail habitat in the Bayview Unit of the Morro Dunes Ecological Reserve

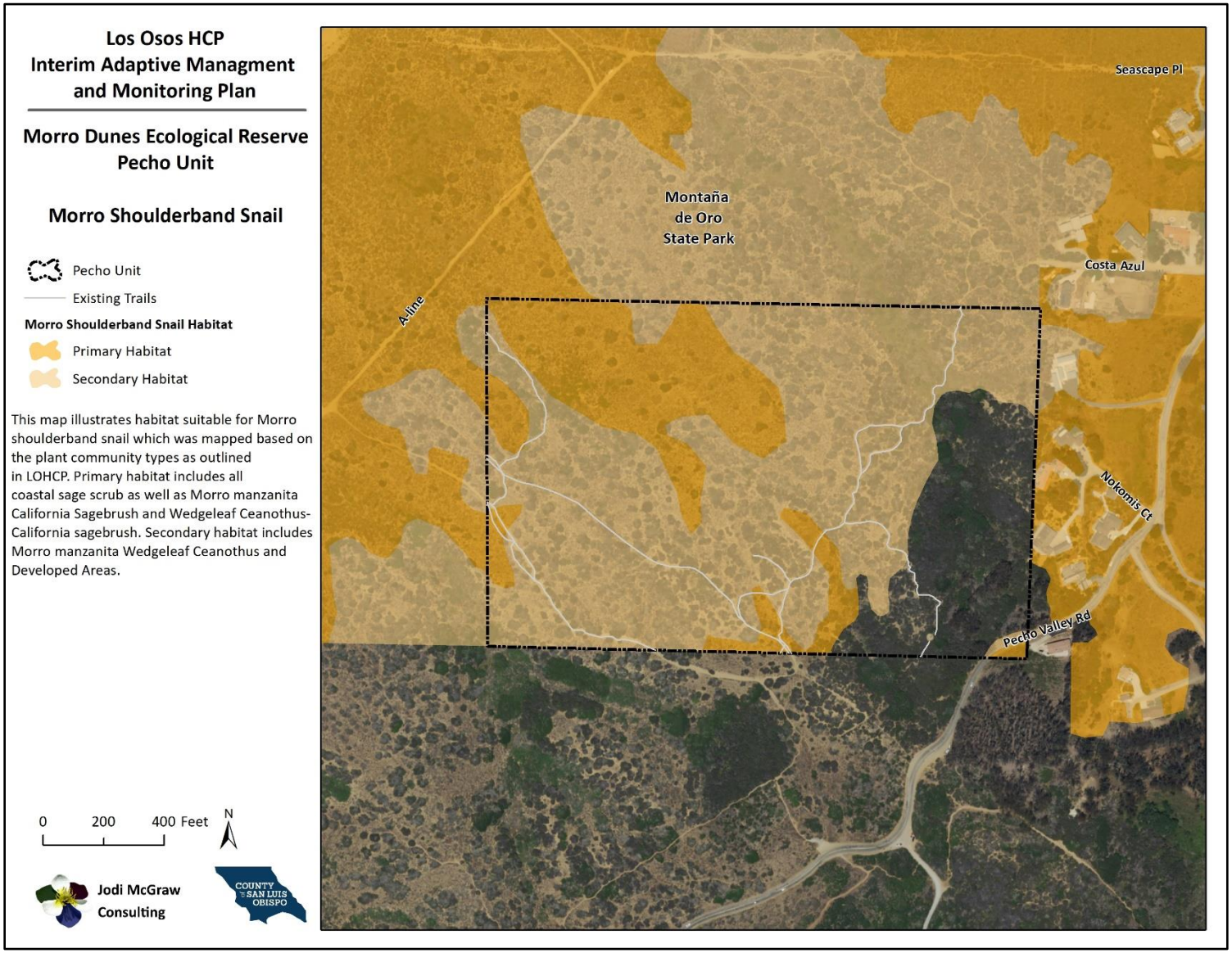


Figure 10: Morro shoulderband snail habitat in the Pecho Unit of the Morro Dunes Ecological Reserve

2.6.4.2 Occurrences within the MDER

The MDER provides suitable habitat remaining for Morro Bay kangaroo rat. Most notably, the more open associations of maritime chaparral and coastal sage scrub located away from adjacent development and associated threats (e.g., domestic pets) provide suitable habitat. The species was not observed during protocol surveys conducted at the site in 2009 (Villablanca 2009). While scent dogs trained to detect Lompoc kangaroo rat (*Dipodomys heermanni arenae*) gave two 'alerts' during searches in 2016, Morro Bay kangaroo rat was not detected in the belt/camera stations that were operated from 12 non-consecutive weeks. Nonetheless, the species may exist at the MDER at below detectable levels.

2.7 Stressors

The natural communities and rare species of the MDER, including the four covered species, are impacted by exotic plants and incompatible recreational use and associated erosion. The following describes the available information about these factors and their likely impacts.

2.7.1 Exotic Species

The MDER features several plant species that are not native to California. These exotic species can compete with native plants, and alter plant community structure and species composition in ways that degrade habitat for native animals (Table 4). The exotic plants discussed here are divided into two main groups: ornamental species and invasive species.

2.7.1.1 Ornamental Species

The northern portion of the Bayview Unit features patchy occurrences of ornamental plants that escaped from adjacent backyards along Highland Drive or in some cases, were deliberately planted into the area behind the houses. These ornamental species include pines (*Pinus* sp.), cypresses (*Hesperocyparis* or *Cupressus* sp.), agave (*Agave* sp.), yucca (*Yucca* sp.), and daffodil (*Narcissu*s sp.), though a comprehensive survey of the site would likely identify additional species. Some of these plants, including the agave, appear to be spreading (i.e., naturally recruiting).

2.7.1.2 Invasive Species

The MDER also features exotic plant species that have become established in natural areas and reproduce and spread on their own. These naturalized plants include some invasive plants, which spread quickly and cause impacts to natural systems. The main invasive plants know to occur in the site are listed in Table 5; a targeted survey of the site would likely reveal occurrences of additional exotic species including other invasive species.

The following sections describe five invasive plants that are of particular concern for management in the MDER, owing to their impacts on the covered species and other rare species, as well as native biodiversity in the reserve: veldt grass, freeway iceplant, narrowleaf iceplant, jubata grass, and eucalyptus. Section D.1 of the LOHCP provides additional information about these and other exotic plants and their management within the LOHCP Preserve System.

Table 4: Impacts of exotic plant species within the Bayview Fine Sands Ecosystem

Impact	Description	Implication for LOHCP Preserve System
Outcompete Native Plants	Exotic plants can deplete soil moisture and nutrients, shade-out native species, and compete for limited space	Exotic herbs (grasses and forbs) complete with native herbs, subshrubs, and shrubs and reduce native plant species richness and abundance. They can reduce establishment of the two covered plant species.
Create Thatch and Litter	Exotic plants can create dense thatch (dried herbaceous biomass) and litter (leaves from shrubs and trees) on the soil surface, which can inhibit establishment of native plants physically and also chemically (allelopathy). Thatch and litter also alter conditions for native animals.	Veldt grass creates persistent, dense thatch while eucalyptus creates thick litter from leaves and bark. These materials inhibit native plant establishment and may play a role in limiting Morro shoulderband snail use of eucalyptus stands (Walgren and Andreano 2012).
Alter Community Structure and Species Composition	Exotic plants alter the structure of native communities, and in doing so, can degrade habitat for native animals including by reducing availability of food and shelter.	Exotic grasses convert shrub-dominated communities including coastal scrub and maritime chaparral to grasslands, while invasive trees like eucalyptus can convert shrublands to forests. These type changes degrade habitat Morro shoulderband snail and Morro Bay kangaroo rat, which can also be impacted by loss of food (i.e., preferred host plants) and shelter.
Promote Fire	Invasive plants can create fuel conditions that promote fire, which can kill native woody species that are not adapted to fire. Fires that kill woody species can result in type-conversion of shrublands to grasslands as part of a grass-fire cycle (D'Antonio and Vitousek 1992).	Veldt grass creates fine fuels that promote fire in shrublands where widely spaced native shrubs and sparse herbs typically will not sustain fire. Grass-fire cycles can convert shrublands to grasslands. Eucalyptus creates dense fuels that can also promote fire (NPS 2006).

Table 5: Invasive exotic plants known to occur within the MDER

Common Name	Scientific Name	CalIPC Ratings[1]
eucalyptus	*Eucalyptus camaldulensis* and *E. globulus*	Watch-Limited[2]
veldt grass	*Ehrharta calycina*	High
freeway iceplant	*Carpobrotus edulis*	High
narrowleaf iceplant	*Conicosia pugioniformis*	Limited
jubata grass	*Cortaderia jubata*	High
red brome	*Bromus madritensis* ssp. *rubens*	High
rip gut brome	*Bromus diandrus*	Moderate
Saharan mustard	*Brassica tournefortii*	High
wild oats	*Avena* spp.	Moderate

[1]California Invasive Pest Plant Council Inventory (2020) Ratings

High – Severe ecological impacts on physical processes, plant and animal communities, and vegetation structure.
Moderate – Substantial and apparent, but generally not severe, ecological impacts on physical processes, plant and animal communities, and vegetation structure.
Limited – Invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score.
Watch – Pose a high risk of becoming invasive in the future in California.

[2] The range reflects the range of ratings for species in this genus

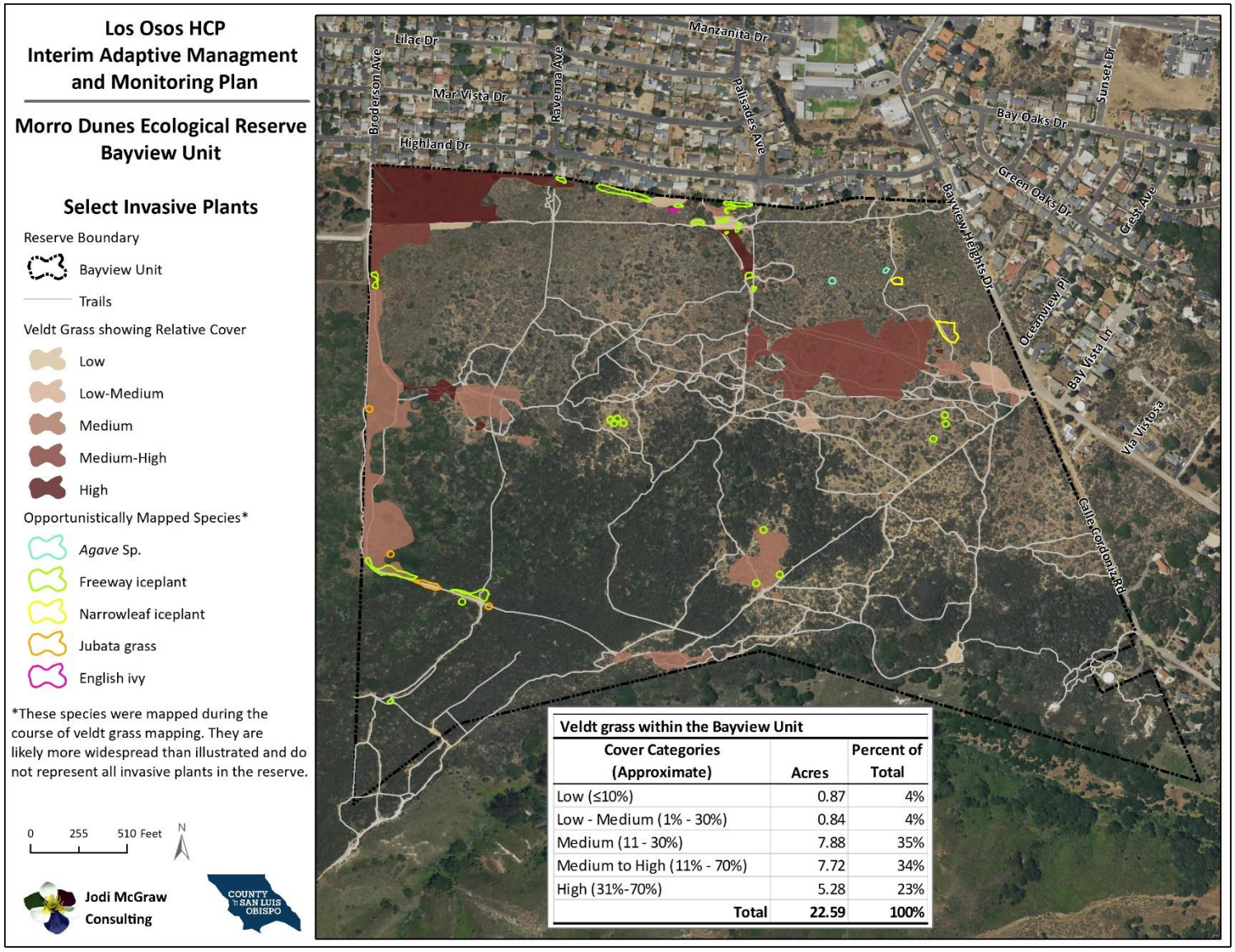
2.7.1.2.1 Veldt Grass

Veldt grass (*Ehrharta calycina*) occurs patchily within the MDER, where its distribution and abundance appear to reflect two primary factors: 1) plant community, and 2) disturbance history. Veldt grass is most widespread and abundant within the California Sagebrush-Black Sage series, and varies in abundance from less than 10% to 70% absolute cover in the Bayview Unit where the species was generally mapped as part of this project (Figure 11). The denser veldt grass patches appear to be associated with areas of soil disturbance, including prior land clearing and recreational use.

Veldt grass is patchily abundant in the Pecho Unit, where it was not mapped to prepare this plan which instead focused on informing initial exotic plant management, which was prioritized in the Bayview Unit (Section 3.1.1).

In the central maritime chaparral, veldt grass is primarily restricted to recreational trails and other gaps in the otherwise dense shrub and tree canopies. Current abundance is very low in these areas; however, future disturbance including fire has the potential to greatly enhance veldt grass distribution and cover in the Morro manzanita stands.

Dense infestations of veldt grass appear to inhibit native plants likely through competition for limited soil resources. Areas with dense (>50% cover of) veldt grass often have few native species occurring in very low abundance (J. McGraw, pers. obs.). These tussock-dominated fields provide very different habitat conditions than uninvaded coastal sage scrub, which is dominated by shrubs and forbs, and thus



Veldt grass within the Bayview Unit

Cover Categories (Approximate)	Acres	Percent of Total
Low (≤10%)	0.87	4%
Low - Medium (1% - 30%)	0.84	4%
Medium (11 - 30%)	7.88	35%
Medium to High (11% - 70%)	7.72	34%
High (31%-70%)	5.28	23%
Total	**22.59**	**100%**

Figure 11: Veldt grass and other invasive plants in the Bayview Unit of the Morro Dunes Ecological Reserve

a)

b)

c)

d)

e)

f)

Figure 12: Images of Stressors to the MDER, showing: a) patch of veldt grass featuring high cover in the Bayview Unit, b) patch of freeway iceplant mixed with veldt grass in the Bayview unit, c) patch of Agave sp. in the Bayview Unit, d) excessively wide trail in the Bayview Unit, e) incised and eroded trail in the Bayview Unit, and f) a stand of eucalyptus in the Pecho Unit. Photographs by Jodi McGraw.

alter conditions for native animals. Veldt grass is credited with transforming shrublands (i.e. maritime chaparral, coastal sage scrub) into grasslands through the grass-fire cycle (Pickart 2000).

A recent analysis of Morro shoulderband snail habitat in the Los Osos area found that the highest number of Morro shoulderband snail occurrences were in veldt grass, although the authors reported that a high count on one of the nine surveyed parcels skewed these results (EcoVision Partners 2019. Though the study confirmed that the Morro shoulderband snail occupies veldt grass areas, it did not compare the frequency or density of Morro shoulderband snails in areas with and without veldt grass, nor did it compare the abundance of veldt grass in areas with and without Morro shoulderband snail, as would be required to establish a preferential occurrence of the rare species in veldt grass-dominated areas. Despite the high abundance of Morro shoulderband snail in veldt grass areas, the authors concluded that invasive plants are a threat to the species and recommended their control to promote Morro shoulderband snail populations (EcoVision Partners 2019). Species protection measures will be used to help minimize the short-term negative effects of exotic plant control efforts on the species, while promoting long-term benefits for the populations (Section 3.3).

Veldt grass has been successfully controlled in other areas in Los Osos including in the Broderson and Midtown sites as part of the County's Wastewater Project, using a combination of herbicide and manual control methods (County of San Luis Obispo 2019).

2.7.1.2.2 Iceplants

The MDER features freeway iceplant (*Carpobrotus edulis*) and narrowleaf ice plant (*Conicosia pugioniformis*). Though primarily occurring in the California Sagebrush-Black Sage series, particularly near areas of disturbance such as trails, old roads, and adjacent residential development, freeway iceplant is also found in gaps in the shrub canopy created by trails in the Morro manzanita chaparral. Like veldt grass, the invasive iceplant species can spread following disturbance (e.g., fire), outcompete native shrubs and herbs, and degrade habitat for native animals.

Owing to their rapid lateral growth, in which shoots can grow 1m/year (D'Antonio 1990b), the long-lived freeway iceplant can form large, impenetrable mats that compete with native seedlings (D'Antonio 1993) and reduce shrub growth (D'Antonio and Mahall 1991). Freeway iceplant can also lower soil pH and increase soil organic matter (D'Antonio 1990a), and in doing so, can increase the invasibility of sandy soils such as the Baywood fine sands (Albert 2000).

Though shorter-lived than freeway iceplant, narrowleaf iceplant readily colonizes disturbances and gaps and grows very rapidly, allowing it to compete with native plants for space and resources. Narrowleaf iceplant may similarly alter soil conditions and facilitate invasion, though this has not been examined (Albert and D'Antonio 2000).

Morro shoulderband snail can also occur, sometimes in high abundance, in areas of degraded habitat, including areas invaded by iceplant (SWCA 2013). Nonetheless, invasive plants have been deemed a threat to the species and their control is recommended to promote Morro shoulderband snail populations (EcoVision Partners 2019). Species protection measures will be used to help minimize the short-term negative effects of exotic plant control efforts on the species, while promoting long-term benefits for the populations (Section 3.3).

2.7.1.2.3 Jubata Grass

Jubata grass (*Cortaderia jubata*) has established small, isolated patches within the Bayview Unit, where its distribution appears limited to trails and other areas of recreation-caused disturbance in the maritime chaparral assemblages on the southern half of the unit (Figure 11). The species was not detected in the Pecho Unit though could be found during future surveys.

Jubata grass is an extremely large bunchgrass that can outcompete native shrubs and herbs within maritime chaparral and coastal sage shrub, creating virtual monocultures. It is a prolific seed producer, creating up to 100,000 mature seeds per individual inflorescence, and windborne seed can disperse large distances (>20 miles; DiTomaso 2000). The distribution and abundance of jubata grass within the MDER may be limited by lack of appropriate conditions for seedling establishment, which appear to be created by disturbance including trail use and attendant erosion. As a result, future disturbances that remove established plants, including fires or activities associated with management, such as fuel management, may enhance the distribution and abundance of this plant.

2.7.1.2.4 Eucalyptus

The southeastern portion of the Pecho Unit features an approximately 0.84-acre stand of eucalyptus (Figures 6 and 12f); additional trees occur in the County road right of way and private parcels to the east. The eucalyptus trees appear to have spread into the reserve from the plantation south of Pecho Valley Road. The stand within the reserve features 26 trees that between approximately 12” and 36” diameter at breast height (DBH) and are approximately 60-100 feet tall. There are also numerous felled trees, many of which have resprouted from their cut stumps. According to CDFW, staff are not aware of any permitted eucalyptus control projects on the property and suspect that the trees were cut as part of utility line clearance projects or by neighbors seeking to maintain coastal views (D. Hacker, pers. comm. 2020). The stand also features several newly established trees that are less than 12” DBH and less than 40 feet in height. Within the 0.84-acre area, there are also two pines (*Pinus* sp.) that are likely non-native, ornamental species, though a positive identification could not be made with the material available during the assessment.

The eucalyptus established within an area of Morro manzanita chaparral (Figure 6). Native plants within the stand are patchily abundant and include Morro manzanita, coast live oak, black sage, California sagebrush, sticky monkeyflower, coyote brush, poison oak, and hedge nettle (*Stachys bullata*).

The large exotic trees compete with the native plants, including Morro manzanita, for light and soil resources. Several snags of Morro manzanita occur on the perimeter of the grove as well as the interior, where shrubs appear to be dying due to competition. The trees also produce a dense layer of litter (leaves, bark, and small limbs) on the soil surface, which can inhibit establishment of native plants. Eucalyptus litter and roots feature phenolic acids and volatile oils that have deleterious effects on other plants species (Molina et al. 1991, Sasikumar et al. 2002, Florentine and Fox 2003). Through these mechanisms, eucalyptus reduce the diversity and cover of native plants, and alter habitat conditions for native animals, including Morro shoulderband snail which was negatively associated with eucalyptus (Walgren and Andreano 2012). In addition, eucalyptus fuels increase the risk of wildfire (Tyler and Odion 1996, NPS 2006, Rejmanek and Richardson 2011).

Eucalyptus stands can provide roosting sites for overwintering monarch butterflies (*Danaus plexippus*; Frey et al. 2003). In order to provide suitable overwintering sites, the stands must feature a microclimate that includes (Griffiths and Villablanca 2015):

- temperatures that are above freezing (Calvert et al. 1983) but not too warm (Alonso-Mejia et al. 1997);
- low light intensity and solar radiation, with high water vapor pressure (Leong et al. 1991);
- wind speeds lower than 2 m/s (Leong 1990); and,
- access to fresh water, sometimes via streams or puddles but often in the form of fog drip or morning dew (Tuskes and Brower 1978).

Landscape factors, as well as tree canopy conditions including height, density, branch configuration, and type of foliage, will determine the microclimate and thus suitability of a stand. These characteristics have not been evaluated for the Pecho eucalyptus stand; however, its narrowness and overall small size suggest it may not be sufficiently sheltered from the wind. Neither the Pecho Unit stand nor the adjacent stand south of Pecho Road within Montana De Oro State Park are identified as known overwintering sites by the Xerces Society (Xerces Society 2020). Nonetheless, a stand assessment and survey would be needed to evaluate suitability of the site and its use by monarchs, respectively.

Eucalyptus stands can also provide habitat for nesting birds including raptors. Tree removal in Los Osos requires a coastal development permit from the County of San Luis Obispo and can be opposed by some members of the public.

2.7.2 Incompatible Recreational Use and Erosion

The MDER has been and is subject to a variety of recreational uses, including:

- Off-highway vehicle use, both by motorcycles and four-wheeled vehicles (quads, jeeps);
- Mountain biking;
- horseback riding;
- dog walking; and
- hiking.

Additionally, some neighbors along Highland Drive have set up recreational equipment in the portions of the reserve behind their houses. The site may also be subject to occasional camping.

Hiking and dog walking (on a leash of no more than 10 feet) are allowed under CDFW regulations that govern management of the reserve, while the California Code of Regulations, Title 14, Sections 550 and 630, prohibits bike riding, horseback riding, off-highway vehicle use, and camping.

As with other disturbances, recreation uses can impact habitat and sensitive species. Trail users can impact the rare plants directly by cutting their branches to create or maintain trails, as have been created through dense stands of Morro manzanita as well as the only known remaining occurrences of Indian Knob mountainbalm. Such pruning can reduce survivorship and reproduction, including seed production as well as vegetation reproduction in the case of Indian Knob mountainbalm. Trail use and

other recreation can trample Morro shoulderband snail directly, as well as degrade habitat by removing native vegetation which the species uses for cover and food. Recreation can similarly impact Morro Bay kangaroo rat habitat by reducing plants used for food and habitat, as well as trampling potential burrows.

The intensity of recreation impacts depends on the characteristics of the recreational use and the habitat in which it occurs. In general, the impacts are proportional to the intensity of the recreation, with off highway vehicles (OHVs) having greater impacts than equestrians which have greater impacts than pedestrians. However, all types of recreation cause disturbance, which removes native plant cover, reduces habitat available to native animals, causes erosion, and enhances the invasion and spread of exotic plants.

Recreational use has resulted in a proliferation of trails within the Bayview Unit, which adjoins residential development on two sides (Figure 3). Most of these trails were neither planned nor constructed in a manner that would reduce the need for maintenance and associated costs due to the perhaps inevitable erosion in sandy soils (USDA 1984). As a result, many of the trails have become incised especially on long, straight trail segments with moderate to steep grades such as the ones that run straight up and down slope (i.e., north to south; Figure 12e). Such trail segments channel water which erodes the trail bed. Eroded trail segments are common on steeper slopes in the southern portion of the two units.

The trails were also not planned nor constructed in consideration of the sensitive species and communities of the Baywood Fine Sands. As a result, they traverse areas supporting endangered species populations. In the central maritime chaparral community, recreational users maintain the trail by actively cutting shrubs such as Morro manzanita and perhaps also Indian Knob mountainbalm, as one of the two occurrences is located along a trail. In areas lacking dense shrub cover, trails become excessively wide; several trail segments in the coastal sage scrub exceed 30 feet in width. Such denuded areas deter use by Morro shoulderband snail and may inhibit the species movement through the site

2.8 Existing Management

Lands within the MDER were designated by the California Fish and Game Commission as an ecological reserve. Section 1580 of the Fish and Game Code states that ecological reserves are established to protect threatened or endangered native plants, wildlife, or aquatic organisms or specialized habitat types, both terrestrial and nonmarine aquatic, or large heterogeneous natural gene pools for the future use of mankind.

The CDFW manages ecological reserves including the MDER to protect and enhance its unique biological resources while providing the public with compatible, wildlife-dependent educational and recreational opportunities. Management is consistent with the California Code of Regulations (CCR) Title 14, Chapter 11, Sections 550 et seq., which includes general provisions for all ecological reserves, and Section 630, which does not contain any specific provisions for the MDER. Regulations for the MDER provide that wildlife viewing, hiking, and dog walking are permitted, provided that dogs are on a leash of no more than 10 feet; however, equestrian use, mountain bikes, hunting, and camping are prohibited, as is the removal of plants. Activities outside of those described in the regulations may be permitted through the CDFW special-use permit process.

The CDFW develops land management plans to:

- Serve as a descriptive inventory of fish, wildlife, and native plant habitats that occur on or use the property;
- Guide management of habitats, species, and programs described in the LMP to achieve the Department's mission to protect and enhance native wildlife for their ecological value and enjoyment by the public;
- Serve as a guide for appropriate public uses for that property;
- Provide an overview of the property's operation, maintenance, and personnel requirements to implement management goals and to serve as a planning aid for annual budget preparation; and
- Present the environmental documentation necessary for compliance with state and federal statutes and regulations, provide a description of potential and actual environmental impacts that may occur during plan management, and identify mitigation measures to avoid or lessen these impacts.

In 1982, CDFW developed a management plan for the MDER that describes the Pecho Unit, which was the only land included in the reserve at the time; the Bayview Unit was added beginning in 2000 and the LMP has not yet been updated to incorporate the new unit (Section 2.4.1). The LMP may be updated at a later date; however, there are no current plans to update the MDER LMP (R. Stafford, pers. comm. 2020).

The LMP for the Pecho Unit recommends the following actions, which are listed in order of priority (CDFW 1982):

1. Complete a flora and invertebrate survey by competent biologists;
2. Delineate the most important habitat areas for habitat enhancement for Morro Bay kangaroo rat;
3. Delineate the areas critical for protection of the banded dune snail (Morro shoulderband snail) and various endemic plants, so they can be left ‘as is’;
4. Conduct periodic monitoring of the efficacy of the management practices, including population sampling for the kangaroo rat; and
5. Meeting twice a year with the State Parks, the USFWS, and Cal Poly staff to review the progress of management and determine the course of future management efforts.

Management of ecological reserves including the MDER is implemented as funding and other resources allow; CDFW does not have a requirement to implement LMPs. The existing management of the MDER is limited to occasional reconnaissance-level site visits by CDFW Environmental Scientists to examine site conditions and activities, and law enforcement actions conducted by CDFW Wardens in response to illegal activities detected by CDFW staff or reported by the public.

The CDFW has installed signs on the perimeter of both MDER units to identify the land as being in a state ecological reserve; however, on some boundaries the signs are too widely spaced to enable law enforcement to implement enforcement for violations of the provisions governing activities on the lands (D. Hacker, pers. comm. 2020). Due to lack of funding and other resources, CDFW does not implement ongoing habitat management to address the stressors to the covered species, nor does it monitor their

populations or habitat conditions. As staff time and other resources allow, CDFW does implement occasional additional biological resources management tasks, such as when biologists salvaged and relocated Morro shoulderband snails from burn piles in the fuel break prior to their ignition in February 2020 (D. Hacker, pers. comm. 2020).

Recognizing these unmet management needs of the MDER, which features large areas of habitat that is essential to the long-term persistence and recovery of the covered species, the LOHCP identified the MDER as an important existing protected habitat area to be included in the LOHCP Preserve System (LOHCP Section 5.3.3.1). Enhanced management, restoration, and monitoring of lands within the MDER will promote achievement of the LOHCP Biological Goals and Objectives (LOHCP Section 5.1), including to Increase the distribution and abundance of the covered species by restoring degraded habitat. As part of a prior analysis detailed in Appendix G of the LOHCP, the Department determined that enhanced management and restoration of lands within the MDER is consistent with the Department's Mitigation Policy Guidelines as well as the agreements associated with grants used to fund acquisition of the reserve lands (McGraw 2020).

The LOHCP requires that landowners who elect to enroll existing protected lands into the LOHCP Preserve System continue to manage, restore, and monitor lands at the same level of effort (or greater) as occurred prior to their enrollment (LOHCP Section 5.3.3.1). This maintenance of effort requirement ensures that the enhanced management, restoration, and monitoring activities implemented on existing protected lands will have additional benefits for the covered species populations and habitat, and thus can be credited for compensatory mitigation under the LOHCP. Enrollment of existing protected lands in the LOHCP Preserve System does not result in habitat protection credits, which instead are only generated with acquisition of fee title or conservation easements for habitat protected through the plan (LOHCP Section 5.3.2).

For purposes of the maintenance of effort requirement of the LOHCP, CDFW will continue to implement occasional site visits and conduct law enforcement activities as outlined above. The benefits for the covered species of the enhanced habitat management, restoration, and monitoring described in the following sections of this IAMMP will be eligible for compensatory mitigation credits as outlined in Section 5.7.2.3.1 of the LOHCP.

3 Habitat Restoration

This section describes how habitat restoration will be conducted in the MDER as part of the LOHCP conservation program during the initial phase of its implementation. Section 3.1 outlines the general approaches to the initial restoration, including the projects selected, their anticipated benefits, implementation steps, and general approaches to restoration including revegetation. Section 3.2 describes the three proposed restoration projects, eucalyptus removal (Section 3.2.1), veldt grass control (Section 3.2.2), and trail restoration (Section 3.2.3), which were identified as the initial priorities for restoration (Section 3.1.1). Section 3.3 describes the species protection measures that will be implemented to reduce the short-term negative impacts of the restoration projects on the covered species.

3.1 Approaches

This section provides general information about the restoration projects proposed in this plan, including: 1) how they were selected, 2) their anticipated benefits for the covered species and natural communities, 3) the phases of project implementation, and 4) general approaches to conducting restoration.

3.1.1 Project Selection

Three main actions are proposed to be implemented in the MDER to restore and enhance habitat as part of this Interim Adaptive Management and Monitoring Plan for the Los Osos Preserve System:

1. **Removing the stand of eucalyptus in** the Pecho Unit, and restoring the estimated 0.84 acres of habitat that has been degraded by the invasive trees (Figures 6 and 12f);
2. **Controlling veldt grass and co-occurring invasive plants** and restoring natural community structure and species composition in an approximately 22.6-acre area within the Bayview Unit (Figure 11); and
3. **Restoring trails** by fencing and signing trails to close excess routes and confining use of excessively wide trails to the central area, to promote native plants establishment and use by native animals within an estimated 4.3 acres of habitat within the Bayview Unit (Figure 12).

Implementation of these high-priority projects early during management of the LOHCP Preserve System will reduce the ongoing negative impacts associated with the continued invasion and spread of eucalyptus and veldt grass, and the ongoing proliferation of trails and the resulting habitat degradation that results, including erosion and spread of exotic plants.

These three initial actions were identified through consideration of the following:

1. examination of the site conditions, as described in Section 2, to identify opportunities to promote populations of the covered species and achieve the LOHCP goals and objectives for the broader ecosystem and communities and also limit the potential for future negative impacts associated with anthropogenic stressors;
2. consideration of the anticipated mitigation needs of the LOHCP and the funding that will be available through implementation of the plan during the initial phase covered by this interim plan (LOHCP Section 7.2.4).

During implementation of this plan, the County will work with its restoration and habitat management partners, including the LOHCP Implementing Entity, if/when appointed, biologists and restoration ecologists with expertise in this system, and the wildlife agencies, to select and implement one or more of the proposed restoration projects. The final project selection will be based upon: 1) the ecological benefits of the project, 2) the financial costs of the project, 3) the anticipated mitigation credits that would be generated, 4) the mitigation needs of the activities to be covered by the LOHCP, and 5) the funds available for mitigation based on the LOHCP mitigation fees and other sources.

If County mitigation needs and/or funding are insufficient to implement all of projects identified in this IAMMP, remaining projects will be addressed in the AMMP. Conversely, if the County has additional mitigation needs and/or additional resources available, it will expand its work as part of the IAMMP to initiate trail restoration and access management in the Pecho Unit.

3.1.2 Anticipated Benefits

Table 6 outlines the anticipated benefits of the proposed restoration projects for the covered species and communities, based on the ecology and life histories of the covered species and the known and hypothesized impacts of exotic plants and trail use on their populations. More detailed information including literature citations for the impacts of recreation and invasive plants and the benefits of their management are provided in Appendix D of the LOHCP, while Appendix B provides additional detailed information about the covered species life histories and ecologies used to prepare this analysis.

3.1.3 Project Implementation Steps

Restoration is anticipated to be implemented over a five-year period through the following process:

1. Develop a project work plan for each restoration project, that identifies the final treatment areas, and outlines the final treatment prescriptions based on the goals, objectives, proposed methods, and general approaches outlined in this IAMMP. The work plan can identify adjustments to the projects, relative to what is provided in this plan, provided that the modifications enhance effectiveness of the project at achieving its goals and objectives, are in keeping with the overall approaches of the plan, and are acceptable to the wildlife agencies, which will review and approve the work plan prior to implementation.
2. Implement initial restoration treatments, conduct monitoring to track conditions and evaluate performance, and inform the need for remedial actions and adaptive management, which will be described in annual work plans that are reviewed and approved by the wildlife agencies each year; and
3. Monitor effectiveness of the projects at achieving the quantitative objectives based on established performance criteria, and calculate the mitigation credits based on the acreage of habitat that is achieving the performance criteria.

As with all aspects of management of the MDER for the LOHCP, the County (or its Implementing Entity) will collaborate with CDFW on all efforts to implement this plan to ensure it is in keeping with the Department's management of the reserve (Section 2.8). Work will also be coordinated on an annual basis with the USFWS to ensure it is meeting the goals and objectives as well as permit requirement of the LOHCP (Section 4.8).

Table 6: Anticipated Benefits of the IAMMP Restoration Projects

Community/Species	Eucalyptus Removal	Veldt Grass Control	Trail Restoration and Access Management
Coastal sage scrub and central maritime chaparral communities	• Increase the cover and richness of native plants, by reducing competition from eucalyptus, which create shade and litter that inhibit native plants. • Restore the structure and native species composition thus improving habitat conditions for animals that utilize the native communities. • Limit the further spread of eucalyptus into intact communities, where it would displace native plants and degrade habitat conditions for native animals. • Reduce the fuel load, which can increase the risk of canopy fire.	• Increase the cover and richness of native plants, by reducing competition from veldt grass and co-occurring invasive plant species. • Restore the structure and native species composition thus improving habitat conditions for animals that utilize the native communities. • Limit the spread of veldt grass into uninvaded communities, where it would displace native plants and degrade habitat conditions for native animals. • Reduce the accumulation of fine fuels created by veldt grass, which can increase the risk of fire.	• Increase the cover and richness of native plants by reducing trampling associated with recreation. • Restore the structure and native species composition of the plant communities and thus restore habitat conditions for animals that utilize them. • Reduce soil erosion that can occur when trails become channelized, particularly on steep slopes. • Limit the proliferation of unauthorized trails, which remove native plants, promote the invasion and spread of exotic plants, and degrade habitat for native animals. • Reduce human and wildlife interactions which can negatively impact some native animal species.
Morro Shoulderband Snail	• Remove an invasive tree that inhibits use of habitat by Morro shoulderband snail (Walgren and Andreano 2012). • Prevent the spread of eucalyptus into occupied	• Increase the cover and richness of native plants with which Morro shoulderband snail has evolved and to which it is adapted, and which can provide food and shelter.[1]	• Increase the cover and richness of native plants in areas denuded by trail use, thus increasing food and shelter and the overall area of habitat that can support the species. • Limit mortality caused by trampling of individuals by recreators. • Promote the permeability of habitat within the reserve by reducing the potential

Table 6: Anticipated Benefits of the IAMMP Restoration Projects

Community/Species	Eucalyptus Removal	Veldt Grass Control	Trail Restoration and Access Management
	coastal sage scrub habitat. • Reduce the risk of fire, which could cause Morro shoulderband snail mortality and temporary habitat loss.	• Reduce fragmentation caused by veldt grass which converts coastal sage scrub and early successional (i.e., open canopy) maritime chaparral to grassland	barrier created by wide, denuded trail corridors traversing the site.
Morro Bay Kangaroo Rat	• Remove an invasive tree that has converted suitable shrublands to likely unsuitable forests. • Prevent the spread of eucalyptus into adjacent suitable coastal sage scrub and maritime chaparral habitat. • Reduce the risk of fire, which could cause Morro Bay kangaroo rat mortality and temporary habitat loss.	• Increase the cover and richness of native coastal sage scrub plants with which Morro Bay kangaroo rat has evolved, but that are outcompeted by veldt grass, thus increasing availability of food and restoring appropriate plant community structure (open shrubland rather than grassland). • Reduce fragmentation of coastal sage scrub and early successional maritime chaparral by veldt grass, which creates grasslands	• Increase the cover and richness of native plants in areas denuded by trail use, thus increasing food and shelter and the overall area of habitat that can support the species. • Limit impacts to of humans and dogs on burrows through trampling and digging, and the species behaviors including foraging, if present. • Create more continuous cover of shrubs to address habitat fragmentation caused by the numerous, and sometimes wide trails.

Table 6: Anticipated Benefits of the IAMMP Restoration Projects

Community/Species	Eucalyptus Removal	Veldt Grass Control	Trail Restoration and Access Management
Indian Knob Mountainbalm	• Remove an invasive tree that has converted potentially suitable maritime chaparral to low-light forests that are not suitable. • Prevent the spread of eucalyptus into adjacent suitable maritime chaparral habitat.	• Reduce potential competition of Indian Knob mountainbalm with veldt grass and co-occurring invasive plants, which could reduce the rare plant's establishment, survivorship, and/or reproduction • Limit the spread of veldt grass into uninvaded areas to maintain suitable habitat and enable population expansion.	• Create opportunities for Indian Knob mountainbalm establishment and growth by closing trails in suitable or occupied habitat, where the rare plant can colonize open canopy areas created by disturbance. • Reduce the incidence of pruning of the rare shrub by recreators seeking to maintain trail corridors, which can reduce survivorship and reproduction. •
Morro Manzanita	• Remove an invasive tree that has converted maritime chaparral that is potentially suitable, to low-light forests that are not. • Prevent the spread of eucalyptus into adjacent suitable maritime chaparral habitat. • Reduce the risk of fire that would cause Morro manzanita mortality and temporary habitat loss and may not promote regeneration of the endangered shrub if it occurs outside of the natural fire regime (e.g.,	• Reduce competition of Morro manzanita with veldt grass and co-occurring invasive plants, which can reduce the rare plant's establishment, survivorship, and reproduction • Limit the spread of veldt grass into uninvaded areas to maintain suitable habitat and enable population expansion. • Reduce the accumulation of fine fuels created by veldt grass, which can increase the risk of fire which could reduce the population if insufficient seed bank has established (Odion and Tyler 2002).	• Create opportunities for Morro manzanita establishment and growth by closing trails through suitable habitat, where the rare plant may establish in areas of open canopy created by the prior disturbance, or where canopy expansion can occur in the absence of ongoing pruning. • Reduce the incidence of pruning of the rare shrub by recreators seeking to maintain trail corridors, which can reduce survivorship and reproduction. • Limit the proliferation of unauthorized trails, which can impact the existing population and degrade suitable habitat including by promoting the invasion and spread of exotic plants.

Table 6: Anticipated Benefits of the IAMMP Restoration Projects

Community/Species	Eucalyptus Removal	Veldt Grass Control	Trail Restoration and Access Management
	insufficient return interval, too intense, canopy fire, etc.)		

[1] While a recent study stated that the highest number of Morro shoulderband snail occurrences were in veldt grass, the study did not establish a preferential occurrence of the species in the invasive plant. Moreover, the authors concluded that invasive plants are a threat and recommended their control to promote Morro shoulderband snail populations (Section 2.7.1.2.1; EcoVision Partners 2019).

3.1.4 Restoration Approaches

Restoration under this plan will be implemented using general strategies and specific techniques that are collectively designed to restore natural community structure, species composition, and ecosystem functions and processes to the communities of the Baywood fine sands ecosystem. As described in the LOHCP, this systems approach is anticipated to achieve the biological goals for the covered species, communities, and Baywood fine sand ecosystem. Single-species management will be limited to that which found to be necessary to facilitate population persistence and promote recovery. Such management will be addressed the AMMP.

The MDER, as well as future lands restored and managed as part of the LOHCP, will be managed as natural landscapes, as opposed to other types of intensively managed systems (e.g., horticultural areas or parks). Under this approach, restoration and management will rely, wherever possible, on strategies that:

1. reduce the anthropogenic (human-induced) factors (pressures) that can degrade ecological conditions (stressors) directly or indirectly; and
2. harness the ecological potential of the natural systems, including species' adaptations to natural disturbances, to re-establish native species using restoration techniques that are minimally invasive and reduce human intrusion into the landscape.

This general approach to alleviating anthropogenic stressors and pressures and managing the landscape using natural disturbances and management techniques that mimic them, is designed to achieve the following objectives for the restoration program within the context of the LOHCP Conservation Program:

1. **Reduce the potential for unintended negative consequences** associated with more intensive or intrusive restoration treatments, which can inadvertently alter genetics, populations, species, and communities.
2. **Promote the effectiveness of the extensive LOHCP monitoring program** (Appendix E; McGraw 2020), which is designed to increase understanding of factors influencing the distribution and abundance of the covered species, and the structure and composition of natural communities that comprise their habitat, in order to inform their conservation and management. The ability of these and other observational studies to use natural species distribution and abundance patterns to evaluate their habitat needs and inform conservation and management will be limited where/ when restoration techniques directly manipulate species distributions (e.g., through planting or translocations).
3. **Reduce restoration costs** and thus free up inherently limited funds that can be used to enhance effectiveness of the LOHCP conservation strategy, including additional restoration and management projects. Generally speaking, more intrusive restoration techniques, including active revegetation (seeding and planting) are more labor intensive and thus expensive. Accordingly, their use should be limited to where needed to achieve the restoration goals.
4. **Minimize anthropogenic infrastructure** within the landscape to that which is necessary, both spatially and temporally. Recognizing that these elements will be necessary for certain projects and in certain locations, limiting the amount of fences, cages, irrigation lines, and other anthropogenic features will limit their potential negative effects on native plants and animals and also scenic qualities of the habitat.

3.1.5 Revegetation Methods

The objective to limit the intrusiveness of restoration and management have important implications for the methods that will be employed to achieve the desired community structure and species composition of natural communities. Wherever possible, revegetation will rely on passive rather than active means; where active revegetation is deemed necessary, the techniques will be as minimally intrusive as needed to achieve the goals and objectives, and will follow the guidelines in Section 3.1.5.2 to achieve the four objectives above.

The following outlines the revegetation framework for this plan, which will be used to develop work plans for the specific restoration projects. It reflects, in part, the decision tree illustrated in Figure 13 (Holl 2020), which illustrates an approach to planting and seeding only where and when needed to assist regeneration of early and/or late successional species. Additional considerations will be used to phase in seeding and/or planting as active revegetation techniques during implementation of this plan.

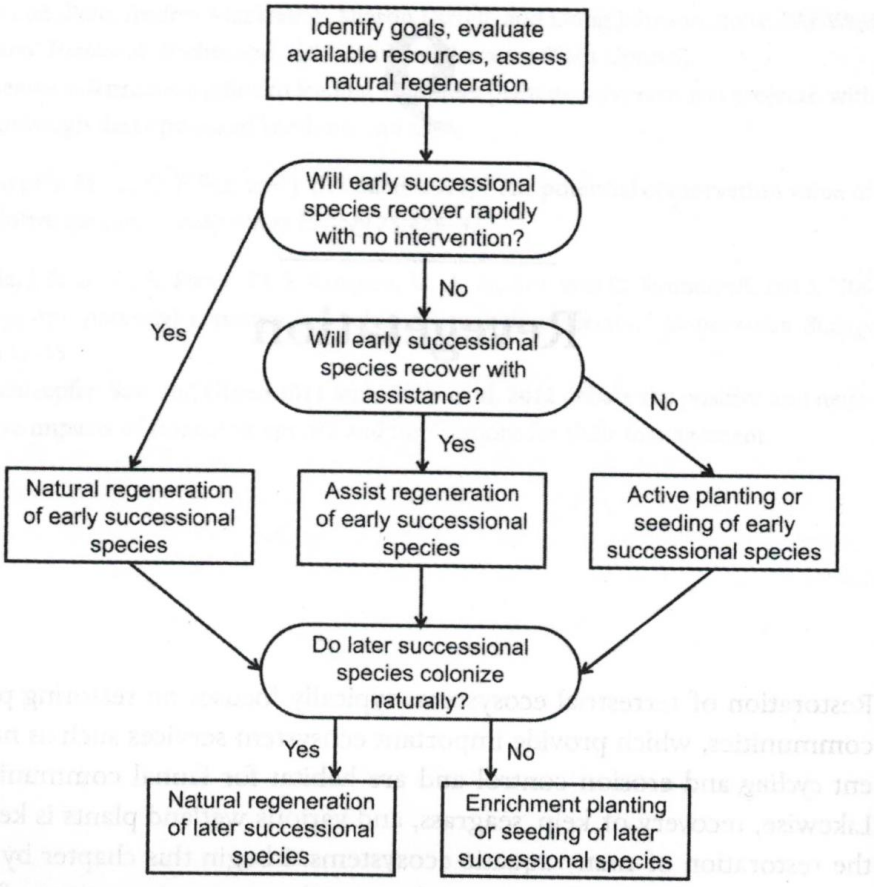


Figure 13: Decision tree for passive vs. active revegetation (Holl 2020).

3.1.5.1 Passive Revegetation

Passive revegetation, as defined for this plan, involves steps to recreate natural community structure and species composition by promoting the natural establishment and growth of native plants; it is

contrasted with active revegetation, which involves the introduction of native plants or their propagules through planting and seeding (Section 3.1.5.2). Passive revegetation differs from *passive restoration*, the process of recovery that occurs without active human intervention *at all,* which is often ineffective (Zahawi et al. 2014).

Passive revegetation promotes native plant establishment by: 1) reinstating or mimicking natural disturbance regimes, 2) restoring abiotic conditions that are limiting plant establishment, and 3) controlling exotic plant species (Holl 2020). In the case of this plan, passive revegetation involves addressing anthropogenic factors that limit native plant establishment and growth within the site: eucalyptus, veldt grass, and co-occurring invasive plant species, and incompatible trail use. These restoration techniques are desigend to allow native plant species within the site, many of which area adapted to disturbance (i.e., fire) and thus feature ecologies conducive to colonizing suitable sites, to expand their distributions into the areas that are currently denuded (trails) or support invasive plants.

This process of passive revegetation can help achieve all of the objectives of restoration in a natural landscape as outlined above. Specifically, passive restoration can:

1. Reduce potential for negative consequences associated with active revegetation, which can cause genetic erosion (i.e., break up locally adapted genetic complexes; Rogers and McGuire 2015), degrade habitat by inadvertently introducing exotic species and pathogens, or by inadvertently creating different community structure (e.g., denser shrubs) or species composition (wrong species palette) relative to what the native species, including the covered species, are adapted.
2. Avoid altering the structure and species composition of habitat in ways that will inhibit habitat characterizations and other observational studies proposed under the LOHCP (Appendix E; McGraw 2020). Specifically, the LOHCP proposes a habitat characterization study to assess Morro shoulderband snail distribution and abundance with respect to abiotic and biotic conditions in the various communities, including plant community composition. Native plant community composition is influenced by abiotic factors including soils and microclimates, that can affect Morro shoulderband snail and other species directly and indirectly. Where seeding or planting occur, they will limit the ability of the habitat characterization to evaluate factors influencing Morro shoulderband snail distribution and abundance. Seeding and planting at the outset also limit the ability of the projects to evaluate native plant responses to the treatments and inform the need for such active revegetation.
3. Reduce the costs of restoration relative to active revegetation by reducing the labor associated with seeding, which entails costs for seed collection, cleaning/processing, storage, and seed dispersal, and planting of container stock, which requires collection of seed or cuttings, contract growing at a nursery or greenhouse, plant installation, and associated plant maintenance including irrigation and caging (e.g., protection from herbivory).
4. Reduce the installation of anthropogenic infrastructure including irrigation and cages typically required (albeit temporarily) for planting.

Although researchers do not often monitor passive (but rather active) revegetation projects, there is evidence from the literature as well as anecdotal evidence that the communities of the Baywood fine sand ecosystem can be effectively revegetated passively. A study in southern California coastal sage scrub found passively revegetated areas achieved 32-78% native plant cover two to three years after removal of invasive artichoke thistle (*Cynara cardunculus*); the high success of the passive approach was attributed to the successful colonization of coastal sage scrub species (DeSimone 2011). A study in

Mediterranean dunes documented annual increases in native plant cover following fencing to prevent trampling, with mean absolute native plant cover increasing approximately 20 (raw) percentage points (i.e., from ~40% to 60%) in four years; native species richness also increased, but following a single-year time lag (Rosario Acosta et al. 2013). Another study in coastal sage scrub documented restoration using a passive approach and credited both shrub colonization and canopy expansion with increasing the cover of native species by an average of 13.7% following exotic plant control (alone), with increases higher in coastal sites compared to inland sites (Griffoul 2017).

In chaparral, seed limitation is cited as the key factor influencing whether passive revegetation will achieve restoration goals; if seed is present, refractory (i.e., dormant) seed can also limit plant establishment following removal of the stressor (Allen et al. 2018). Also, type conversion can occur if the areas are colonized by coastal scrub (Allen et al. 2018), though this community may ultimately succeed to maritime chaparral.

Passive revegetation has been documented in the Baywood fine sands ecosystem where native plant species have established following cessation of disturbance (i.e., ongoing trail use) and removal of veldt grass. In the Elfin Forest (State and County Park), passive revegetation was used to restore 10 areas identified in the Recovery Action Plan for the El Moro Elfin Forest (Morro Group 2003) where fences and targeted weed abatement were used to reduce the anthropogenic stressors of trampling and competition. A qualitative assessment in 2018 concluded that 7 of the 10 restoration sites were “largely or substantially revegetated”; the remaining three areas featured uncontrolled exotic plants and/or erosion. These passively revegetated areas were characterized similarly to two separate sites that had been actively revegetated through planting of coastal scrub species prior to 2003, which were also substantially revegetated (Terra Verde 2018). Quantitative analysis would be required to assess whether the passive and active revegetation areas differ in terms of plant species composition.

Current plant species composition in the Bayview Unit of the MDER also suggests that passive revegetation can be effective at restoring coastal sage scrub and maritime chaparral communities, which occupy areas that were completely cleared and used for agricultural crop production in 1949 (Section 2.4.2, Figure 2; Land Conservancy of San Luis Obispo County 1999). It is unlikely that the site was seeded or planted following cessation of agriculture (though this information is not available); nonetheless, the Bayview Unit features diverse assemblages of native plants characteristic of coastal sage scrub and maritime manzanita chaparral series (Section 2.5).

The successful natural regeneration of coastal sage scrub and maritime chaparral following clearing and restoration treatments (exotic plant control and trail closure at the Elfin Forest) likely reflects the adaptation of these communities to recurring disturbance. Though the natural disturbance regime includes fire, many plant adaptations to recurring fire, including the ability to colonize sites that feature bare mineral soil, could also promote regeneration following soil disturbances. Such beneficial responses of native plants and communities have been documented in the Santa Cruz sandhills (McGraw 2004)—an ecologically analogous system to the Bayview fine sands ecosystem, where native plant diversity was found to be enhanced by slides, trails, and gopher mounds. Experimental research in this system found that native plant cover and richness increase following exotic plant removal, even in the absence of seeding (McGraw 2004).

When compared with active revegetation, passive revegetation may result in slower rates of native plant establishment, due to the time lag between preparation of the site and natural dispersal of seed. Therefore it may not be suitable in situations where native plant establishment is time sensitive, as may

be in the case when plant cover is deemed necessary or advantages to controlling erosion, such as on steep slopes.

However, based on its demonstrated efficacy in this and other systems, and its advantages as part of the overall LOHCP conservation program, passive revegetation will be the default approach to recreating native plant community structure and species composition in the MDER. In circumstances where its efficacy is uncertain, it will be attempted and evaluated using monitoring. If native plant establishment from passive revegetation is limited, monitoring will be used to identify the causes. If the causes are erosion, exotic plant competition, or other factors not related to propagule supply, then remedial treatments will be implemented to address those limitations. If and where monitoring indicates that propagule supply is limiting native plant establishment, then active revegetation techniques (i.e., seeding then planting) will be phased in as part of remedial actions implemented through an adaptive management framework (Section 4.4, Table 9). Active revegetation will also be used at the outset under circumstances where passive revegetation is anticipated to be insufficient to establish the desired native plant community structure and species composition.

3.1.5.2 Active Revegetation

Active revegetation may be necessary to restore the structure and species composition of native plant communities when/where: 1) native plant seed is not present at the restoration site, and seed is not anticipated to disperse into the site from adjacent areas, at sufficient density and/or diversity, or b) when aspects of the site conditions might inhibit native plant establishment from seed, such as altered soils (e.g., thin or chemically altered), and thus seeding, planting, and amendments are needed, and/or, 3) when plant cover is needed to help prevent erosion that would otherwise occur if the site were left to passively revegetate, such as on steep slopes or in former gullies.

When and where deemed necessary, active revegetation will be implemented following a detailed plan that identifies revegetation treatments that address the following approaches designed to safeguard native biodiversity and restore the site as part of an ecological reserve.

1. **Use Only Site-Collected Seed:** All seed (or cuttings for container stock) will be collected within the reserve unit where the restoration will take place. This will ensure not only that the correct species are utilized, but locally adapted genetic complexes are incorporated in the seed and container stock. This will not only increase effectiveness of the revegetation, but also avoid the potential for genetic contamination to the native plant populations that could result from introducing genetic material collected from other sites. The exception could include incorporating Indian knob mountainbalm, if this is approved by the wildlife agencies and as covered under a separate scientific, educational, and management permit (2081[a] permit) issued by CDFW.
2. **Target Community and Species Palette**: Seeding and planting plans should be designed to achieve *over time*, with the aid of natural successional processes, the natural community composition and structure of the specific plant community(ies) (i.e., series) that would naturally occur within the area, based on the soils and microclimate. The revegetation should be designed to 'seamlessly' tie in with the existing natural plant communities.

   Species palettes will be identified in work plans based on the adjacent vegetation, which can inform decision-making about to species and their relative abundance. The species palette and seeding and planting plans should assume that some species will establish naturally from seed

dispersal over time, including as part of the natural successional process as described in Section 3.1.5 of the LOHCP (McGraw 2020).

The amount of seed and number of plantings in the seeding and planting plans should reflect the following factors: 1) the relative abundance of the species in the target community, 2) the species role in the successional process, and 3) the species anticipated rates of establishment, survivorship, and growth, based on its life history, the microsite conditions within the restoration area, and performance in other restoration sites.

3. **Revegetation Methods:** Seeding should be used to introduce the broad suite of native plants in the target community. The specific methods, including hydroseeding, broadcast seeding, and direct seeding, should reflect the microsite conditions within the restoration area and other goals for the restoration, such as erosion control; for example, where access is available, hydroseeding could be used on steep slopes to aid in erosion control, whereas flatter terrain could be broadcast seeded. Direct seeding could be used for species that establish when their propagules buried at depth (e.g., coast live oak).

   Plantings should be used to establish species that do not recruit well (or at all) from seed, and/or where container stock is deemed necessary to help prevent erosion (e.g., on the steep slope). Seeding, rather than planting, should be used wherever possible to reduce costs associated with contract growing, installation, irrigation, and associated plant maintenance (e.g., protection from herbivory), which can be considerable due to the labor involved. Seeding can also help create a more natural dispersion of plants than outplanting container stock, as the site environmental conditions can interact with life history of the species that are seeded to select those that are suitable in a given area much as occurs with natural seed dispersal.

4. **Container Stock:** Container plants must be grown from site-collected seed (or cuttings, where appropriate) as outlined in Item #1 above. Container stock should be grown following methods to limit contamination with exotic plants or pathogens (e.g., *Phytophthora* spp.). Planting plans, which identify the species and spacing should be designed to complement the existing plants at the site to 'tie into' what is already there, and should be integrated with the seeding plan.

5. **Amendments and Irrigation:** Use of fertilizers, mulches, and irrigation should be carefully planned to avoid promoting exotic plants, which generally benefit from increased nutrient availability and soil moisture that are otherwise limited; exotic plants can also be vectored by mulches. A soils analysis should be conducted to evaluate the need for fertilizer based on the soil nutrient requirements of native plant species (as opposed to agricultural crops). If fertilizers are necessary, the formulation, application rate, and areal extent should be limited to that necessary. Generally speaking, slow-release fertilizers applied to the rhizosphere of the container plants (as opposed to the entire site) are recommended.

   Likewise, mulches to reduce soil moisture loss and suppress exotic plants should be limited to just the area around individual plantings (as opposed to the entire site) as they can inhibit establishment of small-seeded native plants from seed.

Finally, irrigation should be targeted (e.g., drip) to avoid promoting exotic plants, and designed and timed to promote growth of deep roots. Plants should be protected from herbivory where it might prevent achievement of the goals and objectives.

3.2 Restoration Projects

The following sections describe the planned restoration treatments in terms of their:

1. Goals and Objectives; and
2. Specific methods, including treatment areas, initial treatments, and follow-up actions, which will be finalized in project workplans developed prior to implementation.

Section 4.2 identifies performance criteria for the restoration projects and how the treatment areas will be monitored to evaluate success based upon the quantitative objectives.

3.2.1 Eucalyptus Removal

This project will eradicate eucalyptus from the Pecho Unit and restore the estimated 0.84 acres of habitat that has been degraded by the invasive trees. This project was identified as a priority for implementation of the IAMMP because it can restore 0.84 acres of Morro manzanita habitat and also prevent the spread of eucalyptus into adjacent maritime chaparral and coastal scrub communities, where the trees could further impact habitat for the LOHCP communities and covered species. The project can also reduce the risk of a catastrophic wildfire that could ignite along Pecho Road and the spread into the tree canopies and beyond into the adjacent Baywood fine sands communities as well as Los Osos community.

3.2.1.1 Goals and Objectives

The goals of eucalyptus removal in the Pecho Unit are to:

1. Re-create the natural community structure and species composition in the Morro manzanita chaparral, by removing the eucalyptus and any co-occurring non-native plants (e.g., non-native *Pinus* sp.); and
2. Prevent eucalyptus from spreading further into uninvaded habitat within the reserve.

The objectives of eucalyptus control are to:

1. Remove the established trees and prevent their re-establishment from resprouts and seed;
2. Achieve native plant species absolute cover and native plant species richness that are similar to those values measured in intact (uninvaded) nearby Morro manzanita chaparral, which will be used as a reference site. The composition of species in the restoration site (i.e., the treatment area) should be similar to that in the reference sites as well.
3. Limit erosion on the over-steepened slope near the road; and
4. Prevent establishment of dense exotic plants within the treatment area.

Section 4.2 describes how monitoring will be used to evaluate achievement of performance criteria that were identified to evaluate whether the restoration will achieve the objectives over time.

3.2.1.2 Proposed Treatment

The eucalyptus removal project will consist of three elements:

1. Remove all eucalyptus trees and their biomass, and treat the trees in a manner that will prevent, or reduce the likelihood of, resprouting;
2. Actively revegetate the treatment area using seeding and container plant installation to promote establishment of native plants, and install erosion control measures where needed; and
3. Maintain the restoration area to control exotic plants and promote success of the native plants.

As with all of the projects, the detailed prescriptions will be developed in a work plan that will also identify the costs and schedule. The following describes the key elements of the restoration strategy that were developed to achieve the goals and objectives and inform such work plans.

3.2.1.2.1 Treatment Area

The treatment area will include the estimated 0.84-acre area affected by the eucalyptus within the Pecho Unit, which consists of a constellation of three stands (Figure 14). The final treatment area will ultimately include not just the area occupied by the trees, as measured here, but also all adjacent areas that are restored and that were impacted by the trees, including areas of dead Morro manzanita on the perimeter of the stand, or the tree removal activities (e.g., slash removal); as a result, it may differ from the acreage estimated in this plan.

As resources allow, the County may elect to remove additional eucalyptus trees located in the County road right-of-way and/or work with adjacent landowners to remove trees on the adjacent, private residential parcels to the east (Figure 14). These areas, which are also within the LOHCP Permit Area, have approximately six trees greater than 12" DBH, as well as additional smaller (newly established) trees. Removal of these trees can promote restoration of habitat offsite as well as within the reserve, by: 1) reducing the shade and litterfall from said trees into the reserve, 2) reducing the likelihood of re-invasion (which may still occur from trees south of Pecho Valley Road), and 3) reducing the risk of catastrophic fire. Such tree removal areas would not be included in the treatment area used to calculate the mitigation credit for the LOHCP, unless they are permanently protected from development and actively managed as part of the LOHCP preserve system.

3.2.1.2.2 Tree and Biomass Removal

The first element of the restoration project is to remove all of the eucalyptus and co-occurring non-native woody species biomass from the treatment area. As described in Section 2.7.1.2.4, the treatment area contains an estimated 26 eucalyptus greater than 12" DBH, additional saplings and stump sprouts, and numerous felled trees and cut stumps; it also includes two pines that will be removed assuming they are not naturally recruiting bishop pine.

To maximize achievement of the goals and objectives for the restoration, the tree removal treatment will include the following elements:

1. Cut all live trees at or near their base and then grind out or grub out the stumps to both prevent tree re-establishment and make bare soil available for native plant establishment;

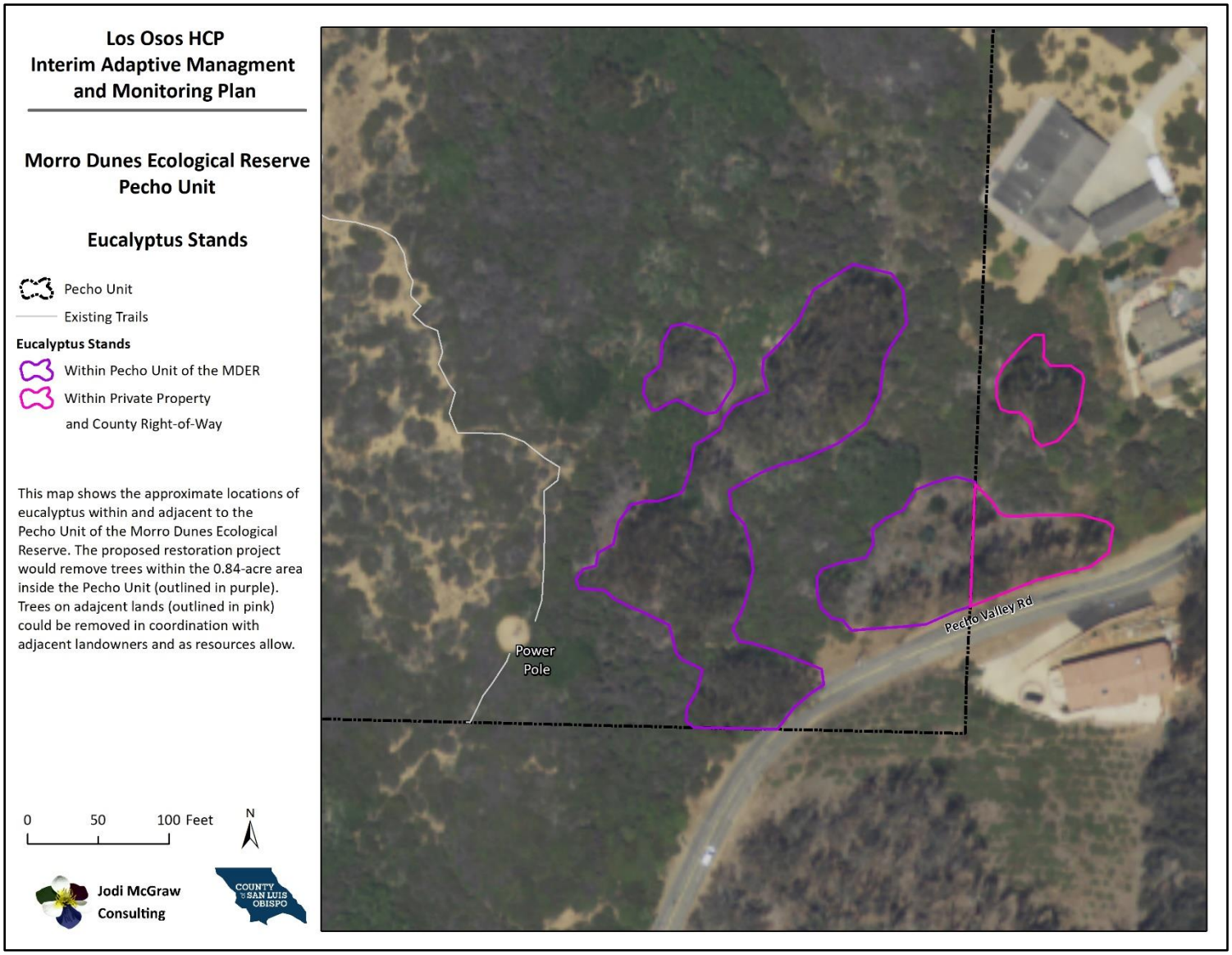


Figure 14: Eucalyptus within the Pecho Unit of the Morro Dunes Ecological Reserve

2. Remove all biomass, including the newly cut trees as well as biomass left on site from prior tree removal/felling, including all stumps (or their grindings), trunks (i.e., rounds), branches, leaves, and bark;
3. Remove all of the native plant biomass in and on the perimeter of the stand, including snags of Morro manzanita.

These elements are designed to remove not only the trees but also the other biomass on the soil surface that will mechanically inhibit native plant seedling establishment (Bossard et al. 2011) and could also reduce the performance of native container stock due to allelopathy (Watson 200; Section 2.7.1.2.4).

Pile burning could provide a cost-effective method to remove slash (branches) and litter (leaves and bark) from the site, where steep slopes limit access from chippers and otherwise make off-hauling challenging. Such treatments should be coordinated with CAL FIRE, and can potentially be conducted through their Vegetation Management Plan (VMP) program. If pile burning is not feasible, all biomass should be removed from the site; chips should not be left on site as a mulch as they will physically and/or chemically limit native plant performance and degrade habitat for other native species (Section 2.7.1.2.4).

If/where it is not feasible to remove the tree stumps through grinding or grubbing, including where such treatments would otherwise increase the cost or reduce the efficacy of the restoration, then a cut-stump treatment must be used to prevent resprouting of the live eucalyptus, which will otherwise vigorously resprout from lignotubers (i.e., dormant buds; Skolmen 1983). Stumps will be cut as low to the ground as possible, and then an herbicide applied to the cambium within 5 minutes of cutting, with 1 minute preferable to ensure it is absorbed into the cambium. If herbicide application is delayed, a second cut should be made immediately before herbicide application. The herbicide will be identified by a pest control advisor in consultation with CDFW Integrated Pest Management (IPM) coordinator as part of the IAMMP restoration work plan, though practitioners report using 25-50% solution of glyphosate (Holloran et al. 2004).

Removal of the trees and their biomass will be complicated by a variety of factors including:

- Vehicle access will not be possible for most trees, which are located down a steep slope and are surrounded by dense native vegetation dominated by Morro manzanita;
- Several trees are growing under/near power lines that are located along Pecho Valley Road and that service private residences north of the reserve and traverse the Pecho Unit.

These and other logistical considerations will be addressed in the work plan (Section 3.2.1.2.5).

3.2.1.2.3 Revegetation and Erosion Control

Following removal of the trees and their biomass, treatments will be implemented to:

1. Stabilize the soil on the steep slopes adjacent to the road, to prevent erosion following removal of the established trees; and
2. Actively revegetate the treatment area through seeding and planting site-collected native plants, to overcome anticipated limitations to natural recruitment of native plants and expedite establishment of native plant cover to control erosion that would degrade habitat.

Erosion control and revegetation treatments will be specified in the workplan developed for this restoration project and will be carefully coordinated to ensure that they will achieve the goals of preventing erosion and promoting native plant establishment.

Erosion control will be used only where needed (e.g., on the steeper slopes) and could include installation of a biodegradable erosion control blanket or turf reinforcement mat on steeper slopes, with coir rolls and/or surface treatment of straw on the gentler slopes. Hydroseeding using biodegradable organic tackifier can also help with slope stabilization. If straw is used, it should be certified 'weed free' straw or rice straw (which generally lacks terrestrial weed species) to avoid introducing invasive plants, which will be eradicated if detected during quarterly monitoring (Section 4.1.1.2).

Active revegetation involving seeding and planting is anticipated to be needed to restore the eucalyptus removal site for the following reasons: 1) the site likely has a limited seedbank due to decades of exotic tree dominance, 2) the site is relatively large and wide in areas, which will reduce natural seed dispersal, and 3) the soil modifications including potential allelopathy caused by the eucalyptus may hamper native plant establishment and growth. Seeding and outplanting container stock with limited amendments can help overcome these factors that are anticipated to limit natural regeneration of native plants within the site. Active revegetation can also help control erosion on the steeper slopes where the sandy soils might erode following removal of the tree canopy, as outlined above.

The revegetation treatments will be identified in the project workplan, which will include a seeding plan for the collection and application of site-collected native plant seed, and a planting plan for the propagation, outplanting, and maintenance of native container stock. These revegetation elements of the work plan will reflect the IAMMP's approaches to active revegetation that are designed to safeguard native biodiversity and restore the site as part of an ecological reserve (Section 3.1.5.2). They will also address the following specific elements for the eucalyptus site:

1. Planting and seeding will be conducted using only material collected in the Pecho Unit. The exception could include incorporate of Indian knob mountainbalm, if this is approved by the wildlife agencies and as covered under a separate scientific, educational, and management permit (2081[a] permit) issued by CDFW.
2. Seeding and planting plans will target establishment of the Morro manzanita series, which occurs adjacent to the grove and likely previously occurred in the area, based on the senescent manzanita snags that remain and the prior mapping (Figures 6 and 8). Due to the north-facing slope and swale topography, the area features a relatively high abundance of coast live oak which may colonize the revegetation area over time (i.e., through succession). However, the revegetation will target early-successional maritime chaparral using species that will be adapted to the high light/more exposed conditions post-tree removal; specifics species to consider including in the palette are: black sage, California sagebrush, wedgeleaf ceanothus, sticky monkeyflower, and Morro manzanita.

   The species palette will be identified in the work plan based on additional examination of the adjacent vegetation to identify the species and their relative abundance. The seeding and planting plans should be finalized after the site is cleared of exotic trees and their biomass, when additional microtopographic variation will be revealed.

   The species palette and seeding and planting plans should assume that some species will establish naturally from seed dispersal over time, including as part of the natural successional

process in maritime chaparral based on the chronosequence (i.e., from wedge-leaf ceanothus to Morro manzanita dominated), as described in Section 3.1.5 of the LOHCP (McGraw 2020).

Other elements of the revegetation should be described in the work plan, and follow the general approaches outlined in Section 3.1.5.2.

3.2.1.2.4 Restoration Area Maintenance

Following tree removal and revegetation, the eucalyptus removal restoration area will be maintained to promote native plant growth and prevent establishment of exotic plants. The site will be examined quarterly to detect and eradicate (or control, where eradication is not feasible), invasive plants that establish following removal of the trees. Targets will include eucalyptus, which may reestablish from buds in cut stumps (even some that are treated with herbicide) and from seed, and also other invasive plants that disperse into the area or are adherently vectored in with restoration materials (equipment, surface treatments, container stock, etc.). Site monitoring will also be used to evaluate the need for container plant maintenance, including supplemental irrigation or protection form herbivory, or remedial erosion control.

3.2.1.2.5 Work Plan

As part of the project design process, a qualified biologist will develop a detailed work plan for implementation of the eucalyptus removal project that incorporates the PCA recommendations, and identifies all relevant elements of the treatment based on the guidelines above, including:

- Final treatment areas;
- Species protection measures, including pre-project surveys and biological monitoring for the covered (Section 3.3) as well as other sensitive species, including monarch butterfly and nesting birds;
- Site preparation methods, including delineating treatment areas and flagging covered plants or other special-status non-target species;
- Personnel including crew size and number and qualifications of supervisors as well as biological monitors;
- Crew and equipment access including routes and travel methods and methods of avoiding impacts to the power lines;
- Tree removal and biomass removal methods;
- Erosion control treatments, including locations and specific methods that are integrated with the revegetation treatments;
- Active revegetation treatments, including seeding and planting plans that identify species, quantities, and spacing, as well as use of amendments, irrigation, and plant protection;
- Site maintenance treatments, including irrigation, plant production, and exotic plant control treatments, which will be refined based on the results of monitoring (Section 4.1); and
- A budget for all work to conduct the project including initial and follow-up treatments, and species protection measures.

The work plan will be provided to CDFW and the USFWS for review at least one month prior to project initiation to enable final review and approval by necessary staff including the CDFW Integrated Pest Management (IPM) Coordinator, who is responsible for reviewing and approving all pesticide use on CDFW lands.

3.2.2 Veldt Grass Control

This project would control veldt grass within the Bayview Unit to enhance habitat that has been degraded by the invasive plant. The Bayview Unit was chosen for initial treatment because it features intact coastal sage scrub and open canopy maritime chaparral that has been degraded by the invasive plant, as well as large areas of uninvaded habitat where the species could spread if not controlled. While the Pecho Unit also features intact as well as invaded habitat, it is surrounded on three sides by densely invaded habitat within the Morro Dunes Natural Area, from which veldt grass will likely reinvade if is not controlled. Control of veldt grass within the Pecho Unit will be further evaluated as part of development of the AMMP, through which the County or its Implementing Entity will work with State Parks to coordinate veldt grass control in the conservation lands in the region west of Pecho Valley Road.

In addition to veldt grass, the Bayview Unit features other invasive plant species that similarly merit control. These species will be controlled in the veldt grass treatment areas, in order to achieve the benefits of invasive plant control and prevent their spread; as resources allow, the other invasive plant species will be addressed adjacent to the designated treatment areas and elsewhere, as outlined below. The AMMP will address control of the invasive species occurrences that are not addressed in this IAMMP.

3.2.2.1 Goals and Objectives

The goals of veldt grass control in the Bayview Unit are to:

1. Re-create the natural community structure and species composition in the treatment areas, by controlling veldt grass and co-occurring invasive plants, including freeway iceplant, narrowleaf iceplant, English ivy, and jubata grass in and adjacent to veldt grass patches; and
2. Prevent veldt grass and co-occurring invasive plants from spreading further into uninvaded habitat within the reserve.

The objectives of veldt grass control are to:

1. Achieve native plant species absolute cover and native plant species richness that are similar to those values measured in intact (uninvaded) areas used as a reference site. The composition of species in the restoration site should be similar to that in the reference sites as well.
2. Achieve exotic plant cover within the treatment area that is similar to values measured within intact (uninvaded) areas of the same community type (reference sites); and
3. Eradicate veldt grass from any new areas where it establishes.

Section 4.2 describes how quantitative monitoring will be used to evaluate achievement of performance criteria designed to evaluate whether the restoration will achieve these objectives over time.

3.2.2.2 Proposed Treatment

3.2.2.2.1 Treatment Area and Targets

This project consists of controlling invasive veldt grass throughout the Bayview Unit (Figure 11). Based on the preliminary mapping conducted in February 2020 to develop this plan, the treatment area is estimated at 22.6 acres (Figure 11). Veldt grass cover in the treatment areas varies and was generally mapped based on five density categories (Figure 11):

- Low density: veldt grass cover 1- 10% (~ 0.87 acres or 4% of total);
- Medium density: veldt grass cover 11-30% (~ 7.88 acres or 35% of total);
- High density: veldt grass cover 31-70% (~ 5.28 acres or 23% of total);
- Low – Medium: patches in which density varied between low and medium (i.e., 1 - 30%) (~ 0.84 acres or 4% of total); and

  Medium – High: patches in which density varied between medium and high (i.e., 11 - 70%) (~ 7.72 acres or 34% of total).

In some cases, other invasive plant species including most notably freeway iceplant, narrowleaf iceplant, and jubata grass, occur within and/or immediately adjacent to the veldt grass patches (Figure 11). These co-occurring invasive plants must also be controlled to achieve the goals, objectives, and success criteria for the restoration. Controlling these species will reduce their impacts on native plants and prevent their spread within and beyond the treatment areas.

3.2.2.2.2 Treatment Methods

The veldt grass restoration project will be accomplished through two primary treatments: invasive plant control and passive revegetation.

3.2.2.2.2.1 Invasive Plant Control

Table 7 outlines the proposed methods to control the four primarily invasive plant species in the Bayview Unit. For veldt grass and freeway ice plant, different treatments are proposed to occur in patches of varying size and abundance (i.e., cover). Manual removal including pulling by hand will be used to remove small patches of veldt grass and freeway iceplant, and also to control occurrences of these species where these species occur at low density. Hand pulling or other non-chemical methods of removal are also recommended for follow-up treatments, assuming the density is low and the occurrence can be managed manually. Herbicide will be used only where it is needed to control medium to large patches with moderate to high density of invasive plants, as part of an overall integrated pest management approach designed to limit herbicide use and its impacts. Chemical control will also be used to control jubata grass, to prevent plants from resprouting following brush cutting. Similarly, herbicides will be used to control narrowleaf iceplant, which is difficult to kill through hand pulling as it readily reestablishes when its tap root is not effectively removed (Table 7).

Table 7: Summary of proposed treatments for veldt grass and co-occuring invasive plants[1]

Species	Patch Type	Initial Treatment	Follow-up Treatment	Treatment Comments
Veldt grass	Small, low to medium density patches	Hand Pull as feasible	Hand pull if low density Spray large or high density	• Hand pulling can be used throughout the treatment area, though can promote seedling establishment and is time consuming • Glyphosate can be used in near monocultures, as needed to achieve control
	Large and/or Medium to High Density patches	Spray with grass-specific herbicide (e.g., fluazifop-p)		
Freeway iceplant	Small patches	Cut and hand pull	Hand pull	Biomass can be left in place to provide litter for Morro shoulderband snail and/or suppress a secondary invasion of exotic plants, though live plants may re-root
	Medium-large patches (which are typically monocultures)	Foliar spray with herbicide (e.g., 2% glyphosate)	Hand pull or respray if the area is large	
Narrowleaf iceplant	All	Foliar spray with herbicide (e.g., 2% glyphosate)		Manual removal is often unsuccessful as it requires complete removal of the taproot, which is often not attained
Jubata grass	All	Cut with chain saw or brush cutter in summer and then foliar spray resprouts in fall.	Re-cut and re-treat resprouts as needed, for up to five years Remove seedlings using a hoe	Manual removal can work but requires complete removal of the root crown to avoid resprouting. All inflorescences must cut, bagged, and removed to avoid spreading seed.

[1] Recommended treatments to be refined through preparation of invasive plant control project work plan developed based upon recommendations from a certified pest control advisor regarding chemical treatments

3.2.2.2.2.2 Herbicide Use

During development of the project work plan for this project, a pest control adviser (PCA) licensed by the State of California will be consulted to develop prescriptions for herbicide use for each species based on the unique circumstances of the treatment areas, including patch density and co-occuring species. The PCA recommendations, which will be reviewed by the CDFW IPM Coordinator, will be designed to ensure that herbicide treatments are effective at controlling the invasive species, and that they minimize negative impacts to native species, as well as humans and other aspects of the environment. In developing the prescription, the PCA evaluate the following:

- Using grass-specific herbicides (e.g., fluazifop-p or clethodim) to control veldt grass, in order to limit impacts on non-target native plant species, virtually all of which forbs, subshrubs, and shrubs (i.e., broad-leaved plants) and therefore will not be as susceptible to herbicide impacts;
- Spraying herbicide during the time of year when it is most effective, including for veldt grass, when the plants are actively growing in the winter;
- Using herbicides that are known or likely to have no or only limited impacts on mollusks to limit impacts to Morro shoulderband snail, spraying during dry conditions when the species is inactive, and relocating the species out of harm's way using pre-project surveys (Section 3.3.4);
- Employing application techniques that will limit overspray and thus non-target species impacts, such as using low-pressure backpack sprayers equipped with large droplet nozzles, and applying herbicides only when winds are less than 10 mph and ground moisture is minimal; and
- Incorporating appropriate adjuvants to improve the performance and effective application of the herbicide, including dyes to facilitate even application.

Herbicides have been successfully used as part of a broader IPM strategy to control invasive plants in the Baywood Fine Sands ecosystem as part of other habitat restoration and management projects in the Los Osos region, including Arrow 2EC (clethodim) which was used as part of the Los Osos Wastewater Project to greatly reduce the abundance of veldt grass in areas that support Morro shoulderband snail (County of San Luis Obispo 2019, KMA 2019). All herbicide applications will be conducted or supervised by licensed qualified applicators registered in the State of California, who will adhere to herbicide label as well as the PCA recommendations. Herbicide treatments will also need to be approved by the CDFW IPM Coordinator. All treatment work, including herbicide application, will be implemented following species protection measures (Section 3.3.4).

3.2.2.2.2.3 Passive Revegetation

Veldt grass restoration areas will be passively revegetated as outlined in Section 3.1.5. While seeding and/or planting could potentially accelerate the rate of native plant establishment, these active revegetation techniques can have negative consequences for long-term conservation management of the site as described in Section 3.1.5. Natural regeneration of native plant communities is anticipated to be sufficient to achieve the performance criteria (Section 4.2.2) in most if not all of the veldt grass treatment areas for the following reasons: 1) most of the treatment areas feature native plants, and likely also feature their dormant seed in the soil (i.e., seedbank), 2) the treatment areas are relatively small and surrounded by intact natural communities from which native plants can spread vegetatively, and disperse from seed (i.e., by gravity, wind, water, and animals); 3) native plant establishment and growth in the treatment areas are not anticipated to be hampered by soil modifications or erosion, 4) seeding and planting the areas would limit the ability of this project to evaluate the potential for passive

restoration to achieve the goals and objectives of this and future similar restoration projects conducted as part of the LOHCP, 5) the treatment areas collectively constitute a large area that would require significant labor and thus cost to seed and/or plant, and 6) the treatment areas are scattered throughout the 230.9-acre property (Figure 11) where installation and maintenance of container plants would be logistically challenging and thus expensive to implement effectively.

If and where native plant establishment and growth are insufficient to achieve the restoration objectives as measured by the performance criteria (Section 4.2.2), remedial actions will be taken to address the known or likely factors limiting success, as outlined in Section 4.4. If propagule supply and/or seedling establishment and survivorship are identified as the causes of the limited native plant cover and/or species richness, and treatments to promote natural seedling establishment and growth and canopy spread are not appropriate, then active revegetation techniques including seeding (first priority) and/or planting (only if seeding is not sufficient) will be used, where appropriate. Such treatments will be developed following the guidelines for revegetation methods of the IAMMP as outlined in Section 3.1.5 and will proposed in the annual work plan (Section 4.8); they will be review by the agencies as part of the annual meeting (Section 4.8) and will be approved prior to implementation.

3.2.2.2.2.4 Work Plan

As part of the project design process, a qualified biologist will develop a detailed work plan for implementation of the treatments that incorporates the PCA recommendations, and identifies all relevant elements of the treatment including:

- Final treatment areas and specific treatments by area, based on examination of the density of veldt grass, co-occurring invasive plants, and native plant and potential sensitive animal species in each area;
- Species protection measures, including pre-project surveys and biological monitoring (Section 3.3);
- Site preparation methods, including delineating treatment areas and flagging covered plants or other special-status non-target species;
- Personnel including crew size and number and qualifications of supervisors as well as biological monitors;
- Crew access including routes and travel methods;
- Biomass removal methods;
- Anticipated follow-up treatments, which will be refined based on monitoring (Section 4);
- A budget for all work to conduct the project initial and follow up treatments, and species protection measures

If the budget for the work outstrips the initial startup funds available for the LOHCP, as described in Section 7.2.4 of the LOHCP, the treatment area can be reduced relative to that illustrated in Figure 11, to focus on the priority areas for invasive plant control. Work should be prioritized to maximize long-term effectiveness such as by working away from undisturbed habitat toward the more invasive habitat, as recommended as part of the Bradley Method (Bradley 1997)

The work plan will be provided to the wildlife agencies for review at least one month prior to project implementation to enable approval by necessary staff including the CDFW IPM Coordinator.

3.2.3 Trail Restoration and Access Management

This project will restore habitat within the MDER that has been degraded by recreation by managing trail use (Section 2.7.2). As with veldt grass management, trail restoration as part of this interim plan for the LOHCP Preserve System will focus on the Bayview Unit of the MDER where:

1. Recreational use is more widespread and the proliferation of trails is resulting in greater impacts on the covered species and their habitats than at the Pecho Unit, where trail use is limited to a few routes (Figures 3 and 4); and
2. Access management can complement efforts to restore veldt grass treatment areas by reducing trampling which could inhibit native plant establishment.

As resources allow, trail restoration could be initiated within the Pecho Unit; accordingly, this plan identifies recommendations for management in this unit, which can be evaluated as part of work to develop the trail restoration work plan.

3.2.3.1 Goals and Objectives

The goals of trail restoration are to:

1. Re-create the natural community structure and species composition in areas degraded by prior recreational use, by using signage, fencing, patrols, and community outreach to limit access to designated trails to hiking, dog-walking, and wildlife viewing, and to close unauthorized routes; and
2. Prevent the ongoing proliferation and widening of trails within the reserve by increasing community awareness of the sensitivity of habitat and thus compliance with the access regulations, and conducting patrols to discourage unauthorized access.

The objectives of trail restoration are to:

1. Achieve a level of native plant species absolute cover and native plant species richness within trails (or portions thereof) where use is discontinued, that is similar to reference sites. The composition of species in the restoration site should be similar to that in the reference sites as well.
2. Achieve exotic plant cover within the treatment areas (i.e., closed trails) that is similar to values measured within intact (uninvaded) areas of the same community type and successional stage (reference sites);
3. Prevent establishment of new trails.

Section 4.2 describes how monitoring will be used to evaluate achievement of performance criteria designed to evaluate whether the restoration will achieve the first two objectives over time.

3.2.3.2 Treatment Methods

3.2.3.2.1 Overview

Under this initial management plan for the LOHCP Preserve System, trail restoration will include three elements:

1. Restricting access to limit ongoing disturbance;
2. Controlling establishment of invasive plants to reduce their negative impacts on the covered species and natural communities; and
3. Passive revegetation, to establish native plants by promoting their natural regeneration following cessation of disturbance.

Trail closure and invasive plant control are anticipated to promote native plant recolonization that will be sufficient to achieve the goals and objectives throughout much of the area subject to trail closure. Passive revegetation may require additional time in some areas, such as wide trails or trails through maritime chaparral where species pools consist of slower-growing shrubs; however, native plant species adapted to disturbance are anticipated to colonize much of the denuded trail areas over time (Sections 3.1.5 and 3.2.3.2.4).

Sections of former trails and roads that have become incised may require additional restoration treatments, including earth work, to prevent continued erosion. Treatments that require more intensive efforts will be phased in during implementation of the LOHCP AMMP in areas where regulating access and controlling invasive plants are not sufficient.

In addition, some segments of the trails designated in this plan for ongoing use may need to be rerouted to be more sustainable; specifically, trails may not to be located on suitable gradients and out sloped so they do not become channelized and erode. These and other trail restoration treatments, which can be identified in the LOHCP AMMP, can build upon the initial efforts to restore trails as part of this plan.

3.2.3.2.2 Regulating Access

The first step to restoring trails will be to promote visitor compliance with existing CDFW access regulations which: 1) limit access to designated routes within the reserve, and 2) allow access only by pedestrians (i.e., hikers) including those walking dogs on leashes that are no more than 10 feet in length (Section 2.8). As a potential exception to this, CDFW will evaluate allowing equestrian use of the West Rim Trail—an existing trail that provides access from Pecho Valley Road to the beach, and which cuts through the southwestern corner of the Pecho Unit (Section 3.2.3.2.1).

The County or its implementing entity will take the following steps to promote compliance with CDFW's access regulations:

1. Install and maintain fences to limit access to designated routes, including to:
    a. close unauthorized trails;
    b. limit use of overly wide trails to the central three-foot-wide portion of the trail, and prevent trails from widening and encroaching into adjacent intact habitat; and

c. protect veldt grass treatment areas to prevent trampling from inhibiting native plant recolonization.

2. Install brush piles to help close trails while providing habitat for certain species;
3. Install and maintain signs to identify open and closed trails, and provide visitors with interpretive information about the sensitive ecology of the site and the conservation needs of the covered species to promote their compliance with the access regulations.
4. Patrol trails to promote compliance with the access regulations and deter access by unauthorized users (OHVs, mountain bikes, equestrians, and campers), and prevent ongoing use of trails designated for closure.
5. In coordination with CDFW staff, conduct community outreach to user groups, neighborhood groups, and community organizations to promote compliance with the access regulations.

3.2.3.2.2.1 Trail Closures

Of the 11.8 miles of trails mapped within the Bayview Unit, 8.9 miles (75% by length) will be closed (Figure 15). These trails are 2 to 30 feet wide (Section 2.7.2). Assuming an average width of four feet, restoration of these trails by preventing disturbance to promote native plant regeneration, and conducting invasive plant control, where needed (Section 3.2.3.2.3), will restore approximately 4.3 acres of habitat.

Within the Pecho Unit, closure of all trails other than the East Rim Trail could similarly restore an estimated 0.50 acres of habitat within the 1.0 miles of trails designated for closure (Figure 16).

To continue to provide visitors with opportunities for compatible recreation, access by hikers and dog walkers will be allowed within the Bayview Unit on a total of 3.0 miles of trails (Figure 15):

1. **Loop Trail:** This 2.2-mile trail on the outer perimeter of the unit will remain open to provide visitors with an opportunity to explore the range of plant communities in the unit and access the southern ridge, which affords scenic vistas. It was designated by selecting from the existing routes those that were deemed most suitable for long-term use; as noted above, the LOHCP AMMP may ultimately identify additional improvements including re-route sections of this trail.
2. **Ridge Trail**: This 0.73-mile route traverses the top of the ridge from Calle Cordoniz Avenue to the East Rim Trail, which is in the northeastern portion of Montaña de Oro State Park. An additional 0.21 miles along the ridge which are illustrated in Figure 15 are south of the Bayview Unit on the adjacent property.
3. **Neighborhood Access:** Two short access routes totaling 0.06 miles will be maintained to provide access from Ravenna and Palisades avenues, as well as Broderson Avenue, where access will remain open as part of the Loop Trail.

Collectively, these trails will provide the community and other reserve visitors the opportunity to access the reserve from the surrounding neighborhoods, experience the various native plant communities traversed by the Loop Trail, enjoy scenic vistas afforded by the Ridge Trail, and tie into the Montaña de Oro State Park trail network via the East Rim Trail. The CDFW will maintain responsibility for operating these trails; the provision of recreation opportunities is beyond the scope of the IAMMP and will not be

Figure 15: Trail restoration within the Bayview Unit of the Morro Dunes Ecological Reserve

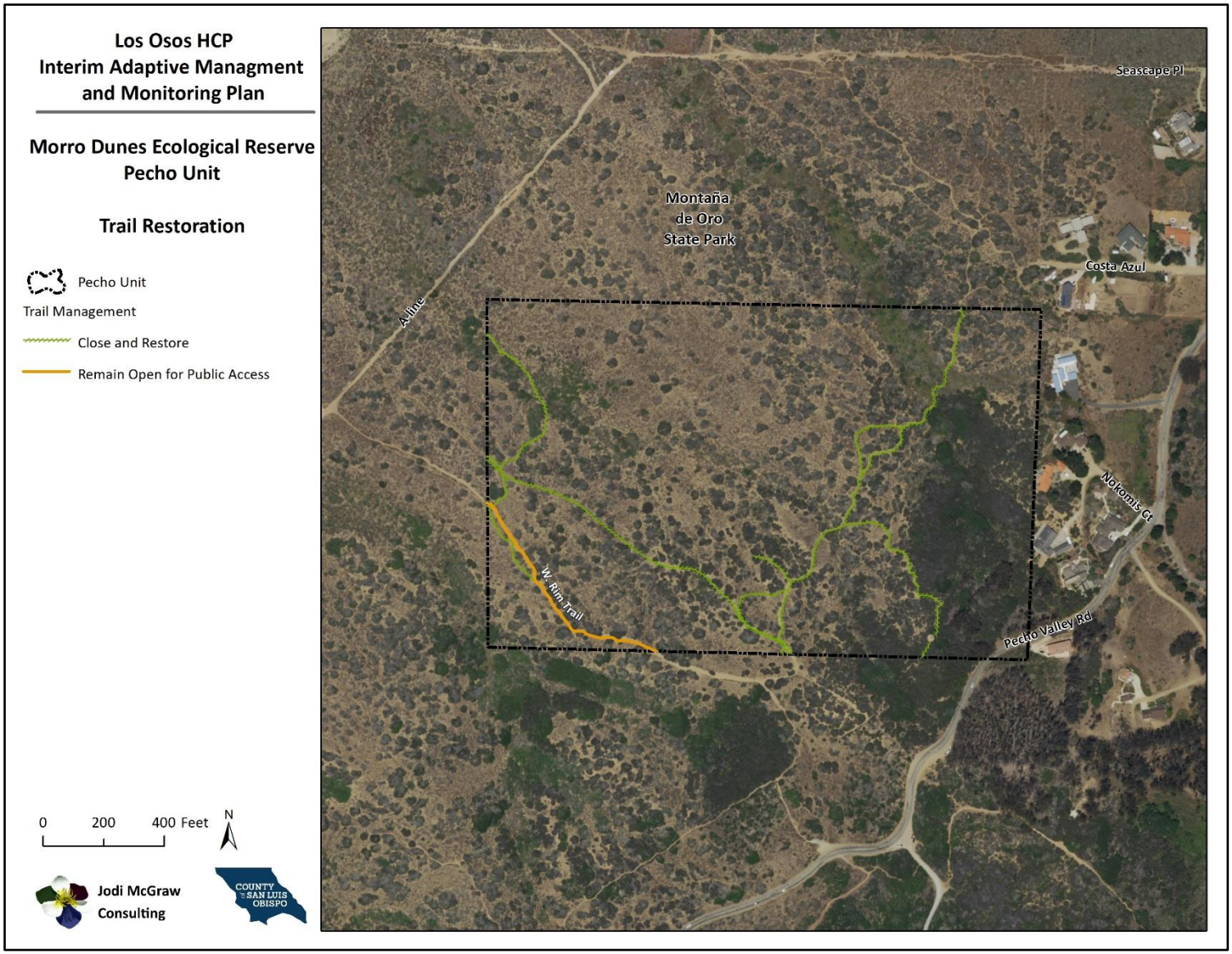


Figure 16: Trail restoration within the Pecho Unit of the Morro Dunes Ecological Reserve

credited for mitigation under the LOHCP, which instead is based on restoration of the closed trails including the narrowing of excessively wide trail corridors.

In the Pecho Unit, the 0.15-mile section of the West Rim Trail will remain open, to connect Pecho Valley Road to the beach and other destinations beyond via the A-Line Trail in the Morro Dunes Natural Area, which is part of Montaña de Oro State Park. The other trails, including the north-south trail on the eastern portion of the reserve, are proposed to be closed (Figure 16).

3.2.3.2.2.2 Signs

To promote compliance with the trail use regulations, which will be necessary to achieve the trail restoration objectives and success criteria, the County will develop, install, and maintain of at least three types of signs:

1. **Entrance Signs or Kiosks**: At the main entrances to the Bayview Unit, large-format signs or kiosks containing maps, graphics, and text, will be posted to provide visitors with information about the reserve's unique ecology, including rare species, and its access regulations and their role in protecting endangered species and restoring their habitat. The signs or kiosks could feature reserve brochures with maps, interpretive information, and the access regulations. Figure 15 identifies eight reserve entrances where the trail restoration work plan will evaluate posting such signage; if resources are limited, priority will be given to entrances with the highest rates of ingress.
2. **Open Trail Signs**: Posted at the entrances to the open trails, these signs will name each trail to aid navigation, and identify the allowed uses; specifically, these trails will note that horses and mountain bikes are not allowed, that dogs must be on a leash less than 10 feet in length at all times, and that trail use must be confined to the designated corridor.
3. **Closed Trail Signs:** These signs will be posted at all junctions between the open trails and the trails that are closed. They will explain briefly that the trail is closed to facilitate restoration of habitat for endangered species.

Additionally, the Loop Trail within the Bayview Unit could feature interpretive signs that educate visitors about the uniqueness and rarity of the ecosystem, both to enhance their experience and to promote compliance with the access regulations. Rather than signs, the Loop Trail could feature numbered posts that correspond to numbered stations in a brochure available at the Entrance Signs or Kiosks, or perhaps available on-line. This signage, which could enhance overall compliance with the trail closures, is optional and not required as part of the IAMMP.

As part of its management of the reserve, CDFW will provide ecological reserve signs for the County to post on the perimeter of the reserve at a minimum frequency of three signs per mile. These signs will enable CDFW Wardens to implement law enforcement action in response to violations.

3.2.3.2.2.3 Fences

The County will erect fences to promote compatible trail use including to facilitate trail closures and to control access from the perimeter of the Bayview unit. Three main types of fences are anticipated to be erected. Fences should feature the appropriate signs (Section 3.2.3.2.2) to communicate their rational and promote their effectiveness at regulating trail use and restoring the designated trails.

1. **Perimeter Fence:** Fences will be installed on the western and eastern boundaries of the reserve where they are needed to control access. The perimeter fencing will be installed in areas where there is evidence of current ingress/egress, and where the perimeter lacks dense, impenetrable vegetation (i.e., a brush barrier) that would inhibit access. To be wildlife friendly, the fence will be constructed of four-stand smooth wire on t-posts. The perimeter fence segments will be posted with ecological reserve signs furnished by CDFW to facilitate law enforcement action in response to violations (Section 3.2.3.2.2).
2. **Fences to Delineate Open Trails:** Fences will be installed along segments of trails designated for ongoing use that are much wider than they need to be to accommodate the allowed use by hikers and dog walkers. In these areas, fences should be installed within the center of the trail corridor, or off to one side, to confine use to the designated three-foot-wide area and promote native plant regeneration along the remainder of the existing corridor. To avoid impeding native animal movement, create an enjoyable visitor experience, and ideally reduce costs, these fences will be symbolic, in that will not prevent people from moving through them. Instead, they will be constructed using posts and cables, as used at the Morro Dunes Natural Area along Army Road, or made of low posts and rope, as used in the County's Mid-Town Site (Figure 17).
3. **Fences to Close Trails:** Where posting signs is not sufficient to deter ongoing use of the myriad trails to be closed, segments of barrier fence will need to be installed. Such fences can be constructed of green plastic mesh or other material that better blends with the natural environment, as is used at the Elfin Forest. Fence segments will need to 'tie in' to shrubs, trees, or other impenetrable vegetation or perhaps topographic features (e.g., steep slopes) to be effective; otherwise, people will simply go around the fence.

Figure 17: Examples of symbolic fences to confine trail use to designated corridors

3.2.3.2.2.4 Brush Piles

Piles of brush (i.e., cut branches of woody plants) can be installed at the entrances to trails or other ingress/egress points to facilitate trail closure or otherwise regulate access. In addition to creating a visual and real barrier, brush piles create habitat for Morro shoulderband snail, dusky footed woodrat (*Neotoma fuscipes*), native bees, and herpetofauna, which were encountered frequently during monitoring of the brush piles created in fall 2019 for the Bayview Unit fuel break (D. Hacker, pers. comm. 2020). Brush piles may also promote establishment of some native plants by collecting or trapping seed and providing a safe site for germination and seedling establishment; however, smaller-

seeded herbaceous plants and subshrubs including many disturbance adapted species that could colonize the closed trails may be physically inhibited by woody debris.

To minimize the negative impacts of brush piles while promoting their effectiveness, the piles should be:

- Comprised of cut material from exotic plants (though should be weed free), dead native shrubs and trees, or native shrubs and tree branches cut during fuel break creation. Living native shrubs or trees, particularly the covered shrub species, will not be cut to generate material for brush piles;
- Located strategically to inhibit trail access, such as the entrances to closed trails, rather than throughout the site;
- Comprised of discrete piles rather than brush spread out on along the trail corridor, where it would inhibit establishment of early successional plant species, and thus the successional processes including soil development necessary to revegetate the trails; and
- Located away from houses (e.g., along Highland Drive) to avoid creating fuels that could exacerbate wildfire risk.

3.2.3.2.2.5 Patrols

The County (or its Implementing Entity) will conduct patrols, as needed, to promote compliance with the trail use regulations. The need for patrols is anticipated to be greater during the initial period of trail closures, which will follow coordinated outreach to the community by the County and CDFW (Section 3.2.3.2.6). During this time, County personnel or volunteers will walk the trails and conduct outreach to people about the trail management regulations. The frequency of patrols necessary to achieve sufficient compliance with the trail closures and promote the trail management goals, objectives, and success criteria is anticipated to decrease over time as compliance increases.

Outreach could be facilitated through establishment of a volunteer trail patrol group whose members could patrol trails and conduct outreach to users, including by providing informative brochures that explain the trail use provisions. Such groups patrol trails in other ecologically sensitive natural areas including the Fort Ord National Monument and Henry Cowell State Park Sandhills, where they have been effective at promoting compliance with the trail closures and other use regulations.

County personnel conducting other aspects of management in the reserve should also conduct outreach to reserve visitors regarding trail use. Biologists and restoration crews can educate users about appropriate trail use when they encounter any use that is not in keeping with the plan.

The County will work with CDFW Environmental Scientists and Wardens to address persistent, unlawful trail use that inhibits achievement of the goals and objectives for trail restoration. Wardens can enforce regulations relating to recreation on CDFW lands including the MDER; likewise, the San Luis Obispo County Sheriff can enforce regulations on County-owned lands (e.g., Broderson).

3.2.3.2.2.6 Outreach

Prior to initiating the trail closures, the County and CDFW will coordinate to conduct outreach to inform neighbors, user groups, and the broader community about the trail use regulations and the plans to enforce them, as well as the planned trail closures and restoration. Representatives from CDFW and the

County (or its Implementing Entity), will provide presentations at existing venues (e.g., community group meetings), hold separate informational meetings, and/or meet with representatives of user groups, to explain the rationale for the regulations and seek compliance. As part of this outreach, CDFW and the County will evaluate interest from the community in forming a 'friends of the reserve' group that would be comprised of people who support the mission of the reserve. Such a group could assist with trail management (e.g., outreach and volunteer patrols, Section 3.2.3.2.5) as well as invasive plant management (e.g., volunteer workdays).

3.2.3.2.3 Invasive Plant Control

Invasive plant control may be needed to promote restoration of the closed trails, including areas along excessively wide trails. Following cessation (or at least significant reduction) of use, these closed areas are anticipated to be colonized by a diverse suite of native plants that are adapted to colonizing bare sand soil; these disturbance-adapted plants are anticipated to passively revegetate the areas, thus facilitating achievement of the goals, objectives, and success criteria without the need for active revegetation (Section 3.1.5). There is evidence of such natural recolonization of former trails within the Bayview Unit, where native plants have recolonized an old trail along Broderson Road that became incised and was presumably abandoned by users in favor of the new route (J. McGraw, pers. obs.).

Like many native disturbance-adapted species, however, invasive plants including jubata grass, veldt grass, and iceplant species, may also colonize the trail corridors following closure. Though the extent of their invasion can be reduced by the concurrent invasive plant control work proposed in this plan (Section 3.2.2), these and other species may nonetheless re-establish from a seed bank, from remaining occurrences on-site, or perhaps through long-distance dispersal mediated by people, animals, or wind.

Accordingly, the County will monitor trails quarterly as part of the ongoing restoration monitoring (Section 4.1) and implement early detection-rapid response to detect and control any invasive plants that establish in the closed trail corridors. If a 'friends of the reserve' group is formed, volunteers can be trained to detect invasive plants to notify managers.

If detected early, new occurrences of invasive plants along closed trail segments and corridors should be small and thus able to be controlled manually (e.g., through hand pulling); however, larger occurrences may require use of herbicide, which would follow the prescription of a PCA (Section 3.2.2.2.2).

3.2.3.2.4 Passive Revegetation

Trail restoration areas will be passively revegetated as outlined in Section 3.1.5. Trail closure and invasive plant control are anticipated to promote native plant recolonization that will be sufficient to achieve the goals and objectives throughout much of the area subject to trail closure. Native plant establishment (i.e., passive revegetation) may require additional time in some areas, such as wide trails or trails through maritime chaparral where species pools consist of slower-growing shrubs; however, native plant species adapted to disturbance are anticipated to colonize much of the denuded trail areas over time.

While seeding and/or planting could potentially accelerate the rate of native plant establishment, these active revegetation techniques can have negative consequences for long-term conservation management of the site as described in Section 3.1.5. Natural regeneration of native plant communities is anticipated to be sufficient to achieve the restoration performance criteria (Section 4.2.2) in most if

not all of the trail restoration areas for the following reasons: 1) most of the treatment areas are narrow so feature adjacent to them diverse assemblages of native plants that can expand their canopies and also disperse their seed (i.e., by gravity, wind, water, and animals) to establish within the trails; 2) the treatment areas collectively constitute a large area that would require significant labor and thus cost to seed and/or plant, and 3) the treatment areas are scattered throughout the 230.9-acre property (Figure 15) where installation and maintenance of container plants would be logistically challenging and thus expensive to implement effectively.

If and where native plant establishment and growth are insufficient to achieve the restoration objectives as measured by the performance criteria, remedial actions will be taken to address the known or likely factors limiting success, as outlined in Section 4.4. If plant establishment is limited, the analysis will evaluate whether this is due to soil conditions (e.g., lack of topsoil, erosion, etc.) which will be addressed first. If limited seedling establishment and survivorship are linked to insufficient propagule supply, then active revegetation techniques including seeding (first priority) and/or planting (only if seeding is not sufficient) will be used, where appropriate. Such treatments will be developed following the guidelines for revegetation methods of the IAMMP as outlined in Section 3.1.5 and will proposed in the annual work plan (Section 4.8); they will be review by the agencies as part of the annual meeting (Section 4.8) and will be approved prior to implementation.

3.2.3.2.5 Work Plan

As part of the final project design process, a qualified biologist will work with CDFW to develop a detailed work plan for implementation of the trail restoration and access management treatments including:

- Signage and fence locations, based on the criteria outlined above and detailed examination of the site conditions including ingress/egress and vegetation (i.e., brush barriers);
- Species protection measures, including pre-project surveys and biological monitoring (Section 3.3);
- Site preparation methods, including delineating fence areas and flagging covered plants or other non-target species;
- Personnel including crew size and number and qualifications of supervisors as well as biological monitors;
- Crew access including routes and travel methods;
- Biomass removal methods for any vegetation removed to install fences or signs;
- Anticipated follow-up treatments, which will be refined based on monitoring (Section 4);
- A budget for all work to conduct the project initial and follow up treatments, and species protection measures.

If the budget for the work outstrips the initial startup funds available for the LOHCP, as described in Section 7.2.4 of the LOHCP, then the treatment area may need to be reduced relative to that illustrated in Figure 15 to focus on the priority areas for trail restoration and access management, such as by addressing areas where impacts of current trails or trail proliferation is greatest.

The work plan will be provided to CDFW and the USFWS for review at least one month prior to implementation of the project to enable final review and approval.

3.3 Species Protection Measures

The restoration treatments in this plan are designed to enhance habitat for the covered species and promote their long-term population persistence; however, they have the potential to cause inadvertent, short-term negative impacts to individuals and perhaps populations (McGraw 2020). The potential for these impacts will be avoided or minimized through implementation of measures identified in the Los Osos HCP as well as the environmental impact report (Rincon 2019). As part of work to develop the project work plans, the project biologist will develop a final set of species protection measures for each project based on the site conditions and the applicable measures below.

3.3.1 Overall

Bio-1: Environmental Awareness Training: Prior to initiation of any ground-disturbance, a United States Fish and Wildlife Service (Service)-approved biologist will conduct a pre-construction training that will be attended by all people who will participate in the project. The training will include a fact sheet that will provide information about the ecology and threats to the covered species, as well as other special-status species occurring in the project area (Table 2), including legless lizard (*Anniella pulchra*) and coast horned lizard (*Phrynosoma blainvillii*). The fact sheet will include pictures of each species and outline the avoidance and minimization measures that personnel must implement during the course of the project to protect them.

3.3.2 Indian Knob Mountainbalm

The following measures will be integrated into project work plans to avoid impacts to Indian Knob mountainbalm individuals. If the biologist, the County (or its implementing entity), and/or the agencies determine these measures are not sufficient to avoid impacts to Indian Knob mountainbalm, the County or its Implementing Entity will seek a State Scientific, Educational, and Management Permit under section 2081(a) of the Fish and Game Code, as the LOHCP take permits will not authorize take of this species (McGraw 2020).

IKM-1 Pre-Project Survey: Prior to initiation of any restoration treatments, a qualified biologist will conduct a survey for Indian Knob mountainbalm within the project areas, including the treatment areas, access routes, and any staging areas. All Indian Knob mountainbalm individuals encountered will be flagged or fenced, as needed, to facilitate avoidance by crews.

IKM-2 Herbicide Avoidance: In areas that support Indian Knob mountainbalm, herbicide application will be avoided in favor of manual or mechanical treatments, as feasible. Where herbicide treatment is deemed necessary, it will only be conducted if impacts to Indian Knob mountainbalm can be avoided through one or more of the following: 1) using a grass-specific herbicide (e.g., fluazifop-p) or other herbicides that otherwise will not harm the species, and/or 2) establishing a no-spray buffer around the shrubs that will prevent overspray and impacts. The buffer will be determined based on the PCA recommendations and will consider the method of application (e.g., foliar spray, daubing, or wicking), the herbicide, and the weather conditions, among other factors.

3.3.3 Morro Manzanita

MM-1 Pre-Project Survey: Prior to initiation of any restoration treatments, a qualified biologist will conduct a survey for Morro manzanita within the project areas, including the treatment areas, access routes, and any staging areas. All Morro manzanita individuals will be flagged or fenced, where needed, to facilitate for avoidance by crews.

MM-2 Herbicide Avoidance: In areas that support Morro manzanita, herbicide application will be avoided in favor of manual or mechanical treatments, where feasible. Where herbicide treatment is deemed necessary, it will only be conducted following methods that minimize impacts to Morro manzanita, including through one or more of the following: 1) using a grass-specific herbicide (e.g., fluazifop-p) or other herbicides that do not harm the shrub, and/or 2) establishing a no-spray buffer around the shrubs that will prevent overspray and impacts. The buffer will be determined based on the PCA recommendations and will consider the method of application (e.g., foliar spray, daubing, or wicking), the herbicide, and the weather conditions, among other factors.

3.3.4 Morro Shoulderband Snail

MSS-1 Pre-Project Surveys: Prior to initiation of any restoration treatments, a Service-approved biologist shall conduct a survey of the treatment area, including any access or staging areas, to evaluate presence of Morro shoulderband snail. All individuals will be relocated to suitable habitat away from the treatment area as outlined in Measure MSS-3.

MSS-2 Biological Monitoring: A Service-approved biologist will be present during invasive plant management and trail restoration activities that involve soil disturbance or vegetation removal (e.g., fence or sign installation) to similarly capture and relocate Morro shoulderband snails to suitable habitat away from the treatment area. During invasive plant management, the biologist will work alongside crews to inspect the branches and litter to detect any Morro shoulderband snails (including their egg masses) that may be present including on veldt grass and iceplants. Crews that encounter snails will cease work in the area until the biologist can take appropriate measures including relocation, as outlined in Measure MSS-3.

MSS-3 Relocate Morro Shoulderband Snails: Live Morro shoulderband snail in any life stage that are encountered during pre-project surveys and biomonitoring will be captured and moved by the biologist to suitable habitat located within the MDER. The biologist will identify the most suitable receiver site, which will generally be located near the treatment area in suitable habitat, as part of the work plan approved by the agencies. Within the designated receiver site, Morro shoulderband snails shall be placed in or near the center of a habitat patch to maximize chance of survival; habitat edges will be avoided.

Capture of individuals will be handled with care for the minimum time necessary. They will be placed in a protective, secure container that contains a layer of duff comprise of native leaf litter. Individuals should be kept in the protective container for the minimum amount of time necessary to move them to the receptor site; in any case, individuals will not be kept in the container for more than an hour. During this period, the biologist must take measures to keep individuals out of the direct sunlight and situations of excessive heat.

Individuals Morro shoulderband snails shall be gently transferred from their protective container to the base of a native shrub species with low-lying branches that can provide cover. The aperture (main opening of the shell) should face the ground surface. The biologist shall gently cover the Morro shoulderband snail with one to two inches of leaf litter.

Capture and release date, times, and locations shall be recorded and provided to CDFW and USFWS in the annual report.

M22 -4 Avoid Trampling Vegetation and Habitat: Measures will be taken to avoid trampling non-target plants during treatment to maintain refugia for Morro shoulderband snails within the treatment area.

3.3.5 Morro Bay Kangaroo Rat

Prior to implementation of the project, a pre-project survey will be conducted for Morro Bay kangaroo rat within the project area, including the treatment area as well as any access routes and staging areas. The survey protocol, which is contained in Appendix F of the LOHCP, will be implemented to ensure that the project does not impact Morro Bay kangaroo rat individuals, as the species is fully protected as well as State endangered and the LOHCP will not result in issuance of a State take permit.

4 Restoration Monitoring and Adaptive Management

This section describes how monitoring will be conducted to evaluate effectiveness of the restoration projects and achievement of the success criteria and thus crediting of compensatory mitigation.

The restoration areas will be monitored to:

1. Evaluate performance of the restoration treatments at achieving their goals and objectives, to gauge their success and thus establish mitigation credit under the LOHCP;
2. Examine the distribution and abundance of Morro shoulderband snail, Morro manzanita, and Indian Knob mountainbalm and assess conditions of Morro Bay kangaroo rat habitat;
3. Determine the need for remedial actions to achieve the performance criteria; and
4. Compare post-restoration habitat conditions to baseline conditions of the reserve.

Monitoring will occur through two main approaches:

1. **Qualitative monitoring** will be used to generally assess changes in site conditions and identify the need for follow-up treatments and remedial actions; and
2. **Quantitative monitoring** will be used to assess plant community structure and species composition to evaluate whether the treatments have achieved their performance criteria by comparing them to intact habitat within the site (i.e., in reference sites), and also assess the frequency and abundance of Morro shoulderband snail to evaluate use of the restoration areas by this covered species.

The following sections describe the two main monitoring approaches and provide specific protocols for each. It also describes how mitigation will be evaluated (Section 4.3), remedial actions will be identified (Section 4.4), and mitigation areas and credits will be determined based on performance of the restoration treatments (Section 4.5). Additional sections describe how ongoing management will be used to maintain the restoration areas (Section 4.6), the adaptive management framework that will be used to implement the plan (Section 4.7), and how restoration will be reported and coordinated with the wildlife agencies (Section 4.8).

4.1 Qualitative Monitoring

Visual observations including photographs will be used to track the status and condition of the restoration treatment areas over time.

4.1.1.1 Photomonitoring

Photomonitoring will be used as part of this plan to:

1. **Document the baseline conditions of the treatment areas,** including any access routes and staging areas, prior to initiation of the restoration projects. The photographs, along with narrative descriptions, will be used to document any existing damage, defects or hazards in the work area prior to the mitigation work, as described in Section IV(B) of the MOU between the County and CDFW.

2. **Evaluate changes in** habitat conditions including plant community structure in the restoration treatment areas over time.

Photomonitoring will be conducted prior to initiation of restoration and then upon completion of each project. Prior to initiation of restoration treatments, permanent photomonitoring stations will be established throughout the restoration areas, including access routes and staging areas, to capture important baseline conditions as well as representative conditions. To facilitate relocation, photostation locations will be permanently monumented on the ground (e.g., using a metal plate or other marker) and recorded using a resource-grade GPS. At each point, the general subject and view direction (azimuth) will be recorded for each photograph. The digital photographs will be labeled according to the station, azimuth, and date; for example, P05_143_20200504 would be the name of a photograph taken at photostation 5 with an azimuth of 143 degrees on May 4, 2020. Labeling photos in this way will enable them to be viewed sequentially to readily evaluate changes over time when stored in the same digital file folder.

4.1.1.2 Quarterly Monitoring

Quarterly monitoring of the restoration areas will be used to:

- Assess treatment effects including their effectiveness at promoting native plant establishment and limiting exotic plant cover, any additional effects including unintended consequences (e.g., non-target species impacts from herbicides);
- Evaluate habitat conditions including the distribution and abundance of any invasive plants and any covered species that are observed; and
- Determine the need for remedial actions to enhance treatment effectiveness, address unintended consequences, or promote covered species populations.

The specific observations and data collected during quarterly monitoring will vary depending on the restoration project(s) being implemented. All projects will examine the following: invasive plants, erosion, human activities, including trail use and vandalism.

The quarterly monitoring for the eucalyptus removal will also include assessment of container plant status and need for maintenance. The project workplans can identify additional factors to assess during quarterly monitoring as well.

4.2 Quantitative Monitoring

Quantitative monitoring will involve collecting data from replicate plots located in the restoration areas and intact communities within the same reserve unit, which will serve as reference sites. The data will be collected to assess whether the restoration areas feature sufficient native plant cover and native plant species richness to achieve the long-term objectives, or success criteria, based on shorter-term measures, or performance criteria. The covered species will also be monitored in the restoration areas; however, restoration success and performance will be gauged based on the ability of the treatments to create natural community structure and species composition, as described in this section.

4.2.1 Success Criteria

Quantitative monitoring of plant species composition will be used to evaluate whether the restoration projects proposed in this plan are meeting the following quantitative objectives, which constitute the success criteria for restoration:

1. Absolute native plant species cover and native plant species richness that are similar to those values measured in intact areas of the same community type. The composition of species in the restoration site should be similar to that in the reference sites as well.
2. Absolute exotic plant cover that is similar to that measured in intact areas of the same community type and successional stage.

These success criteria for the initial restoration work of this IAMMP reflect the goal to re-create native plant community composition and reduce two key stressors to the covered species: invasive plants and incompatible trail use (Sections 2.7 and 3.1.4). Addressing these stressors is anticipated to benefit the covered species in the long-term by promoting native plant establishment and, in doing so, recreating the natural community structure and species composition of the covered species habitat. Addressing the stressors is also anticipated to promote populations directly through other mechanisms as outlined in Table 6.

The abundance of Morro shoulderband snail, Morro manzanita, and Indian Knob mountainbalm within the restoration areas and reference sites will also be examined as part of this monitoring study, which can also be used to evaluate suitable habitat conditions for Morro Bay kangaroo rat. However, the success of the restoration will not be evaluated based on covered species abundance. Colonization of the treatment areas by the covered species, and their occurrence within the monitoring plots, will be influenced by a variety of factors including the suitability of microhabitat conditions, which will vary within the restoration treatment areas, the distance of the restoration treatment areas from occupied habitat, and the timeframe for monitoring restoration; a time lag is expected between removal of the stressors and establishment of the covered shrubs and dispersal by Morro shoulderband snails.

If the monitoring of the restoration treatment areas as outlined below reveals that the covered plants and Morro shoulderband snail do not become established in the restoration areas that otherwise achieve their performance criteria based on plant community structure and species composition, and if the results of the long-term monitoring of the populations as part of the LOHCP AMMP reveals declines relative to the baseline, which will be established as part of the AMMP as described in Appendix E of the LOHCP, then future restoration and management projects developed as part of the AMMP will incorporate additional measures to promote the covered species populations. These additional measures could include growing and outplanting Indian Knob mountain balm and Morro manzanita, and translocating Morro shoulderband snail from occupied habitat into the restoration areas. Such efforts would be evaluated to examine their effectiveness at restoring habitat for the species as well as enhancing understanding of the habitat factors that influence their distribution, abundance, and population growth and persistence. However, the approach of the LOHCP as a habitat-based conservation plan is to promote the covered species populations by addressing the anthropogenic factors that limit their populations and reserve more intrusive interventions including planting and translocations for if/when restoration are not successful.

4.2.2 Performance Criteria

Performance criteria will be used to evaluate whether each restoration project is on track to achieve its success criteria. That is, while ultimate success is defined based on achieving similar native plant cover and species richness as in intact natural communities (reference sites), achieving this objective could take several years. This is because the reference sites are not subject to ongoing anthropogenic disturbances (e.g., trail use) and do not support (large) populations of invasive and exotic plants; as a result, they feature relatively high cover and also diverse assemblages of native plants. It will take several years or perhaps more than a decade, in the case of the maritime chaparral communities, to establish native plant species cover and richness that is similar to that in communities that have not been recently disturbed by trails or invasive populations. Likewise, exotic plant populations may initially be higher in the short term than desired in the long term, since many exotic plants are disturbance adapted (Hobbs and Huenneke 1992) and could be promoted by aspects of the restoration treatments. Accordingly, it may take several years to reduce their populations to those observed in the intact natural communities selected as reference sites.

For this reason, performance criteria were established to gauge whether the treatments are likely to ultimately achieve the desired metrics for native plant cover, native species richness, and exotic plant cover over time. The performance criteria identify the level that must be achieved at three monitoring intervals within the five-year restoration period to conclude that the revegetation is performing as desired and will likely achieve the success criterion over time, as part of succession. Once they are met, the mitigation can be calculated and credited (Section 4.5). The restoration sites will be subject to ongoing management and observation to ensure they continue to proceed toward the desired future condition (Section 4.6).

As described in greater detail in Section 4.2.3, the performance criteria will be evaluated by sampling plant species composition within replicate plots randomly located within the restoration areas and comparing those measurements to data collected from reference sites: intact (non-degraded, non-managed/restored) habitat of the same community type within the same reserve unit. This reference site approach is designed to help ensure that the restoration is compared to conditions that are comparable to intact natural communities both spatially and temporally (White and Walker 1997, Holl 2020).

The performance criteria were selected to reflect the anticipated trajectories of plant species populations following the treatments and were established for years 2, 4 and 5 (Table 8). They were developed based on the available literature on the rates of passive revegetation following disturbance, which are admittedly limited since researchers often do not monitor passive (but rather active) revegetation projects (Section 3.1.5.1). As a result, the quantitative targets represent hypotheses (educated guesses) for successful restoration trajectories, as there are no known published data from this system or an ecologically analogous system under similar treatments as proposed here. If the performance criteria are determined to not effectively reflect the efficacy of the restoration areas at achieving the goals and quantitative objectives, then they can be adjusted, with approval from the wildlife agencies, as part of the adaptive management process (Section 4.7).

The criterion for exotic plant cover is based on (raw) absolute cover measured in the restoration sites, as exotic plants can be subject to active control as part of the restoration treatments. The specific criteria call for a reduction in exotic plant cover over time, based on the assumption that exotic plants may establish early in the restoration, as many exotic plants are disturbance adapted (Hobbs and Huenneke

Table 8: Performance criteria to gauge long-term success of the restoration

	Percentage to be achieved in each Monitoring Year		
Measure and Specific Metric	**Year 2**	**Year 4**	**Year 5**
Native Plant Cover (All Species) (minimum percentage relative to reference site)[1]	10	20	40
Native Woody Plant Cover (Shrubs and Trees Only) (minimum percentage relative to reference site)[1]	5	15	20
Native Plant Species Richness (minimum percentage relative to reference site)[1]	15	30	50
Exotic Plant Cover (maximum absolute value)[2]	25	10	5

[1] These values represent the minimum percentage of the value in the restoration (i.e., treatment) area relative to the value in the reference site. For example, if the restoration area has 20% cover of native plants while the reference site has 40% cover of native plants, then the restoration site has 50% of the reference site. Likewise, a restoration site with 6 native plant species would have 33% of the native species richness of a reference site with 18 species.

[2] This is the maximum absolute cover of exotic plants in the restoration site. That is, the restoration site can have no more than 25%, 10%, and 5% absolute cover of exotic plants in years 2, 4, and 5, respectively.

1992), but that that their abundance can and should be controlled to promote native plant establishment and growth within the sites.

The performance criteria for native species, (total) native plant cover, woody native plant cover (i.e., cover of shrubs and trees), and native plant richness, are based on percentages of the values measured in the reference sites. A separate revegetation criterion is provided for shrubs and trees to ensure that these important species are establishing within the site.

These performance criteria reflect the desire to have the restoration sites increase in native plant cover and richness over time but recognizes that, due to their earlier successional stage, the absolute values will necessarily be lower as described above. Using a comparative approach addresses the potential for interannual variability in rainfall to influence the reference and restoration sites, and allows that temporal variability in the reference site to be factored into the target conditions.

For example, if the plots located in the reference area in California Sagebrush-Black Sage community at Bayview Unit average 50% cover of native shrubs, then in the second spring following restoration, the performance criterion for native woody plant cover would be 2.5% cover. This criterion would increase to 7.5% in Year 4 and 10% in Year 5, assuming that cover in the reference site remains at 50% over time; however, the criteria would be adjusted if the measured shrub cover in the restoration area changes to ensure that the reference areas are comparable temporally, as outlined below.

4.2.3 Sampling Design

As noted above, performance criteria will be quantified in replicate plots randomly located within the restoration areas, which will be compared to data collected from reference sites located within the same community type and reserve unit (i.e., Bayview or Pecho). This reference site approach is designed to help ensure that the restoration is compared to conditions that are comparable to intact natural communities both spatially and temporally (White and Walker 1997, Holl 2020).

1. **Spatially,** the reference sites will be located in the same unit and community type of the MDER where the restoration is occurring. This approach will help ensure that abiotic conditions (e.g., soils, slope-aspect, slopes) and species pools of the reference site are similar to those in the restoration areas and thus represent an appropriate 'yardstick' for assessing successful restoration.
2. **Temporally,** reference site conditions will be quantified the same year as data are collected in the restoration sites. This will reduce the potential for interannual variability in weather (e.g., high precipitation or drought), which can have strong effects on native plant cover and richness in sandy soil systems, to cause measurements in reference and restoration sites to differ, as might be the case if they were collected in different years. In contrast, sampling the reference and restoration sites in the same year will enable more apt comparison.

Figure 18 illustrates reference site locations within the various maritime chaparral and coastal sage scrub communities where restoration projects are planned within the Bayview Unit. Figure 19 identifies the reference site within the Morro manzanita chaparral within the Pecho Unit, that would be used to evaluate success of the eucalyptus restoration. These areas were selected based on on-the-ground examination of site conditions and aerial image analysis, which indicate that these areas feature plant communities that are dominated (in terms of cover) by native plants characteristic of the specific communities (i.e., series), as described in Section 2.5. Specifically, they are dominated by the characteristic native shrubs, and in the case of the California sagebrush, Morro manzanita-California sagebrush, and Morro manzanita-Wedgeleaf ceanothus series, they also feature perennial herbs and subshrubs and open (unvegetated) areas featuring lichens and other cryptograms and annual plants; the Morro manzanita chaparral areas generally feature a dense canopy of shrubs with emergent coast live oak).

The reference sites areas are traversed by some trails and likely also feature isolated occurrences of (unmapped) invasive plants; these and any other areas will be excluded from sampling and analysis, as outlined below. The degraded habitat will be subject to restoration as part of this IAMMP or the AMMP. The intact habitat within the reference site areas within the MDER will still require future management to address anthropogenic stressors including the invasion and spread of exotic plants, fire (exclusion and wildfire) and incompatible uses, as well as changed circumstances caused by climate change. As a result, these areas can be used as reference sites for restoration under the IAMMP while still being subject to enhanced manage and monitoring under the AMMP.

Sample plots within restoration and reference sites will be randomly located using the "create spatially balanced random points tool" in ArcGIS or a similar method that randomly selects plots throughout the sampling strata (i.e., restoration or reference site). This tool will enable the sample plots to capture the range of variation and avoid human bias associated with siting the plots deliberately. Reference site plots should collectively feature a mix of structure and species composition, including canopy gaps

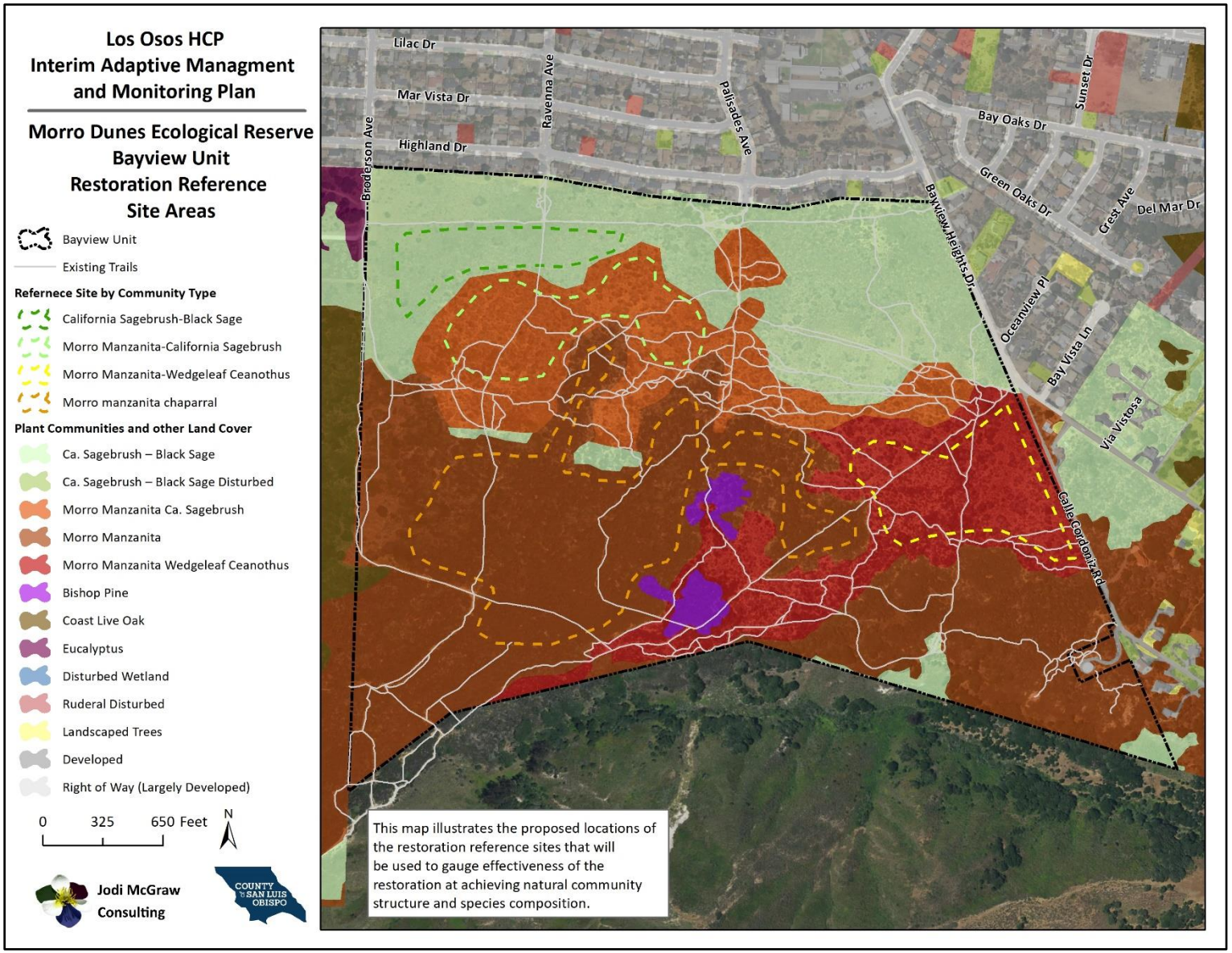


Figure 18: Restoration reference areas within the Bayview Unit of the Morro Dunes Ecological Reserve

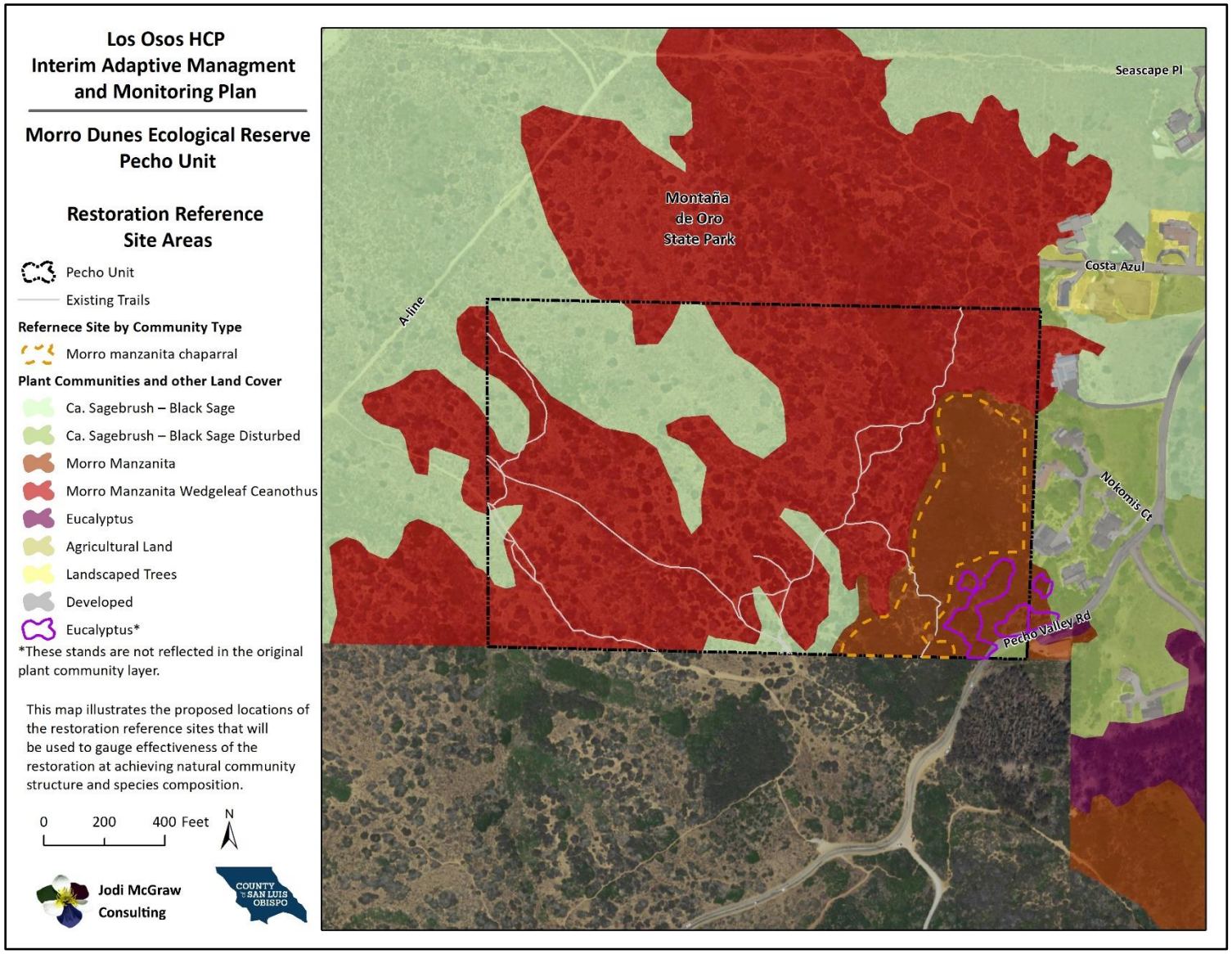


Figure 19: Restoration reference areas within the Pecho Unit of the Morro Dunes Ecological Reserve

between shrubs as well as areas of dense shrub (and tree) cover. However, reference plot locations will not be selected to be 'representative' in other respects. If any randomly located sample plots are located in areas that are unsuitable as references for restoration, because they feature anthropogenic factors that degrade habitat (invasive plants, trails, erosion, etc.), those plots locations will be replaced with alternates that are also randomly located.

For each restoration project (i.e., eucalyptus removal, trail restoration, and veldt grass control), a minimum of five plots will be sampled in the restoration area and also the reference area within each community type; stratifying sampling by community type will enable examination of differential performance of the restoration in the different plant assemblages, while also enabling direct comparison of restoration areas to their appropriate reference areas. The number of plots to be sampled in each sampling area may need to be increased (above five) if the plots are highly variable. To reduce costs associated with monitoring, the same reference plots (or a subset thereof) can be used for evaluating the effects trail restoration and veldt grass control within the Bayview Unit.

In each area, narrow rectangular plots (e.g., 1 m x 5 m) plots will be used, to facilitate sampling of trails (which are long and narrow), better capture native plant richness, and increase the diversity of the habitat sampled, both of which are generally greater in rectangular compared to square plots.

The plots will be permanently monumented (e.g., using metal stakes or other suitable markers) and georeferenced using global positioning system so that they can be resampled, as needed, thus reducing interannual variability associated with using temporary plots.

4.2.4 Data Collection

Data will be collected from each plot at two time periods: in the winter rainy season, to evaluate use by Morro shoulderband snail, and during the spring, to evaluate plant community structure and species composition, including occurrences of the covered plants.

During the winter rainy season when Morro shoulderband snails are most active and therefore visible, biologists will carefully search the vegetation, litter, and top one inch of soil for a specified period of time (e.g., 10 minutes). The time-constrained search should provide enough time to search the entire plot while avoiding inadvertent bias (e.g., searching plots located in perceived 'good habitat' longer). The number of live and dead snails will be recorded according to each of the three age classes developed by Roth (1985; Box 3). Dead snails (empty shells) will be removed from the plots so that they are not counted in future monitoring. Monitors will also record the number of other terrestrial snails including the native Big Sur shoulderband snail (*Helminthoglypta umbilicata*) and introduced European brown garden snail (*Cornu aspersum*) observed in each plot. If repeated sampling of plots for Morro shoulderband snail in years 2, 4, and 5 proves destructive, such as

Box 3: Morro Shoulderband Snail Age Classes (Roth 1985)

Category A: with periostracum intact or nearly so, shell about as in life although generally with some loss of luster and translucency. Age is approximated to be less than 1.0 year old.

Category B: with periostracum mostly or entirely missing, pigmentation of shell retaining brown. Age is approximated to be between 0.5 year and 2 years old.

Category C: with periostracum missing, shell white, all or nearly all brown pigment removed by erosion or bleaching. Age is approximated to be from 1.5 years old, possibly to 10.0 years or older.

if the surface litter and/or established plant cover is displaced in a manner that would degrade native plants or deter use of the habitat by Morro shoulderband snail, then methods of evaluating Morro shoulderband snail habitat use, such as temporary plots, will need to be used.

During the spring, when annual plants are in peak flower (e.g., mid-April to late May) and therefore have their highest visibility and cover, the absolute cover of each plant species will be estimated visually using the following values: 0.1%, 0.5%, 0%, and any integer between 1% and 100%. Additional data will be collected to understand factors that might influence plant community structure and species composition, including:

- Litter cover, using cover values;
- Litter depth;
- Soil depth, using a soil probe; and
- Canopy cover, using a spherical densiometer.

Quantitative monitoring will be conducted in years two, four, and five. Data will be collected by biologists who can identify the plant species and estimate their cover in an accurate and repeatable manner, and who can identify terrestrial snails in the region, including Morro shoulderband snail, and classify individuals based on thee age classes (Box 3).

4.2.4.1 Data Analysis

The spring plot data will be used to calculate the mean and standard deviation of the three main metrics:

1. **Native plant cover:** the sum of the absolute cover of all native plants;
2. **Native plant richness:** the number of species in each plot; and
3. **Exotic plant cover**: the sum of the absolute cover of all plants not native to the Los Osos Baywood fine sands ecosystem. This would include plant species that are native to California, but not native to this ecosystem, such as such as Monterey pine (*Pinus radiata*) or Monterey cypress (*Hesperocyparis macrocarpa*).

Other variables can be calculated to explore patterns in the data and evaluate the treatments; for example, the percent cover of native shrubs, versus that of native herbs, can be calculated to assess plant community structure.

The measures above will be calculated for the restoration areas and then compared to values from corresponding reference sites. Mean values from the reference site will be multiplied by the relative (i.e., percentage) values established as performance criteria (Table 8) to assess whether the restoration sites are achieving the performance criteria.

The frequency and abundance of Morro shoulderband snail (by age class), Morro manzanita, and Indian Knob mountainbalm in the restoration treatment plots will also be quantified and compared to reference sites to evaluate the extent which the restoration treatments promote natural recolonization of the covered species. The plant community composition and structure will be compared to that described as suitable for Morro Bay kangaroo rat, as detailed in Section B.4 of the LOHCP. However, as

described in Section 4.2.1 , there are no specific success criteria (or performance criteria) related to the species occurrences or specific habitat conditions tied to the species for these restoration projects. Instead, the restoration success will be evaluated based on whether it achieves native plant community structure and species composition similar to that in the intact habitat located within the reference sites.

4.3 Mitigation Evaluation

The data analyses outlined above will be used to evaluate whether the restoration projects have achieved their performance criteria in years two, four, and five following treatment. For example, if the eucalyptus trees are removed in September 2021, and the treatment area is revegetated in winter 2021-2022, then monitoring would be conducted in April or May 2023, 2025, and 2026. If the tree removal or revegetation are delayed, so too will the monitoring be delayed, so that it occurs two, four, and five years after treatment, rather than on a fixed annual calendar.

For the veldt grass and trail restoration projects, achievement of the performance criteria will be used to credit the restoration as mitigation, as outlined in Section 4.5. For the eucalyptus removal project, mitigation credits will be generated following removal of the trees and their biomass from the site (Section 3.2.1.2.2). This reflects the more immediate benefit of this project from a restoration and risk-reduction standpoint.

For the veldt grass and trail removal projects, if the restoration area or portions thereof are not meeting the performance criteria overall, descriptive statistical analysis and further on-the-ground assessment will be used to identify specific restoration areas that are meeting the objectives versus those that are not. In this approach, the mean values for native cover, native species richness, and exotic plant cover calculated within intact habitat will be used as the basis for evaluating whether each treatment area has achieved the performance criteria.

If the performance criteria are not being met three years following treatment but progress suggests they will achieve the Year 5 criteria with more time, monitoring can be repeated in subsequent years after the treatments; this will allow more time for the beneficial effects of the restoration treatments to develop, including by allowing native plant regeneration to progress. Additionally, subsequent monitoring can be conducted following implementation of remedial actions to promote success.

4.4 Remedial Actions

Where additional treatments are determined to be needed to facilitate achievement of the restoration success and performance criteria, such remedial measures will be taken. The specific measures will depend on the conditions of the site and the factors determined to be inhibiting achievement of the performance criteria; as a result, the actions may differ among treatment areas as well as projects. Table 9 identifies examples of potential actions that could be taken to promote achievement of the performance criteria based on issues identified during monitoring of the restoration areas and the overall approach to landscape-level habitat restoration and management outlined in section 3.1.4. To ensure that sufficient funding is available to implement remedial actions, budgets in project workplans should feature funding for remedial actions.

Table 9: Examples of Remedial Actions that can be Implemented to Achieve Performance Criteria

Issue	Description	Potential Remedial Actions
Trampling	Ongoing trampling by humans, horses, and/or dogs limits native plant establishment and performance	• Install additional fencing, signage, or brush piles to deter ongoing use • Conduct additional patrols and outreach to deter ongoing use
Erosion	Wind, water, or gravity displace soil and limit native plant establishment or performance	• Install erosion control based on the erosion feature, including surface treatments (e.g., weed free hay or rice straw), coir rolls (wattles), brush piles, or other biotechnical treatments to intercept rainfall and break up flow paths. • Use active revegetation where seeding and/or planting can help stabilize soils and slopes
Exotic Plant Competition	Exotic plants limit native plant establishment or performance	Conduct targeted treatments to reduce the abundance or competitive effects of exotic plants
Non-Target Native Plant Competition	Abundant early successional native plants (e.g., *Erigeron canadensis, Heterotheca grandiflora*) limit shrub establishment and performance	• First, confirm that early successional species are having competitive effects, as many can be abundant initially in restoration sites but decline over time and may actually facilitate native shrubs (e.g., through soil development, or by acting as nurse plants). • If early successional native plants are inhibiting shrub establishment, conducted targeted removal
Limited Seed Availability	The seed bank and seed dispersal are insufficient to establish native plants of the target species/community	Identify species or guilds (e.g., shrubs) missing from the restoration site and seed site-collected seed of these species. If they fail to establish from seed, develop a planting plan to grow and outplant container stock to complement existing native plants.
Limited Native Plant Survivorship	Native plants established from seed (natural or seeded) and/or outplanted container stock experience low survivorship and/or growth	Identify the factors influencing poor native plant performance and address them. For example: • Protect plants from exposure (e.g., shade cloth) • Apply a thin layer of weed-free straw or mulch around plants to reduce evaporative water loss • Provide protection from herbivory (e.g., cages) • Provide supplemental water (irrigation) Outplant (additional) native container stock if/where doing so is anticipated to establish native plant cover

In areas where aspects of the habitat (e.g., topography) are determined to inhibit restoration performance in ways that cannot be overcome with remedial actions, at least not in a reasonably cost-effective manner, then these areas can be excluded from the final calculation of the restoration area.

This assumes that the areas are small and will contribute to overall heterogeneity of habitat conditions and will not present issues for the ecology and conservation of the site.

4.5 Determining the Mitigation Area and Credit

The compensatory mitigation value of the habitat restoration in this plan will be quantified on a per-acre basis. As part of steps to develop each project workplan, the specific treatment areas will be mapped using global positioning systems and/or remote sensing using geographic information system technology, which will enable spatial tracking of the treatments. After evaluation of mitigation effectiveness based on quantitative monitoring (sections 4.2 and 4.3), the areas deemed to achieve the restoration objectives will be measured to calculate the acres benefited to the nearest thousandth of an acre (i.e., 0.001 acres or 44 square feet). For the eucalyptus removal project, where restoration success will be based on or after tree and biomass removal, the area of tree removal and associated restoration treatments will be used to calculate the mitigation area and thus credits.

The projects in this plan will be credited as restoration, rather than management, under the LOHCP conservation program, as they meet the operational definition for restoration used in the LOHCP, which is to recreate native habitat structure and/or function where they have been lost or severely impacted by anthropogenic (human-related) factors (e.g., invasion by exotic plant species, vegetation removal; McGraw 2020). Thus, eucalyptus removal, veldt grass control, and trail restoration areas will generate 1.5 acres of mitigation credit for every one acre of habitat that achieves the restoration success criteria.

4.6 Ongoing Management

Once the treatment areas have been restored, the County will implement ongoing habitat management to maintain their conditions, as part of the LOHCP conservation program (McGraw 2020). This ongoing management for the restoration areas identified in this IAMMP is anticipated to entail the following:

1. **Exotic Plant Control:** Control of exotic plant species in the invasive plant removal areas, where the invasive plants as well as other exotic plant species may become established following treatment. Exotic plant control will also likely be needed in the trail restoration areas. The intensity and frequency of this maintenance is anticipated to diminish over time as the frequency and intensity of disturbance are reduced, native plants increase in cover and thus outcompete exotic plants, and the exotic plant seed sources, including seed bank, are reduced.
2. **Fence and Sign Replacement:** Signs and fences may need to be replaced following achievement of the objectives. The overall length of fencing that needs to be maintained is anticipated to decrease over time as trails are recolonized by plants and less attractive to users, and community awareness of, and support for, the trail closures increases.

Additional management activities may also be needed to maintain the restoration areas in keeping with the requirements of the LOHCP, which requires that areas credited as restoration mitigation be subject to ongoing management (McGraw 2020). These will be determined by the County during the course of restoration and monitoring. The management actions will be identified in the AMMP, which will guide ongoing management of the restoration areas addressed in this IAMMP

4.7 Adaptive Management

The IAMMP will be implemented in an adaptive management framework, which addresses the uncertainty inherent in habitat restoration and management, enables managers to adapt to changed conditions, and increases understanding of the covered species and communities over time, in ways that will promote long-term effectiveness of management. Adaptive management will also be needed to confront the changes in conditions during the course of implementation of the IAMMP. Changes caused by the invasion of new exotic plants or fire, among others, may necessitate changes in implementation of this plan.

As part of this adaptive approach, the results of monitoring of the restoration projects will be used to evaluate their effects on the covered species and communities, including their effectiveness at achieving the success criteria. Should the projects succeed, their benefits will be documented and used to inform future restoration and management. Should they fail, monitoring results will be used to inform future restoration projects to increase the likelihood restoration project success. Notwithstanding the objective of learning from unsuccessful projects, management and restoration projects will still be required to meet specified performance criteria (in the case of veldt grass removal and trail restoration) in order to be credited as mitigation (sections 4.3 and 4.5). The exception will be made if the performance criteria are found to be inappropriate (Section 4.2.2).

The success criteria and performance criteria used to evaluate them, will be revised, when needed, to ensure that the restoration achieves the restoration goals and objectives (sections 3.2.1.1, 3.2.2.1, and 3.2.3.1). Specifically, the IAMMP performance criteria identify quantitative targets predicted to indicate whether the restoration treatments are on track to re-create natural community structure and species composition over time. If monitoring reveals that those metrics (e.g., native plant cover) or their target values were not appropriate for the system, then the targets will be adjusted to better reflect the goals and objectives, with approval of the wildlife agencies.

Specifically, the performance criteria reflect an anticipated successional trajectory for native plant regeneration following initial treatment (invasive plant removal and/or trail closure). If the restoration metrics reflect the desired trajectory towards improvement but are not meeting the quantitative targets identified in Table 8, the role of anthropogenic related factors, such as human activities (e.g., trail use or vandalism), erosion, or exotic plants in deterring progress will be evaluated. If anthropogenic factors are found to be causing or contributing to slower than anticipated restoration progress, they will be addressed through remedial actions. If, however, anthropogenic factors are not causing reduced progress relative to the targets reflected in Table 8 and if the trajectory of the metrics indicates that the success criteria will be achieved over time, then the performance criteria will be adjusted to reflect the more realistic pace of native plant regeneration, with approval of the wildlife agencies.

4.8 Reporting and Agency Coordination

Activities implemented under this plan will be documented within the LOHCP annual monitoring reports, as outlined in Section 5.6 of the LOHCP (McGraw 2020). The annual reports for the IAMMP can be an appendix to the LOHCP annual reports, and will contain the following information:

1. Description of the restoration activities conducted, in terms of the area treated and specific management treatments implemented including any changes relative to the plan;

2. Species protection measures implemented and their outcomes including covered species observations and relocations, and incidental take/impacts;
3. Results of monitoring including qualitative and quantitative monitoring, if performed; and
4. Management and monitoring planned for the following year, including follow-up treatments and remedial actions.

The final annual monitoring report for the IAMMP will also document:

- the acres and location of habitat deemed successfully restored (Section 4.3);
- mitigation credits generated (Section 4.5); and
- ongoing management that will be used to maintain the restoration areas to ensure that the benefits for the covered species and communities are sustained (Section 4.6). These management measures will be incorporated into the LOHCP AMMP, which will guide ongoing management of the MDER following completion of this plan.

In the fall of each year, the County will prepare an annual work plan that will document the restoration treatments planned for the following year. The work plan will be provided to the wildlife agencies for review and approval at least thirty days in advance of planned work. After the work plan is circulated for review, the County will convene the wildlife agencies to discuss the work that was conducted during the current year, the results of qualitative and quantitative monitoring (which may be preliminary), and the proposed work plan for the follow year. Key discussion points and decisions from these meetings will be incorporated into the annual report provided the following winter, which will also contain the final work plan. Preparing the work plan in the fall/early winter and the annual report the following spring, will allow managers to plan the work based on preliminary results of monitoring, while allowing more time to prepare a detailed and comprehensive annual report.

5 Fuel Reduction

This section describes how fuel reduction can be conducted in the MDER by fire safety agencies and organizations seeking to develop a shaded fuel break as part of efforts to implement the Los Osos Community Wildfire Protection Plan (SLOCCFSC 2009)[3]. Specifically, it provides treatment recommendations to protect sensitive species and their habitat as well as identifies the avoidance and minimization measures that must be implemented for incidental take associated with the treatments to be covered under the incidental take permits issued based on the LOHCP. Such fuel modification is not proposed as mitigation under the LOHCP; however, it is described in this plan to ensure that the methods employed are consistent with the LOHCP, which includes implementation of fuel break as part of the Community Wildfire Protection Plan (CWPP) as a covered activity (LOHCP Section 2.2.7). The fuel break prescription and species protection measures are also provided in this IAMMP to ensure that the work is conducted in a manner that is compatible with the management of the MDER as a preserve within the LOHCP Preserve System, as well as a CDFW ecological reserve.

5.1 Background

In 2009, the San Luis Obispo County Community Fire Safe Council developed the CWPP, which identifies fuel reduction and fire hazard abatement treatments to reduce the risk of wildfire (SLOCCFSC 2009). The latest version of the CWPP for the Los Osos area (CAL FIRE/San Luis Obispo County Fire 2013) remains in draft form, covers San Luis Obispo County (not just Los Osos), and has yet to be adopted.

The approved CWPP calls for creation of a shaded fuel at the wildland-urban interface—the area between the intact native vegetation in parks and reserves (the wildland) on the perimeter of Los Osos, and the developed portions of the community (the urban area) in the center. In a shaded fuel break, vegetation is thinned to reduce the risk of fire and the rate of fire spread as well as provide a point of access to facilitate fire control. Shaded fuel breaks do not remove all vegetation in a given area but rather, reduce, modify, and manage fuels.

As part of coordination to develop the LOHCP, CAL FIRE Station 15, which works under contract with the Los Osos Community Service District to provide fire protection in the region, mapped an 89.4-acre area proposed for creation of a shaded fuel break (Figure 20). This included an approximately 100-foot-wide strip on the northern portion of the Bayview Unit where the unit abuts residences along Highland Drive.

While the CWPP identified a potential shaded fuel break in the southeast corner of the Pecho Unit (SLOCCFSC 2009), this fuel break was not included in the project description and the associated GIS layer provided to the County by CAL FIRE for coverage in the LOHCP; accordingly, this area was assumed to be dropped and was not included in the covered activities of the LOHCP.

The USFWS and CDFW have worked closely with CAL FIRE to develop avoidance and minimization measures for the CWPP; these measures have been incorporated into the LOHCP, which includes the CWPP as a covered activity (McGraw 2020). As a result of these measures and other aspects of the design of the project, the CWPP will avoid take of Morro Bay kangaroo rat and Indian Knob

[3] The latest version of the CWPP for the Los Osos area (CAL FIRE/San Luis Obispo County Fire 2013) remains in draft form and has yet to be adopted. Accordingly, the 2009 adopted plan is included as a covered activity in the LOHCP.

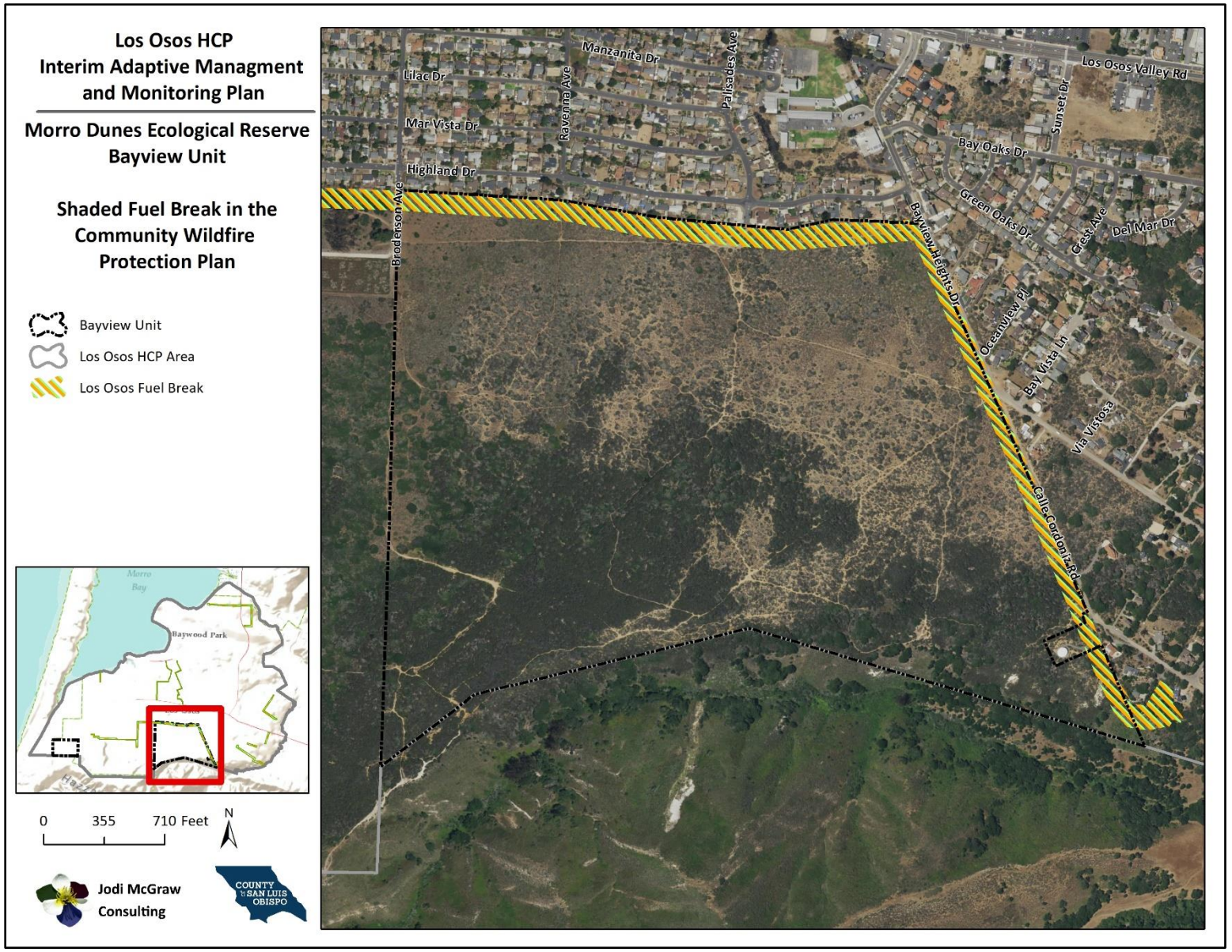


Figure 20: Fuel Break within the Bayview Unit Proposed as Part of the Community Wildfire Protection Plan

mountainbalm, and is anticipated to have negligible effects on Morro shoulderband snail and Morro manzanita through implementation of avoidance and minimization measures (McGraw 2020).

In 2019, CAL FIRE began constructing the fuel break within the Bayview Unit, where work to date has consisted of removing dead and downed material only; removal of live plants has not yet been initiated. The remaining work will be treated as funds allow. Cal FIRE and others must seek approval from CDFW for fuel break modifications prior to entering the site for work.

To help ensure that this restoration and management of the fuel break can be successful, the IAMMP provides recommendations for fuel reduction work in the MDER to maximize its benefits and minimize its impacts on the covered species and their habitats and to ensure that the work to reduce fire risk is maximally compatible with efforts to manage the MDER to promote populations of the covered species and safeguard sensitive habitat in the reserve. Such fuel modification is not proposed as mitigation under the LOHCP or the IAMMP.

5.2 Shaded Fuel Break Treatment Guidelines

The LOHCP specifies that, within the LOHCP Preserve System, CWPP projects must be designed and implemented to ensure that they limit their short-term negative impacts on, and maximize their ecological benefits for, the covered species and natural communities within the Baywood fine sands ecosystem.

The following are recommendations for future work to construct the shaded fuel break in the Bayview Unit by reducing fuels; the recommendations were based on the existing site conditions, including plant cover in the proposed treatment area and the sensitive ecology of the covered species and rare communities. Prior to implementation of the next phase of fuel break work in the reserve, a qualified biologist should be engaged to conduct a detailed assessment of the proposed treatment area and work with fire professionals to develop a fuel break prescription based on the current conditions within the treatment area and the fuel management objectives identified by the fire safety experts (i.e., desired height and spacing of remaining plants).That prescription should incorporate the following recommendations, which are listed in order of their priority for inclusion in the prescription; that is, step 1 should be implemented first, then step 2 should be implemented if and where additional biomass must be removed to achieve the fuel reduction objectives. Steps 3 and 4 should be implemented sequentially, only where needed to achieve the fuel reduction objectives.

> **Step 1: Remove Exotic Plant Species:** As part of work to reduce the amount and continuity of fuels within the fuel break, crews should prioritize removal of all plants (dead and alive) that are not native to the Baywood fine sands ecosystem. The target list should be compiled by a qualified biologist as during preparation of the site-specific prescription prepared based on examination of the treatment area, but should include the following species that have been observed in the designated fuel break area (i.e., the area within 100 feet of the residences along Highland Drive).
>
> a. Non-native trees including pines (other than naturally occurring Bishop pine, *Pinus muricata*) and cypresses (*Cupressus and Hesperocyparis* spp.);
>
> b. All escaped and planted ornamental plants including (but not limited to) Agave species, cacti (e.g., *Opuntia* sp.), yuccas (*Yucca* sp. or *Hesperoyucca* sp.), and daffodil (*Narcissus* sp.);

c. Invasive plants including veldt grass, freeway iceplant, and narrowleaf iceplant; and

d. Exotic annual grasses and forbs, including ripgut brome, red brome, and wild oats.

Removing these non-native plants can contribute to the fuel reduction goals for the shaded fuel break while also enhancing habitat for covered species, as required for the CWPP impacts to covered species to be covered under the LOHCP incidental take permit.

All biomass resulting from this and subsequent steps should be removed from the treatment area as part of the project and not left in piles for later burning, as such piles could be occupied by Morro shoulderband snail, which would then be incinerated. Woody biomass (i.e., shrub and tree branches) can be used by the County and/or CDFW to create brush barriers to close trails (Section 3.2.3.2.2.4).

Step 2: Remove Dead Biomass: After all exotic plants are removed, the next step to achieve fuel reduction should entail removing dead native shrubs and trees (if present) and their biomass laying on the soil surface (e.g., old branches). This material has ecological benefits including for Morro shoulderband snails, which can inhabit areas beneath dead shrubs, so some woody material should be retained where doing so is consistent with the fuel management objectives.

Step 3: Prune Live Shrubs and Trees: For senescent shrubs or trees featuring large areas of dieback, but that are still alive, cut dead branches at their base (i.e., where they diverge from live growth). For live shrubs and trees, cut lower limbs to reduce continuity of fuels.

a. In compliance with the LOHCP minimization measures for the CWPP (Table 10, Section 5.3), avoid and minimize canopy thinning or and limbing up of Morro manzanita.

b. Avoid removing mock heather, dune bush lupine, sand almond, and any other species important for Morro shoulderband snail, as required by the CWPP Avoidance Measures (Section 5.3).

Step 4: Remove Entire Native Woody Shrubs: Where entire shrubs need to be removed to achieve the desired spacing and height:

a. retain a diverse assemblage of native shrubs by preferentially removing more abundant species and retaining those that occur at lower abundance (the actual species to be removed versus retained will be determined based on examination of species composition and abundance);

b. Do not remove Morro manzanita, as required by the CWPP Avoidance and Minimization Measures (Table 10, Section 5.3); and

c. Avoid removing shrubs important for Morro shoulderband snail, including mock heather, dune bush lupine, and sand almond, as required by the CWPP Avoidance Measures (Section 5.3).

5.3 CWPP Avoidance and Minimization Measures

Section 5.2.4 of the LOHCP identifies a series of avoidance and minimization measures to limit take of/impacts to the covered species and nesting birds during implementation of the fire hazard abatement treatments as part of the CWPP (Table 10). These measures were developed by the USFWS and CDFW, which have worked closely with CALFIRE since 2010 to facilitate the CWPP. The measures for the four

covered species are designed to reduce take in the form of injury or mortality for Morro shoulderband snail, reduce the severity of impacts to Morro manzanita, and avoid take of/impacts to Morro Bay kangaroo rat and Indian Knob mountainbalm. Take of Morro shoulderband snail would be predominantly in the form of capture; trimming of Morro manzanita would be limited to the minimum required to achieve the fuel reduction objectives, with no removal of individual plants allowed. Based on the use of these measures as part of the LOHCP (Table 10) and the limited scope of abatement activities, implementation of the CWPP is expected to have a negligible effect on the covered species.

5.4 Compatibility with Restoration and Management

As noted at the outset of this section, fuel reduction is not a restoration or management action under the IAMMP; it is not being implemented as part of the LOHCP conservation strategy nor will the activity be used as mitigation for the LOHCP covered activities. Rather, it is a covered activity under the LOHCP. Nonetheless, when conducted appropriately, including based on the treatment guidelines (Section 5.2) and following the requisite avoidance and minimization measures (Section 5.3), fuel reduction can enhance habitat for the covered species, including by reducing the cover and competitive effects of exotic plants. In doing so, it has the potential to promote their populations.

Fuel reduction can also enhance resiliency of the covered species populations by reducing the likelihood that a fire in the developed areas will spread into the reserve. As discussed in greater detail in Section D.3 of the LOHCP, fire is a natural part of the Baywood fine sands ecosystem disturbance regime, and several of the covered species have life histories and ecologies that are adapted to recurring fire, as detailed in Section B of the LOHCP. Nonetheless, fire could have negative consequences for the covered species, particularly if the fire is outside of the natural fire regime (return interval, season, type, etc.) or is very large. Notably, Morro shoulderband snail is not adapted to fire and a large fire could eliminate or greatly reduce their population, potentially having consequences for long term persistence (e.g., by reducing genetic diversity).

Recognizing its potential benefits, fuel reduction work is not being proposed in this IAMMP as a habitat restoration treatment; instead, the treatments in this plan focus on addressing other more impactful and time-sensitive stressors: incompatible trail use and invasive species. As a result, fuel reduction will not be funded or implemented by the County nor credited for mitigation as part of this IAMMP; instead, it will be implemented by CAL FIRE as a covered activity under the LOHCP following the guidelines and avoidance and minimization measures designed to make the treatments maximally beneficial.

Nonetheless, the area within the designated fuel break features habitat for the covered species that is currently negatively impacted by invasive plants, ornamental plants, and incompatible recreation as, described in Section 2.7 and illustrated in Figures 3, 11, and 12. Work implemented by the County within the designated fuel break area, to restore and manage this habitat by addressing these stressors, including restoration projects outlined in this IAMMP, will be credited for compensatory mitigation as part of the LOHCP provided it meets the performance criteria (Section 4.5).

As described above, the fuel reduction work is anticipated to be compatible with the County's restoration work in the fuel break area. However, if fuel break activities conducted by CalFire or others degrade the habitat that was restored by the County, the County will provide alternative mitigation to replace any areas for restoration mitigation credit was received. The likelihood of such a conflict is low, since CAL FIRE and others must seek approval from CDFW prior to fuel break work, and must adhere to the prescriptions and mitigation measures designed to protect species.

Table 10: **Avoidance and Minimization Measures for Creation of the Shaded Fuel Break as part of the Community Wildfire Protection Plan (McGraw 2020)**

Taxa	Measure	Description
All Covered Species	All-1: Procedures and Training	Clearly defined operational procedures will be developed and implemented by CALFIRE. A USFWS-approved biologist will develop and deliver environmental awareness training sessions for all personnel involved in hazard abatement activities. The training will inform personnel regarding the identification, status, and presence of covered species likely to be present in each abatement area; those avoidance and minimization measures that must be implemented, and the legal ramifications associated with non-compliance. Training materials will include descriptions and pictures of the covered species, relevant provisions of the State and Federal Endangered Species Acts, and the project boundaries for each abatement action. CALFIRE will ensure that all personnel who participate in hazard abatement activities within the Plan Area receive this training immediately prior to the start of any hazard abatement activities.
	All-2: Biological Monitor	A USFWS-approved biologist will monitor all vegetation removal activities that will take place within habitat suitable for the covered species. Monitoring activities will be required daily until completion of initial disturbance at each location to ensure that avoidance and minimization measures are implemented. The monitor will be granted full authority to stop work at his or her discretion if abatement-related activities occur outside the demarcated boundaries of the treatment footprint. The monitor will stop work if any of the covered species are detected within the proposed abatement area and take the appropriate species-specific avoidance or minimization measures.
Morro Shoulderband Snail	MSS-1: Pre-Project Survey and Translocation of Morro shoulderband snail	Prior to the start of any abatement activities, a USFWS-approved biologist will conduct surveys to identify the location of any Morro shoulderband snails present in treatment areas. These surveys shall be conducted within 24 hours of the commencement of any activities associated with hazard abatement that could result in take of the species. The primary objective of the pre-activity surveys is to locate as many Morro shoulderband snails as possible so that they can be captured and moved out of harm's way. All live Morro shoulderband snails of any life stage found during pre-activity surveys, or any phase of hazard abatement, will be captured and moved out of harm's way to a pre-determined, USFWS and CDFW-approved receptor site by the surveying biologist.
	MSS-2: Minimize Impacts to Native Plants Important to	Canopy thinning and limbing up of plant species of particular value to Morro shoulderband snail must be avoided or minimized to the maximum extent possible. Pre-project surveys of treatment areas should be used to identify native plant species that should be avoided, which include but are not

Table 10: **Avoidance and Minimization Measures for Creation of the Shaded Fuel Break as part of the Community Wildfire Protection Plan (McGraw 2020)**

Taxa	Measure	Description
	Morro shoulderband snail	limited to mock heather (*Ericameria ericoides*), dune bush lupine (*Lupinus chamissonis*), and sand almond (*Prunus fasciculata* var. *punctata*).
	MSS-3: Monitor for Morro shoulderband snail	Prior to initiating any hazard abatement activities, a USFWS-approved biologist will be present to ensure that the limits of work are clearly delineated. This biologist shall have the authority to order any reasonable measure necessary to avoid the take of Morro shoulderband snail and to stop any work or activity not in compliance with the conditions set forth in the HCP/ITP. The biologist will notify the Ventura Fish and Wildlife Office, CDFW, and the County of San Luis Obispo Department of Planning and Building of any "stop work" order that is issued and this order will remain in effect until the issue has been resolved.
Morro Bay Kangaroo Rat	MBKR-1: Avoid Impacts to Morro Bay Kangaroo rat	Prior to initiating any fire hazard abatement activities in areas featuring habitat suitable for MBKR, a CDFW and USFWS-approved biologist will conduct a visual assessment of the site, which will be followed by a survey, as needed, to ensure the site is not occupied.
Morro Manzanita	MM-1: Minimize Impacts to Morro Manzanita	No individual Morro manzanita plants will be removed and all canopy thinning and limbing up of lower branches of Morro Manzanita will be avoided or minimized to the extent that abatement goals can still be achieved.
Indian Knob Mountainbalm	IKM-1: Avoid Impacts to Indian Knob Mountainbalm	Prior to initiating any hazard abatement activities, a CDFW and USFWS-approved biologist will survey the treatment area to assess the presence of Indian Knob mountainbalm. If the species is detected within or adjacent to the treatment area, CALFIRE must consult with the USFWS and CDFW to determine how to proceed as no impacts to individuals this species will be authorized.
Migratory Birds	MBA-1: Avoid Impacts to Migratory Birds	All hazard abatement activities will be conducted outside of the bird breeding season, which is generally considered to be between March 15 and September 15, annually. This seasonal prohibition period will be adjusted, as needed, to reflect changes in the breeding bird season due to climate change or other factors. If it is necessary to conduct abatement activities during this timeframe, a USFWS and CDFW-approved biologist must be retained to conduct breeding bird and nest surveys; treatments may only proceed if no breeding activity or nests are detected.

6 Implementation

This section describes how the MDER will be enrolled in the LOHCP Preserve System so that the habitat restoration and management actions outlined this plan can be credited as mitigation under the LOHCP. It also outlines the IAMMP implementation steps and their anticipated timeline.

6.1 Enrollment of the MDER in the LOHCP Preserve System

The following are required for the County to enroll the MDER into the LOHCP Preserve System and begin the restoration, management, and monitoring outlined in this plan:

1. **Memorandum of Understanding** The Memorandum of Understanding (MOU) between the California Department of Fish and Wildlife and the County of San Luis Obispo will enable CDFW to permit the County to conduct restoration and management within the property under the terms of a special-use permit.
2. **Cooperative Management Agreement:** The Cooperative Management Agreement between the County and CDFW meets the requirements in the LOHCP (sections 5.3.3.1 and 6.2.3.1), which require that preserve landowners maintain their management effort and ensure durability of the conservation actions on lands enrolled in the LOHCP Preserve System.

As described in detail below, the County and CDFW will develop a MOU that meets the requirements for both of these agreements.

6.1.1 Memorandum of Understanding

The County and CDFW are developing a Memorandum of Understanding (MOU) that will enable the County or its Implementing Entity to conduct the habitat restoration, management, and monitoring actions outlined in this plan on the MDER, which is managed by CDFW. This Interim Adaptive Management and Monitoring Plan for the Los Osos Habitat Conservation Plan Preserve System (IAMMP) was developed, in part, to serve as the "Mitigation Plan" for the MOU. The purpose of the IAMMP is to describe the specific management and/or restoration actions that will be implemented and the monitoring that will be used to evaluate their effectiveness, consistent with the Adaptive Management and Monitoring Plan for the Los Osos HCP Preserve System. The Mitigation Plan must be approved in writing by CDFW prior to CDFW's issuance of a Special Use Permit (SUP) to the County, which will enable the County to enter the MDER to implement habitat restoration, management, and monitoring. As these activities are being conducted as mitigation for the LOHCP covered activities, the MOU will refer to them as "the Mitigation."

6.1.2 Cooperative Management Agreement

To ensure that management of existing lands like the MDER promotes attainment of the LOHCP goals and objectives, Section 6.2.3.1 of the LOHCP requires that land management agencies and organizations seeking to enroll their lands into the LOHCP Preserve System must guarantee the following:

1. **Maintenance of effort:** the agency or organization will continue existing restoration and management efforts on the property, such that efforts funded through the LOHCP have added benefit for the covered species and do not simply replace existing efforts; and

2. **Long-term habitat protection:** the agency or organization must demonstrate that the property, or at least the portion that will be managed as part of the LOHCP Preserve System, is permanently protected from development or other activities that would result in loss or degradation of the habitat.

Table 11 outlines the elements of the cooperative management agreement (CMA) to enroll the MDER into the LOHCP Preserve System. Rather than creating a separate legal agreement, the MOU that will be signed by the County and CDFW incorporates these elements and will constitute the CMA for purposes of enrolling the MDER into the LOHCP Preserve System. The MOU includes the language in Table 11 regarding *Maintenance of Effort* and the *Method of Habitat Protection*. The MOU also describes how the entire MDER *Habitat is to be Enrolled*, and this IAMMP, which will be an appendix to the MOU, details the *Habitat Treatments.*

6.2 Responsibilities

The following outlines the responsibilities of the agencies involved in implementation of this plan.

1. **County**: The County will be responsible for all aspects of plan development and implementation.
    a. The County, which has funded development of this IAMMP, will be responsible for funding and implementing all work including developing the work plans. As outlined in the LOHCP and MOU, the County intends to designate an entity acceptable to CDFW (Implementing Entity), such as a land trust or conservancy, to implement the habitat restoration, management, and monitoring.
    b. The County is also responsible for California Environmental Quality Act (CEQA) compliance and must obtain and maintain all state, federal, and local permits, and licenses and approvals applicable to the Mitigation.
    c. The County will provide 60-days' notice to CDFW prior to conducting restoration and management, and will schedule a walk through with CDFW at least 30 days prior to any work to document the baseline conditions, as required by the MOU .
2. **CDFW:** Representatives of CDFW will facilitate implementation of the plan.
    a. Following approval of this plan, CDFW will be responsible for issuing to the County a SUP that will enable County entry into the MDER for purposes of implementing this IAMMP.
    b. CDFW will coordinate with the County on implementation of the IAMMP including by reviewing work plans and participating in walk throughs to establish baseline conditions.
    c. CDFW will assist with outreach to the community regarding trail management as outlined in Section 3.2.3.2.2.6.
    d. Consistent with the maintenance of effort requirement for enrolling existing protected lands in the LOHCP Preserve System (Section 6.1), CDFW will continue existing management of the reserve, which consists of occasional site visits and law enforcement (Section 2.8).
    e. Provide feedback on the restoration work plan, annual work plans, and the annual monitoring reports developed by the County (Section 4.8).
3. **USFWS:** The USFWS will review and provide feedback on the final work plan, annual work plans, and the annual monitoring reports developed by the County (Section 4.8).

Table 11: Elements of the Cooperative Management Agreement (CMA) required to enroll the MDER in the LOHCP Preserve System

CMA Element	MDER
Habitat to be Enrolled: the specific habitat areas to be enrolled in the LOHCP Preserve System, which must meet the following criteria: • provide suitable habitat for one or more of the covered species; and • have management or restoration needs that are not the current responsibility of the landowner/manager and met by available resources. If the property will be enrolled over time, the management units and their sequence or phasing will be determined.	The entire 278.7-acre area of the MDER including all of the Pecho and Bayview units will be enrolled in the LOHCP. As part of this IAMMP, the County will focus work on the Bayview Unit such that only the 230.9 acres within that unit needs to be enrolled at this time.
Habitat Treatments: the specific habitat restoration and management activities that will be implemented to improve habitat conditions as mitigation for the LOHCP.	This IAMMP describes the habitat restoration and management actions that the County (or its Implementing Entity) will conduct in the Bayview Unit as part of this plan. The AMMP will be developed during implementation of the IAMMP and will guide subsequent restoration, management, and monitoring within the MDER.
Method of Habitat Protection: the legal mechanism that will be used to ensure that the enrolled habitat is permanently protected from development, so that the restoration and management benefits resulting from mitigation are not wasted. Legal mechanisms can include conservation easements, permanent deed restrictions, and other legal documents (e.g., contracts) that restrict land use and associated activities, as appropriate and as approved by the USFWS.	As an ecological reserve, the MDER is protected by CDFW pursuant Fish and Game Code Sections 1580 and 1764 managed per California Code of Regulations (CCR) Title 14, Chapter 11, Sections 550 et seq., which includes general provisions for all ecological reserves, and Section 630, though the latter does not currently contain any specific provisions for the MDER. If there is a change in the laws or regulations that remove protection for the MDER, CDFW will provide the County and USFWS with 60-days advance notice before taking action to void or modify the protected status of the MDER. If there is a change in law or regulation that removes protection for MDER lands enhanced, restored, or managed by the County as part of the Conservation Program, the County will meet with the Service to identify alternative compensatory mitigation acceptable to the Service for any loss of mitigation value resulting from such a change.

Table 11: Elements of the Cooperative Management Agreement (CMA) required to enroll the MDER in the LOHCP Preserve System

CMA Element	MDER
Maintenance of Effort Plan: the current management and restoration activities that are being implemented by the landowner. These activities will continue to be implemented by the landowner to ensure that the LOHCP mitigation has added benefits for the covered species.	As described in greater detail in Section 2.8, CDFW has a land management plan that provides recommendations for management and monitoring of the Pecho Unit of the MDER; however, CDFW has not committed to implementing the LMP nor any other management, restoration, or monitoring activities within the MDER, which are implemented only as CDFW funds and other resources allow. Currently, CDFW Environmental Scientists conduct occasional site visits while CDFW Wardens conduct necessary law enforcement activities. For purposes of the CMA, CDFW agrees to continue to conduct occasional sites visits and implement law enforcement.

6.3 Plan Implementation Steps and Anticipated Timeframe

Table 12 outlines the steps to implement the IAMMP including their estimated timeframes relative to approval of this plan. It incorporates the requirements of the LOHCP for enrollment of preserves, and the MOU, including issuance of the Special Use Permit (SUP) and documentation of baseline conditions. As reflected in Table 12, the restoration treatments and monitoring to document their effectiveness are anticipated to be implemented over a five-year period that will begin following approval of this plan and subsequent issuance of a SUP. Initial restoration treatments will be conducted in the first year, while follow-up treatments and any remedial actions will be implemented in Years 2 and 3. Qualitive monitoring will be conducted quarterly in Years 1-3 while quantitative monitoring will be conducted the third spring following implementation of the treatments. If remedial actions and/or more time are required for the restoration areas to achieve the quantitative objectives, then monitoring will be repeated into years 4 and 5 as needed.

The steps to implement the IAMMP will occur concurrently with development of the AMMP based on surveys and more detailed planning as outlined in Section 5.3.3.2 of the LOHCP (McGraw 2020). The AMMP will incorporate the results of the IAMMP including by documenting the need for ongoing management actions to maintain the restoration areas once they have achieved the quantitative objectives and thus been credited for mitigation. The AMMP will also include any restoration projects identified in the IAMMP but not implemented due to limitations of the budget and/or LOHCP mitigation needs (Section 3.1.1). Concurrent with the steps to implement the IAMMP, the County will work to develop and obtain CDFW and USFWS approval for the AMMP prior to conclusion of the IAMMP. These and other steps to implement the LOHCP are outlined in Section 6.10 of the LOHCP (McGraw 2020).

Table 12: Tasks and timeline for implementation of this plan

Task	Description	Anticipated Timeframe
Year 1		
Enter into the MOU	CDFW and the County will sign the MOU to enable the County to conduct restoration, management, and monitoring	Within 2 weeks of approval of the IAMMP
Issue the Special Use Permit	The CDFW will issue to the County a SUP to permit implementation of the plan	Within 2 weeks of signing the MOU
Develop Restoration Project Work Plan(s)	The County will develop work plans for the selected restoration projects, to identify the final treatments, schedule, and costs, among other details.	Within 2 months of issuance of the SUP
Approve Work Plan(s)	CDFW and the USFWS will approve the restoration work plan(s)	Within 1 month of receipt of the work plan(s)
Conduct Baseline Monitoring	The County and CDFW will walk through the property and the County will document baseline conditions and conduct photomonitoring as required by the MOU.	Within 2 weeks of CDFW approval of the work plan(s)
Implement Initial Trail Restoration (if selected)	The County and CDFW will implement trail restoration per the workplan • CDFW and the County will conduct coordinated outreach to the community regarding trail management. • The County will install signs and fences to restrict trail use to designated areas and protect the restoration areas.	Within 2 weeks of documenting baseline conditions (except where the work plan schedule calls for seasonal timing)
Implement Initial Invasive Plant Control (if selected)	The County will conduct initial treatments to control veldt grass and co-occurring invasive plants per the management plan prescriptions	Within 1 year of MOU being signed (treatments will be seasonally timed)
Eucalyptus Removal (if selected)	The County will • conduct seed collection and contract growing • conduct surveys for monarch butterfly overwintering and nesting birds (as needed) • conduct the tree and biomass removal, and conduct erosion control and revegetation, if container stock will be available in time for winter planting (otherwise wait a year)	Tree Removal: September 1 – mid-October (after nesting bird season and before monarch arrival)

Table 12: Tasks and timeline for implementation of this plan

Task	Description	Anticipated Timeframe
Qualitative Monitoring	The County will assess habitat conditions and treatment effectiveness quarterly	Every three months following initial treatment
Agency Review Meeting (Year 1)	The County, CDFW, and USFWS will meet to discuss the restoration and monitoring activities and preliminary monitoring results, as well as anticipated actions for the following year	Fall Year 1
Annual Report (Year 1)	The County will prepare an annual report documenting the restoration treatment(s) and monitoring results, which will be included as part of the LOHCP Annual Report	March 31 of the year following initiation of restoration
Agency Review Meeting (Year 1)	The County, CDFW, and USFWS will meet to discuss the restoration, monitoring results, and next steps including follow-up treatments	April – June of the year following initiation of restoration
Year 2		
Follow-up Treatments	• The County will conduct follow-up invasive plant control in the invasive plant removal and trail restoration areas (if selected), and conduct remedial management, as needed • CDFW and the County will conduct additional coordinated community outreach, as needed, to enhance compliance with access regulations, if trail restoration is selected	Year 2
Qualitative Monitoring	The County will assess habitat conditions and treatment effectiveness quarterly	Quarterly in Year 2
Quantitative Monitoring	The County will use quantitative monitoring to assess achievement of the restoration objectives	Third spring (April or May) following initiation of restoration
Agency Review Meeting (Year 2)	The County, CDFW, and USFWS will meet to discuss the restoration and monitoring activities and preliminary monitoring results, as well as anticipated actions for the following year	Fall Year 2
Annual Report (Year 2)	The County will prepare an annual report documenting the restoration treatments and monitoring results, which will be included as part of the LOHCP Annual Report	March 31 following the second year of restoration
Year 3		

Table 12: Tasks and timeline for implementation of this plan

Task	Description	Anticipated Timeframe
Follow-up Treatments	• The County will conduct follow-up invasive plant control in the invasive plant removal and trail restoration areas (if selected), and conduct remedial management, as needed • CDFW and the County will conduct additional coordinated community outreach, as needed, to enhance compliance with access regulations, if trail restoration is selected	July – December in Year 3
Qualitative Monitoring	The County will assess habitat conditions and treatment effectiveness quarterly	Every three months in Year 2
Agency Review Meeting (Year 3)	The County, CDFW, and USFWS will meet to discuss the restoration and monitoring activities and preliminary monitoring results, as well as anticipated actions for the following year	Fall Year 3
Annual Report (Year 3)	The County will prepare an annual report documenting the restoration treatments and their effectiveness, which will be included as part of the LOHCP Annual Report. The report will document the acres of habitat restored to calculate the mitigation under the LOHCP.	March 31 following the third year of restoration
Years 4 and 5		
Follow-up Treatments	• The County will conduct additional follow-up treatments, qualitative monitoring, and quantitative monitoring, as needed for individual projects (invasive plant control vs. trail restoration) and within specific treatment areas, as needed, to achieve the restoration objectives. • The County will identify ongoing management needed to sustain the restoration treatment benefits, which will be incorporated into the AMMP.	Fourth and fifth years after initiation of management, as needed
Qualitative Monitoring	The County will assess habitat conditions and treatment effectiveness quarterly	Every three months in Years 4 and 5
Quantitative Monitoring	The County will use quantitative monitoring to assess achievement of the performance criteria	April or May each year
Agency Review Meeting	The County, CDFW, and USFWS will meet to discuss restoration and monitoring activities and preliminary monitoring results, as well as	Fall each year

Table 12: Tasks and timeline for implementation of this plan

Task	Description	Anticipated Timeframe
	anticipated actions for the following year (Year 4) as well as established mitigation credit (Year 5)	
Annual Report	The County will prepare an annual report documenting the restoration treatments and monitoring results, which will be included as part of the LOHCP Annual Report. The Year 5 report will document the mitigation credits resulting from monitoring.	March 31 following the reporting year

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