Moran Lake Monarch Butterfly Habitat Management Plan Update

prepared with the assistance of

Creekside Science
Stuart B. Weiss, PhD
Creekside Center for Earth Observation
Menlo Park, California 94025

prepared by

Rincon Consultants, Inc.
2511 Garden Road, Suite C-250
Monterey, California 93940

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Table of Contents

Tables

Figures

Appendices

1 Introduction

Rincon Consultants, Inc. (Rincon) has prepared this report for the Santa Cruz County Department of Parks, Open Space & Cultural Services (County Parks) as an update to the 2010 Moran Lake Monarch Butterfly Habitat Management Plan (MBHMP). The 2010 MBHMP integrated previous reports and studies regarding monarch butterfly overwintering habitat surrounding Moran Lake in Santa Cruz County, California. This updated MBHMP details the most recent monarch population data, describes current monarch overwintering conditions at Moran Lake, and provides updated monarch habitat management recommendations. This plan includes content that is consistent with the 2022 Monarch Overwintering Grove Management Plan Template. The template was developed for land managers of overwintering sites by the following agencies and organizations: Xerces Society for Invertebrate Conservation,[1] Groundswell Coastal Ecology,[2] California Department of Parks and Recreation, and the U.S. Fish and Wildlife Service (USFWS).

The 2010 MBHMP integrated the Management Plan for the Monarch Habitat at Moran Lake County Park (Joni L. Janecki & Associates 2004), the Management Plan for the Monarch Habitat at the D.A. Porath Sanitation Facility of the Santa Cruz County Sanitation District (Joni L. Janecki & Associates, Inc. 2006), and portions of the Moran Lake Water Quality Study & Conceptual Restoration Plan prepared for the Santa Cruz County Redevelopment Agency (John Gilchrist & Associates and Fall Creek Engineering 2005). This plan, unlike the 2010 plan, does not address improvements to County Parks' facilities (trails, amenities, etc.) or to the structure of the lake (bank stabilization). A separate project addressing those elements is being developed presently.

Land ownership of the overwintering habitat surrounding Moran Lake is shared between County Parks and the Santa Cruz County Sanitation District (Sanitation District). The overwintering habitat includes the eucalyptus groves within Moran Lake County Park and the Sanitation District's D.A. Porath Sanitation Facility. Each agency currently manages the monarch habitat on their own property.

County Parks was awarded a grant from the USFWS Coastal Program for Central California Coast. The USFWS agreement contains two objectives for County Parks to meet by 2023:

- Objective 1 – Create an updated site assessment and set of management recommendations, based on monitoring of the overwintering monarch site, to be referenced and considered in a future Monarch Butterfly Habitat Management Plan
- Objective 2 – With stakeholder and community input, prepare an updated Monarch Butterfly Habitat Management Plan for Moran Lake County Park, prepare environmental review document in accordance with the California Environmental Quality Act, and present to the County Board of Supervisors for review and adoption, allowing subsequent objectives to be completed.

[1] The Xerces Society for Invertebrate Conservation is an international nonprofit organization that protects the natural world through the conservation of invertebrates and their habitats. As a science-based organization, they both conduct their own research and rely upon the most up-to-date information to guide their conservation work. Key program areas include pollinator conservation, endangered species conservation, and reducing pesticide use and impacts (Xerces 2023a).

[2] Groundswell Coastal Ecology is a 501(c)(3) dedicated to building healthy coastal ecosystems through education and community-based ecological restoration and research. The organization partners with land managers, agencies, stakeholder groups, and the public to identify, prioritize, plan, and implement projects that enhance biodiversity and the long-term health of coastal habitats (Groundswell Coastal Ecology 2023).

To meet these objectives, County Parks contracted a qualified entomologist specializing in migratory monarchs to assess the site, complete an updated report, and provide a set of recommendations for monarch habitat management at Moran Lake County Park. Entomologist Dr. Stu Weiss's findings and recommendations are presented in the 2022 Moran Lake Monarch Butterfly Habitat Existing Conditions Report (Appendix A). Recommendations were modified in 2024 based on additional available information and written as an addendum to the Moran Lake Monarch Butterfly Overwintering Habitat Existing Conditions Report prepared in 2022. Data and management recommendations from the 2024 Addendum have been incorporated into this plan, and are in Appendix A.

County Parks is currently orchestrating stakeholder and community input that will be used to complete this Monarch Butterfly Habitat Management Plan for Moran Lake County Park. In addition, County Parks has contracted with consultants to prepare an environmental document in accordance with the California Environmental Quality Act and present it to the County Board of Supervisors for review and adoption, which would facilitate achievement of the aforementioned objectives.

2 Background and Purpose

Available reports regarding the origin of the blue gum eucalyptus forest that provides the monarch butterfly overwintering habitat include the1980 Environmental Baseline Study for the Moran Lake Enhancement Plan Santa Cruz, California, and the 2005 Santa Cruz County Redevelopment Agency's Moran Lake Water Quality Study & Conceptual Restoration Plan, and the 2010 Moran Lake Monarch Butterfly Habitat Management Report (MBHMP) The consensus is that the blue gum eucalyptus growing around Moran Lake were likely planted as windbreak trees in the late 1800's or early 1900's. An analysis of aerial photos showed that the trees were well-established by 1929. Two adjacent woodlots were planted north of the lake. The main eucalyptus grove is likely the remains of one of the woodlots and now surrounds the Sanitation District's D.A. Porath Sanitation Facility, which was constructed in 1953.

The 1980 Environmental Baseline Study (Study) was prepared for the first phase of the Moran Lake Enhancement Plan. The Study notes that surveys were conducted that year for water quality in relation to biological abundance and diversity. Biological inventories included vegetation, birds, aquatic invertebrates (benthic and planktonic), fish and mammals. The stated intent of the Study was for the baseline information to be used for comparison, with post-restoration monitoring at Moran Lake. No known monitoring reports are available at the time of the drafting of this document. The Study notes that Moran Lake supported an extremely impoverished fauna of estuarine organisms at that time. No data regarding monarch butterflies is provided.

The Redevelopment Agency's Restoration Plan discusses Moran Lake historically as a pocket beach heavily influenced by seasonal tides that was filled with soil and materials in the early 1960s when Wood's Lagoon was expanded and converted into the Santa Cruz Yacht Harbor. The 2005 Plan describes the area being colonized primarily by non-native plants at that time, including by the dominant trees of blue gums (*Eucalyptus globulus*) and Monterey cypress (*Cupressus macrocarpa*).

In 1997, the Xerces Society, a volunteer citizen scientist group, began recording monarch butterfly overwintering counts in the state. In 1997, the organization recorded approximately 70,000 overwintering monarchs at the Moran Lake site. In 2016, the Xerces Society listed the Moran Lake site as one of the top 10 highest priority overwintering sites in the region. The western population of monarch butterflies has fluctuated greatly in recent years. An annual count of monarchs at Moran Lake in 2020 recorded just 50 overwintering monarchs; 7,050 were recorded in 2023 (Xerces Society 2023b).

In 2010, Moran Lake County Park's MBHMP was prepared to include the most recent monarch population use and habitat information and provide County Parks with an updated, comprehensive, and certified monarch management plan. The MBHMP provided goals and management recommendations for all monarch overwintering habitat surrounding Moran Lake. Since that time, County Parks has struggled with the funding to implement such a plan, and thus, management actions were constrained.

Over the past decade much of the monarch overwintering habitat at Moran Lake, comprised of eucalyptus groves, has been altered by drought. The long-term drought has negatively affected monarch overwintering habitat along the California coast as it has at the Moran Lake site. The drought, plus permitted and non-permitted tree removals, non-holistic tree maintenance, and poorly draining soil resulting in multiple tree failures of windbreak trees are contributing to the declining habitat.

The purpose of this updated MBHMP is to describe the current habitat conditions on-site and provide updated management recommendations based on current monarch overwintering observations and existing habitat conditions that will aid in the restoration, preservation, and future enhancement of monarch overwintering habitat at Moran Lake.

2.1 Monarch Butterfly Habitat Listing Status

2.1.1 Federal

In 2014, the Center for Biological Diversity petitioned the USFWS to list the monarch butterfly as a threatened species under section 4(d) of the federal Endangered Species Act (ESA; Center for Biological Diversity 2014). The USFWS updated their status assessment on December 15, 2020 (USFWS 2020), finding that listing of the western monarch population was warranted but precluded. The finding stated that the USFWS could not identify Evolutionary Significant Units (ESU) for monarchs, because, as defined in the ESA, when invertebrates, including butterflies, are evaluated, they are evaluated across the entire range. The evaluation was based on the global population that includes monarchs that occur east of the Rocky Mountains and on multiple continents. Monarchs were ranked at priority level #8 on the species list, where they still remain, with the proposed listing decision by USFWS set for 2024 (USFWS 2022).

2.1.2 State

Monarchs are included on the California Department of Fish and Wildlife (CDFW) Terrestrial and Vernal Pool Invertebrates of Conservation Priority list with a State Ranking of S2S3, Imperiled/Vulnerable (CDFW 2017). The monarch is also listed as a Species of Greatest Conservation Need on California's State Wildlife Action Plan (CDFW 2015). The Sacramento Superior Court ruled in *Almond Alliance of California v. California Department of Fish and Wildlife,* Sacramento Superior Court No. 34-2019-80003216 (Nov. 13, 2020) that insects are not protected under the California Endangered Species Act (CESA). On May 31, 2022, an appellate court ruled that the CESA does in fact cover terrestrial invertebrates, thereby reversing the previous ruling (Sacramento Superior Court No. 34-2019-80003216CUWMGDS). Currently, monarchs are not listed under the CESA, though there is potential for the overwintering population to be listed in the future, based on the May 2022 ruling. Monarchs do have protection under California Fish and Game Code (Section 1002), which prohibits the take or possession of wildlife and California Code of Regulations Title 14 Sections 650(a) and (b), which requires a valid Scientific Collection Permit issued by CDFW for "handling monarchs, removing them from the wild, or otherwise taking them for scientific or propagation purposes, including captive rearing."

The California Coastal Act (CCA) defines Environmentally Sensitive Habitat Areas (ESHA) as "any area in which plant or animal life or their habitats are either rare or especially valuable because of their nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments." Unique plant habitats, rare and endangered plant and animal habitats, wetlands, coastal streams, rocky points, sea cliffs, intertidal areas, and kelp beds are typically considered ESHA. Therefore, according to the CCA the riparian corridors within the Coastal Zone are also considered ESHAs and the riparian vegetation associated with Moran Creek is an ESHA. Additionally, the marine and estuarine habitat that occurs in the southwestern portion of the Project Area, below the hightide line of the Pacific Ocean is also considered an ESHA. Areas which provide habitat for rare, endangered, or threatened species are also considered ESHA. The

eucalyptus groves within Moran Lake County Park which provide overwintering habitat for the monarch butterfly are therefore also ESHAs.

2.1.3 Regional

The Santa Cruz County Code's Chapter 16.32 Sensitive Habitat Protection, section 16.32.040 defines ESHAs as Sensitive Habitat. Habitat is considered sensitive if it provides habitat for plant or animal species or communities that are locally unique or are recognized by the State or Federal Resource Agencies as being rare, threatened endangered, or a species of special concern (County of Santa Cruz 2024). Therefore, Moran Lake, its associated wetlands, Moran Creek, and the monarch butterfly overwintering habitat are ESHA per County Code.

County Code Chapter 16.34 Significant Trees preserves significant trees and forest communities on private and public property in the County's Coastal Zone to protect and enhance the County's natural beauty, property values, and tourist industry. The ordinance prohibits the removal of significant trees. Significant trees include any tree, sprout clump, or group of trees, as follows:

(A) Within the urban services line or rural services line, any tree which is equal to or greater than 20 inches d.b.h. (approximately five feet in circumference); any sprout clump of five or more stems each of which is greater than 12 inches d.b.h. (approximately three feet in circumference); or any group consisting of five or more trees on one parcel, each of which is greater than 12 inches d.b.h. (approximately three feet in circumference).

(B) Outside the urban services line or rural services line, where visible from a scenic road, any beach, or within a designated scenic resource area, any tree which is equal to or greater than 40 inches d.b.h. (approximately 10 feet in circumference); any sprout clump of five or more stems, each of which is greater than 20 inches d.b.h. (approximately five feet in circumference); or, any group consisting of 10 or more trees on one parcel, each greater than 20 inches d.b.h. (approximately five feet in circumference).

(C) Any tree located in a sensitive habitat as defined in Chapter 16.32 SCCC. Also see SCCC 16.34.090(C), exemption of projects with other permits.

Tree removal exemptions listed in Section 16.34.090 of the ordinance include tree removals for Sensitive Habitat Protection. The monarch butterfly management area is sensitive habitat; therefore, the tree removal exemptions apply when trees are removed for habitat protection or protection of the management area. Sensitive habitat includes riparian corridors, all lakes, wetlands, estuaries, lagoons, streams and rivers, areas which provide habitat for species of special concern as listed by the California Department of Fish and Game in the special animals list, natural diversity database. Tree removals may be conducted consistent with Section 16.34.090 and as "habitat" versus single trees.

Biological and water resources are protected by the County of Santa Cruz General Plan and the Local Coastal Plan (LCP) policies outlined in *Chapter 5: Conservation and Open Space* of the General Plan. Relevant policies for the Moran Lake County Park Improvement Project include those outlined under the following General Plan and Local Coastal Plan objectives: *5.1 Biological Diversity, 5.2 Riparian Corridors and Wetlands, 5.3 Aquatic and Marine Habitats, 5.4 Monterey Bay and Coastal Water Quality,* and *5.7 Maintaining Surface Water Quality*.

2.2 Consistency with Other County Plans

The MBHMP is in the jurisdiction of two local land use plans: the Pleasure Point Community Plan and the Santa Cruz County 1994 General Plan and LCP. The Pleasure Point Community Plan was adopted in May 2010 through County ordinances and focuses primarily on design standards and public improvements in the Pleasure Point/26th Avenue area (Santa Cruz County 2010). Since the MBHMP does not propose development as a part of the plan, the Pleasure Point Community Plan does not apply and is not evaluated further within this document. However, the Santa Cruz County 1994 General Plan and LCP includes several policies that serve to protect sensitive habitat areas, and thus, avoid or mitigate potential impacts to sensitive habitat that may occur as a result of development in the County. The MBHMP's consistency with these policies is discussed below.

Table 1 MBHMP Consistency with the 1994 General Plan and Local Coastal Program

County of Santa Cruz LCP Policy and Programs	Consistency Discussion
Conservation and Open Space Element	
5.1.4 Sensitive Habitat Protection Ordinance (LCP). Implement the protection of sensitive habitats by maintaining the existing Sensitive Habitat Protection ordinance. The ordinance identifies sensitive habitats, determines the uses which are allowed in and adjacent to sensitive habitats, and specifies required performance standards for land in or adjacent to these areas. Any amendments to this ordinance shall require a finding that sensitive habitats shall be afforded equal or greater protection by the amended language.	**Consistent.** The MBHMP in itself serves to protect the monarch butterfly overwintering habitat by setting forth management actions consistent with Ordinance 5.1.4.
5.1.7 Site Design and Use Regulations (LCP). Protect sensitive habitats against any significant disruption or degradation of habitat values in accordance with the Sensitive Habitat Protection ordinance. Utilize the following site design and use regulations on parcels containing these resources. excluding existing agricultural operations: (a) Structures shall be placed as far from the habitat as feasible. (b) Delineate development envelopes to specify location of development in minor land divisions and subdivisions. (c) Require easement, deed restrictions, or equivalent measures to protect that portion of a sensitive habitat on a project parcel which is undisturbed by a proposed development activity or to protect sensitive habitats on adjacent parcels. (d) Prohibit domestic animals where they threaten sensitive habitats. (e) Unlit removal of native vegetation to the minimum amount necessary for structures, landscaping. driveways, septic systems and gardens. (f) Prohibit landscaping with invasive or exotic species and encourage the use of characteristic native species.	**Consistent.** The plan would not result in disruption or degradation of a sensitive habitat and would incorporate native plants in an effort to improve monarch success at Moran Lake.
5.1.9 Biotic Assessments (LCP). Within the following areas, require a biotic assessment as part of normal project review to determine whether a full biotic report should be prepared by a qualified biologist: (a) Areas of biotic concern. mapped; (b) Sensitive habitats, mapped & unmapped.	**Consistent.** The MBHMP serves as a biotic assessment of the monarch habitat of Moran Lake. The primarily goal is to enhance the function of Moran Lake through restoration activities which would better sustain a native monarch population.

County of Santa Cruz LCP Policy and Programs	Consistency Discussion
5.1.10 Species Protection (LCP). Recognize that habitat protection is only one aspect of maintaining biodiversity and that certain wildlife species, such as migratory birds, may not utilize specific habitats. Require Protection of these individual rare, endangered and threatened species and continue to update policies as new information becomes available.	**Consistent.** The MBHMP provides updated management recommendations based on current data that will aid in the restoration, preservation, and enhancement of monarch overwintering habitat at Moran Lake. Implementation of the plan would improve habitat protection for monarchs.
5.1.14 Removal of Invasive Plant Species (LCP). Encourage the removal of invasive species and their replacement with characteristic native plants, except where such invasive species provide significant habitat value and where removal of such species would severely degrade the existing habitat. In such cases, develop long-term plans for gradual conversion to native species providing equal or better habitat values.	**Consistent.** Where blue gums are dead, dying or removed at historic aggregation locations, they will be replaced with blue gums or other suitable species. Recommended replacement trees, not at aggregation sites will include blue gums, other blue gums species (red ironbark and karri), and other native species (oaks, cypress, etc.) to provide biodiversity and to adjust to the climatic conditions that are hotter and direr than in the past. The hot dry weather is contributing to the diminished health of the blue gum trees. Replacement trees will be selected based on the specific soil, water, sunlight, and need for wind protection at each location. This is being done in order to adapt to the existing conditions and promote longevity of the site.
5.2.3 Activities Within Riparian Corridors and Wetlands (LCP). Development activities, land alteration and vegetation disturbance within riparian corridors and wetlands and required buffers shall be prohibited unless an exception is granted per the Riparian Corridor and Wetlands Protection ordinance. As a condition of riparian exception, require evidence of approval for development from the US Army Corps of Engineers, California Department of Fish and Game, and other federal or state agencies that may have regulatory authority over activities within riparian corridors and wetlands.	**Consistent.** The project site contains Moran Lake: the coastal lagoon and associated wetlands. Recommended tree planting would occur directly adjacent to these areas. However, removal and replanting of trees on the project site would be required to comply with all applicable laws and regulations. Furthermore, the Park's arborist would be consulted prior to initiating management activities. These actions would limit any adverse effects on water quality in Moran Lake and associated waterways.
5.2.8 Environmental Review for Riparian Corridor and Wetland Protection (LCP). Require environmental review of all proposed development projects affecting riparian corridors or wetlands and preparation of an Environmental Impact Report or Biotic Report for projects which may have a significant effect on the corridors or wetlands.	**Consistent.** The MBHMP in itself is a biotic report which identifies sensitive habitats on the project site and sets forth management actions to improve the habitat. Future management plan actions proposed under the plan would not have adverse effects on Moran Lake nor its associated wetlands.
5.10.8 Significant Tree Removal Ordinance (LCP). Maintain the standards in the County's existing ordinance which regulates the removal of significant trees and other major vegetation in the Coastal Zone, and provide appropriate protection for significant trees and other major vegetation in areas of the County located within the Urban Service Line.	**Consistent**. The trees at Moran Lake are regularly inventoried by an arborist certified by the International Society of Arboriculture. Many of the trees in the management area meet the "Significant Tree" criteria. Collectively the trees create an urban forest and are sensitive habitat. This plan specifically provides recommendations for tree removals and replacement plantings to maintain monarch butterfly overwintering habitat. The need for replacement trees will be determined based on the function and need of the habitat, versus by a ratio (e.g., two replacement trees for one removal) and will be conducted in accordance with the ordinance.

LCP = Local Coastal Plan; MBHMP = Monarch Butterfly Habitat Management Plan

Source: Santa Cruz County 1994

3 Site Description

3.1 Location

The site is located in and around Moran Lake County Park in the unincorporated Live Oak area of the County, approximately 0.25-mile west of Soquel Point and directly northeast of the Pacific Ocean (Figure 1). The site is surrounded by residential neighborhoods to the west, north, east, and south, as well as Moran Lake Beach to the southwest (Figure 2). The site is depicted on the *Soquel, California* United States Geological Survey (USGS) 7.5-minute topographic quadrangle map and is located in Township 11 South, Range 1 West, Section 21.

The site is located within the Central Coast geographic subregion of California (Baldwin et al. 2012). The climate in this region is characterized by warm, dry summers and mild, wet winters. The average high temperature during summer months (June through September) is 75 degrees Fahrenheit (°F) and the average low temperature is 50 °F. The average high temperature during the winter months (December through March) is 62 °F and the average low temperature is 40 °F. Average annual precipitation is 29.3 inches, with the majority of rainfall occurring during November through March (Western Regional Climate Center 2022). Topography on-site is generally flat, with elevations ranging from approximately 10 to 50 feet above mean sea level.

The management area for this MBHMP update includes the monarch butterfly overwintering habitat which is the eucalyptus groves of Moran Lake County Park and the Sanitation Facility that surround Moran Lake and Creek (the coastal lagoon and associated wetlands), the sandy beach around the lake, and the vegetation that comprises the windbreak at the site. It also includes a small rectangular parcel at 40 Moran Way, which contains additional eucalyptus grove habitat.[3] A separate plan and project addressing the Moran Lake County Park amenities (trails, picnic tables, the restroom, etc.) and the culvert at East Cliff Drive will be prepared to address those features. Sensitive habitat on private properties immediately adjacent to the management area contributes important windbreak for the site. While the County cannot manage the private land, the designation of the parcels as sensitive habitat will function to conserve the habitat.

3.2 Soils

The U.S. Department of Agriculture, Natural Resources Conservation Service (USDA NRCS) Web Soil Survey identifies three soil map units within the management area: Watsonville loam, 0 to 2 percent slopes; Watsonville loam, thick surface, 0 to 2 percent slopes; and Watsonville loam, thick surface, 2 to 15 percent slopes. Watsonville loam soils are derived from alluvium and formed on marine terraces from 0 to 1,200 feet in elevation. The depth to the water table is more than 80 inches. The frequency of flooding and ponding is none. The available water supply is very low (about 2.9 inches), and the soils are somewhat poorly drained (USDA NRCS 2022a). Watsonville loam soils are included on the NRCS list of hydric soils (USDA NRCS 2022b). The soils in many areas of the site, particularly on the northern edge of the lagoon, and within the 40 Moran Way parcel, suffer from poor drainage and are prone to ponding. This has led to the failure of large eucalyptus trees due to windthrow.

[3] "Management area" and "Moran Lake site" will be used interchangeably throughout this report to refer to the outlined area depicted in Figure 2 and described in Section 3.1.

Figure 1 Regional Location

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Management Area

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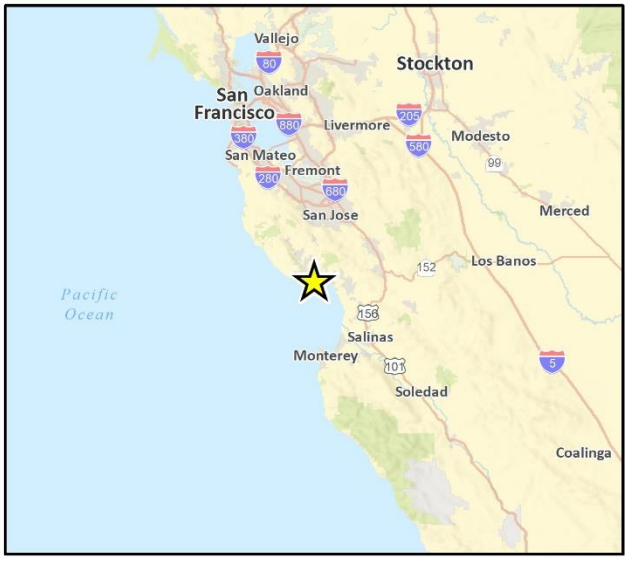

Fig 1 Regional Location

Figure 2 Monarch Habitat Management Area

Imagery provided by Microsoft Bing and its licensors © 2023.

3.3 Dominant Tree Community: Eucalyptus Grove

The eucalyptus groves in the management area currently most closely resemble the Eucalyptus spp. Woodland Semi-Natural Alliance (*Eucalyptus globulus* Association) described by Sawyer et al. (2009). Eucalyptus trees are dominant in this alliance and preclude most other plant species from growing in the understory. Eucalyptus groves were planted as windbreaks throughout California and have also been naturalized in many areas adjacent to streams and lakes.

Eucalyptus groves cover approximately 8.18 acres of the management area, with dense stands growing around the D.A. Porath Sanitation Facility in the northern portion of the management area, along the western edge of the lagoon near the center of the management area, along the southeastern corner of the lagoon, and within the 40 Moran Way Parcel in the easternmost portion of the management area (Figure 2). The understory of the eucalyptus groves is generally scarce. Poison oak (*Toxicodendron diversilobum*) dominates the shrubby understory, forming low density and coverage thickets, and the herbaceous understory is generally absent. Although eucalyptus groves are non-native, they do comprise the important overwintering habitat for monarch butterflies on-site.

Rincon prepared the Moran Lake Arborist Report in 2022, which details the findings from the tree survey conducted by International Society of Arboriculture (ISA) certified arborist Casey Clark and Rincon Biologist Kate Ludwig on June 7 and June 8, 2022. During the survey, the location, species, diameter at breast height (DBH), height, canopy spread, general health condition, and any relevant notes (particularly pertaining to structural integrity) were recorded for each tree. A tree tag was also assigned to each tree surveyed. The 2022 Arborist Report is included in Appendix A.

3.4 Other Vegetation Communities

In addition to eucalyptus groves, the management area includes a coastal lagoon (Moran Lake) and its surrounding wetlands, which have been heavily modified by urban development and the introduction of non-native plant species. The 2005 Redevelopment Agency document discussed the trend/transition of vegetation on-site to dominant non-natives as “somewhat disturbing” when they compared the number of native shrubs and herbaceous plants then, to the 1980 Environmental Baseline Study for the Moran Lake Enhancement Plan. Upland native vegetation species identified in 1980 but not in 2004 include deerweed (*Lotus scoparius*), sky lupine (*Lupinus nanus*), bush lupine (*Lupinus arboreus*), coyote brush (*Baccharis pilularis*), California poppy (*Eschscholzia californica*), coast hedge nettle (*Stachys chamissonis*), seaside dandelion (*Agoseris apargioides*), loosestrife (*Lythrum hyssopifolia*), slough sedge (*Carex obnupta*), and bulrush (*Scirpus americanus*).

The following vegetation communities and land cover types exist within the management area: eucalyptus groves, pickleweed mats, disturbed riparian scrub, ice plant mats, sandy beach, annual grassland, ruderal, and developed. The Biological Resources Assessment Report prepared in 2022 provides a full discussion regarding vegetation communities and other biological resources and is included as part of Appendix A.

3.5 Current Management

An agreement between Parks and Sanitation to manage the eucalyptus trees and overall habitat was made in the past; however, changes in staff for both entities have meant separate

management. The two entities are currently discussing an updated MOU that would potentially result in Parks managing the entire habitat to promote holistic management.

3.5.1 County Parks Management

Regular vegetation maintenance is conducted at Moran Lake County Park, including annual high weed mowing along the east and west bank walkways, trimming of eucalyptus tree limbs upon resident request (not more than one third of the new growth), and removal of small saplings that sprout from trunks of previously failed or removed eucalyptus trees. Parks' certified arborist conducts hazard tree assessments and identifies trees to be removed for the safety of the public and infrastructure. Emergency hazard tree removals are ongoing at present, due to the 2023 and 2024 winter storm events. Since early 2023, hazard tree removals have included the removal of three eucalyptus that have fallen and three that were leaning and creating imminent danger to the public and infrastructure beneath the trees. Prior to tree removals Parks has conducted the required nesting bird surveys, monarch surveys, and received authorization via the Planning Department. The February 2024 windstorm resulted in the failure of 28 blue gum eucalyptus trees, 20 from the 40 Moran Way property, and 8 within the Moran Lake Park property adjacent to Baker Street. Several of the trees damaged park property and private property, includes residences and vehicles along Moran Way, Baker Street, and Placer Street. The failures compromised adjacent trees that did not fall, but were weakened and/or damaged. After the storm event, an additional 13 trees were removed due to their imminent danger. These tree removals were recommended by Nigel Belton, ISA-certified arborist and authorized by the Planning Department.

3.5.2 Sanitation District Management

In July 2017, the County Environmental Planning Department issued a Biotic Approval for vegetation management and debris removal activities within the eucalyptus grove surrounding the Sanitation Facility. Since that time, ongoing maintenance activities within the eucalyptus grove have been conducted as necessary to reduce the risk of falling limbs or trees, fire, and homeless activity at the Sanitation Facility and adjacent properties. Nigel Belton, ISA-certified arborist, and John Dayton, Biologist/monarch butterfly specialist, were retained as consultants to provide guidance and recommendations for all vegetation removal activities.

In 2017, brush clearing and debris removal was performed in the area to the west and north of the Sanitation Facility's western parking area. Tree trimming work within the Sanitation District property and rear yards of several adjacent Placer Street properties was performed based on the recommendations by Mr. Belton and Mr. Dayton, which included topping some of the blue gum eucalyptus within the Sanitation District property, which is not normally recommended, but was needed to preserve at least a portion of the trees for windbreak. Tree maintenance was also performed along the trail for trees that posed a threat to a private residence located on Palisades Avenue. In July 2018, brush clearing and vegetation removal continued in the area near the northeast of the Sanitation Facility entrance. Tree maintenance work also continued along Placer Street, based on Mr. Belton's 2017 recommendations. Tree saplings were planted by Confluence Restoration, which was also contracted to maintain and irrigate the saplings during the establishment phase of the mitigation planting.

In July 2019, brush clearing and vegetation removal was performed in the area surrounding the Sanitation Facility, as well as tree maintenance work along the Moran Trail to the east of the Sanitation Facility. In April 2020, Mr. Belton provided an updated assessment of the trees within the

eucalyptus grove from the north end of the Sanitation Facility to the west end, near the storage yard located at the end of Quartz Drive.

In July 2020, brush clearing and vegetation removal continued near the storage yard and along Moran Trail. Tree maintenance work was also performed in July 2020 near Moran Pump Station, along Moran Trail heading west towards the storage yard, and behind the warehouse near the access road to the storage yard. In September 2020, tree maintenance work continued along Moran Trail (towards 30th Avenue) to remove dead branches that posed a risk to the public.

In 2021, brush clearing and debris removal were performed in the area surrounding the Sanitation Facility, as well as tree maintenance work along northeast and west side of the Sanitation Facility.

In 2022, vegetation clearing was performed in the eucalyptus grove northeast of the Sanitation Facility.

3.5.3 Sensitive Habitat on Privately Owned Property

The hillsides, vegetation (including trees) and structures on private property immediately adjacent to the management area, provide critical windbreak to the habitat. Figure 3 displays the location of the sensitive habitat on private land. The County Board of Directors required that the sensitive habitat be designated and mapped through an amendment at the 2011 adoption of the 2010 Plan. These areas should be managed consistent with the actions described for the wind shelter and in coordination with the butterfly specialist.

3.6 Overwintering Habitat Zones

The USFWS Western Monarch Butterfly Conservation Recommendations (February 2023) to manage coastal California overwintering habitat as three zones is being implement through this plan update. The zones are the core zone (cluster area), shelter zone (wind protection and outer site boundaries surrounding core zone) and support zone (area within 500 feet of an overwintering site that provides nectar, hydration, and microclimate protection) and are shown on Figure 4.

Figure 3 Moran Lake Sensitive Habitat on Private Land

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Fig 3 Moran Lake Private Ownership Sensitive Habitat

Figure 4 Moran Lake Monarch Buttterfly Overwintering Habitat Zones

Imagery provided by Microsoft Bing and its licensors © 2024.

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Fig 2 Moran Lake MBHMP Management Area_Overwintering Zones

3.7 Climate Change

Climate change and sea level rise is impacting all coastal communities around the world. In the past century, average global temperatures have increased by about 1.4 °F, and average global sea level has increased by 17 to 21 centimeters (7 to 8 inches) (Intergovernmental Panel on Climate Change 2013). Western monarchs are particularly vulnerable to climate change, due to their reliance on coastal overwintering habitat and their dependence on environmental cues to trigger reproduction, migration, and hibernation (Advani 2015). Increased temperatures, wildfires, and drought conditions are impacting eucalyptus grove habitat along the California coast, resulting in degraded or destroyed monarch overwintering habitat in multiple locations (Xerces Society 2020). Drought has impacted the health of the eucalyptus trees surrounding Moran Lake in recent decades, and climate change will likely continue to exacerbate both drought conditions and intense, episodic storm events. This plan serves to guide the management actions of the habitat to accommodate current and future climate change impacts, for example by adjusting the approach for tree replacement planting from requiring tree replacements at a 2:1 ratio to requiring replanting that supports the functional need of the habitat.

Coastal Santa Cruz County is already experiencing the impacts of climate change, and coastal lagoons in the county, including Moran Lake, are predicted to become more vulnerable to tidal inundation and coastal flooding in the coming years (Central Coast Wetlands Group 2017). Sea-level rise could alter salinity in Moran Lake and potentially impact the eucalyptus grove habitat surrounding Moran Lake. These impacts are most likely to occur during large swell and/or high-tide events, when the ocean inundates the lagoon and surrounding area and could affect eucalyptus trees directly and/or increase the soil salinity in and around the groves. For example, if winter storms cause the ocean to overtop and spill into Moran Lake with relative regularity, higher salinity inputs may negatively affect vegetation that cannot survive in higher saline environments. Around Moran Lake, if the water level rises, the salinity and saturated soils will rise with it and could cause trees and other vegetation to die off and retreat from the water line. Management recommendations provided in Section 5 below will aid in protecting and enhancing monarch overwintering habitat in the face of changing climatic conditions.

The Climate Action and Adaptation Plan (CAAP) developed by the County in December 2022 includes a number of strategies and objectives for responding to climate change. One of the strategies outlined in the CAAP is to increase the urban tree canopy (County 2022). The recommendations outlined in this MBHMP (e.g., improving the health of existing eucalyptus trees and planting new trees within eucalyptus groves at the Moran Lake site) will directly align with the objectives laid out in the CAAP for increasing the urban tree canopy in the county.

4 Monarch Overwintering Information

4.1 History of Counts

Xerces notes on their website that the past 25 years of data demonstrate that overwintering western monarchs have undergone a greater than 90 percent decline since the 1980s. Western monarch butterfly population numbers have generally seen a downward trajectory, since the inception of the Western Monarch Count in 1997, and counts have fluctuated widely over the years throughout California. The Moran Lake overwintering population is typically the third largest in Santa Cruz County, behind the Natural Bridges State Beach and Lighthouse Field sites.

The Moran Lake Overwintering Site boundary defined by the Xerces Society is roughly the same as the management area depicted in Figure 2, except for the inclusion of a small portion of the residential neighborhood around the lake. Monarch butterflies are present in the Moran Lake overwintering habitat from October through February in most years, and small numbers of monarchs have been observed as early as mid-August and as late as April in some years. Based on its continual occupation by monarch butterflies throughout the wintering period, the habitat at Moran Lake is classified as full-term overwintering habitat.

The current and historic estimated overwintering population numbers for the Moran Lake site were obtained through the Western Monarch Count (Xerces Society 2022). The Western Monarch Count is a citizen scientist-powered organization that is sponsored by the Xerces Society. The Western Monarch Count conducts annual population counts at overwintering sites throughout California each Thanksgiving and at the start of each new year (Xerces Society 2022). These data are used by many agencies and conservation organizations to aid in conservation efforts and estimate population trends for the western monarch butterfly.

Table 2 below provides the estimated monarch count at the Moran Lake site, along with every other overwintering site in the county, since the inception of the Western Monarch Count in 1997. Additionally, Table 2 provides the total number of overwintering monarchs in the county and California since 1997, the percentage of overwintering monarchs at the Moran Lake site each year in comparison to the total population of overwintering monarchs in the county, the percentage of overwintering monarchs at the Moran Lake site each year in comparison to the total number of overwintering monarchs in California, the yearly average of overwintering monarchs at each overwintering site, the county, and California since 1997, and the 10 year average of overwintering monarchs at each overwintering site, the county, and California (Xerces Society 2022).

These numbers help to identify regional and statewide fluctuations, to understand if fluctuations in the Moran Lake overwintering counts are consistent with the regional and state-wide changes, and to determine how the regional and statewide importance of Moran Lake as an overwintering site has changed since 1997.

Table 2 Western Monarch Count Statistics for Santa Cruz County Since 1997

Count Year	Overwintering Sites in Santa Cruz County				Santa Cruz County Total	California Total	% in Comparison to Santa Cruz County	% in Comparison to California
	Moran Lake	Natural Bridges State Beach	Lighthouse Field	Seascape Golf Course, Aptos				
1997	70,000	120,000	70,000	--	260,000	1,235,490	27%	5.7%
1998	8,000	60,000	50,000	240	119,898	564,349	7%	1.4%
1999	4,500	15,000	9,500	280	31,958	267,574	14%	1.7%
2000	4,000	20,000	35,000	1,050	62,961	390,057	6%	1.0%
2001	1,500	3,000	--	1,400	6,123	209,570	24%	0.7%
2002	1,000	6,000	3,200	4	10,234	99,353	10%	1.0%
2003	6,000	5,700	11,000	--	22,704	254,378	26%	2.4%
2004	4,500	9,600	9,600	950	25,276	205,085	18%	2.2%
2005	3,400	3,900	14,000	--	22,045	218,679	15%	1.6%
2006	6,600	7,300	10,300	2,000	28,271	221,058	23%	3.0%
2007	2,200	2,700	5,700	48	10,675	86,437	21%	2.5%
2008	4,023	3,500	2,607	1,560	12,127	131,889	33%	3.1%
2009	2,276	1,300	4,000	23	7,674	58,468	30%	3.9%
2010	3,000	2,300	4,000	1,000	10,332	143,204	29%	2.1%
2011	4,500	3,000	18,100	--	25,600	222,525	18%	2.0%
2012	2,500	500	3,200	2,500	9,316	144,812	27%	1.7%
2013	790	4,600	4,500	0	11,497	211,275	7%	0.4%
2014	4,300	3,400	7,000	--	15,981	234,731	27%	1.8%
2015	5,800	8,000	12,000	1,800	29,870	292,888	19%	2.0%
2016	4,000	3,500	12,000	1,000	28,101	298,464	14%	1.3%
2017	5,400	9,000	12,000	100	29,918	192,624	18%	2.8%
2018	1,373	1,120	1,802	--	5,043	27,721	27%	5.0%
2019	400	1,997	3,402	0	6,057	29,436	7%	1.4%
2020	50	550	50	0	711	1,899	7%	2.6%
2021	1,100	2,100	410	700	5,418	247,237	20%	0.4%
2022	5,701	7,500	3,365	500	17,861	335,479	32%	1.7%
2023	7,050	6,500	10,000	252	25,967	233,394	27%	11%
Average Count Since 1997	6,073	11,558	11,731	571	31,171	242,892	21%	2.1%
10-Year Average	2,856	3,842	5,430	733	14,525	183,324	20%	1.6%

It is important to note that the number of sites monitored fluctuates any given year. Over the past 7 years, more than 200 sites were monitored, whereas in years prior less than 200 sites were monitored.

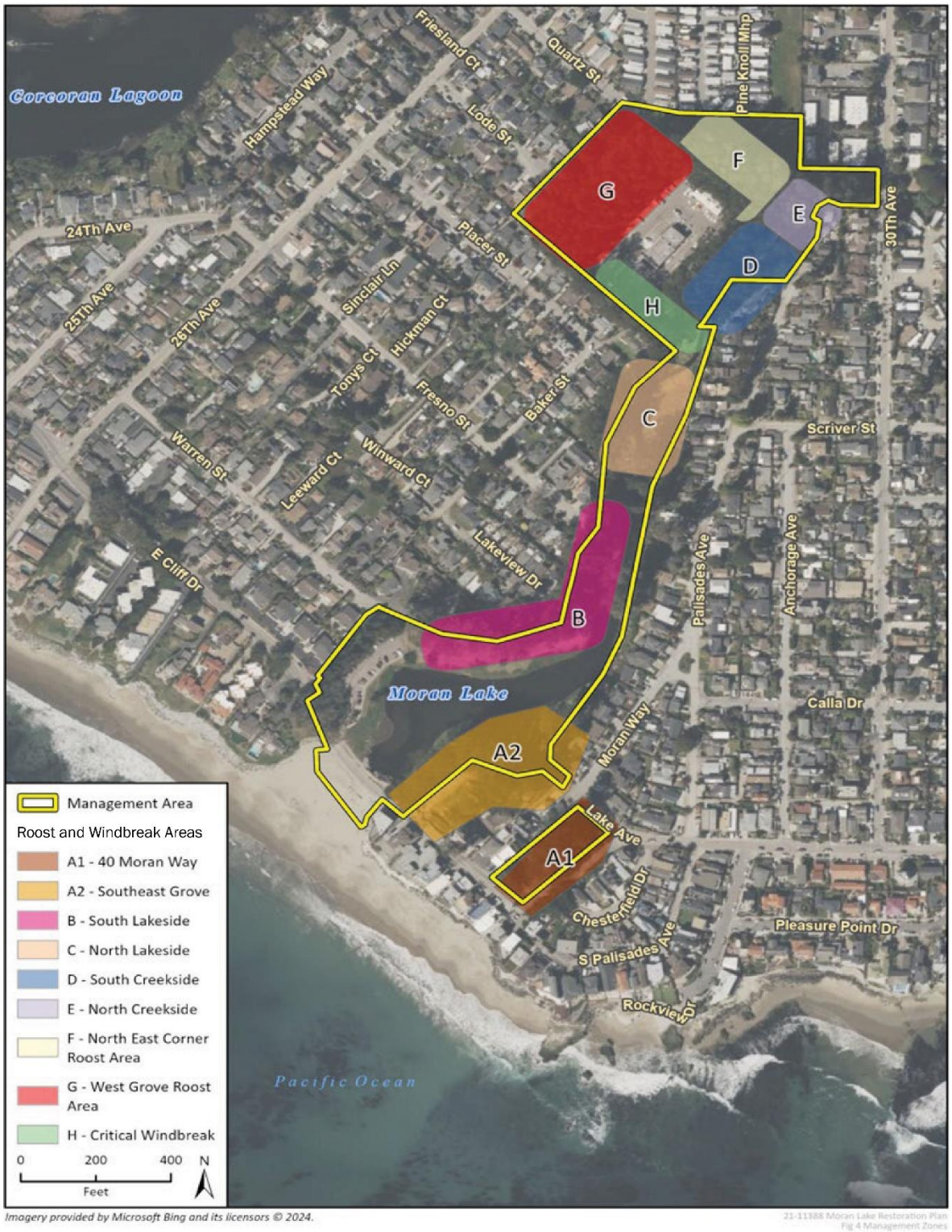
4.2 Monarch Activity History

The 2010 MBHMP provides a summary of historical patterns of monarchs at Moran Lake. See Figure 4 for a map of roost areas and windbreak areas, and that was adapted and updated from the 2010 MBHMP. Names of roost areas and windbreak areas used throughout this document are shown on this map. The text below was taken from the 2010 MBHMP:

> "Monarch butterflies are present in the Moran Lake wintering habitat from October through February in most years, and small numbers have been observed as early as mid-August and as late as April in some years. Based on its continual occupation by monarch butterflies throughout the wintering period, the habitat at Moran Lake is classified as a full-term overwintering habitat.
>
> In the past (1980s), monarchs typically began to congregate along the northwestern shore of Moran Lake during early October, and formed clusters in the North and South Lakeside roost areas. As the population increased during October, clusters also formed in the North and South Creekside roost areas and the lakeside butterflies gradually shifted north into the more sheltered Creekside roost areas (Figure 5). Then around mid-November the population shifted its clusters into the Primary Roosting area where they remained until warming temperatures initiated the spring migration sometime in February.
>
> The North Lakeside roost area usually supported clusters of roosting monarchs throughout the month of October, whereas the South Lakeside roost area typically supported clusters only intermittently during the fall. Thus the North Lakeside roost area historically functioned as an autumnal roost area and the South Lakeside roost area functioned as refuge/bivouac habitat. Tree and limb loss in these habitats has since reduced wind protection and eliminated many of the lower roost limbs that once supported clusters. Currently both roost areas function as refuge/bivouac habitats.
>
> Tree and limb losses in the North Creekside roost area have degraded this habitat over the past ten years resulting in less frequent occupation of the North Creekside roost area and a gradual shift of occupation to the South Creekside roost area. In March/April of 1999, residents on the property adjacent to the South Creekside roost area removed all the eucalyptus trees on their property along the east side of the creek and in that process eliminated all of the eastern windbreak/shade trees that sheltered the South Creekside roost area. During the winter preceding the tree removal (1998-99) the entire wintering population at Moran Lake (approximately 18,000 monarchs) occupied the South Creekside roost area from early October through most of November. During the winter of 1999-2000, no clusters were observed in the South Creekside roost area. Both North and South Creekside roost areas now function only intermittently as refuge/bivouac habitat.
>
> The Primary Roosting area, despite several significant tree removal events, has consistently supported mid-winter monarch populations for at least the past twenty years. With the loss of suitable autumnal habitat in the Lakeside and Creekside roost areas, the Primary Roosting area has now begun to function additionally as autumnal roost habitat. The Primary Roosting area is the only consistently occupied roost area remaining in the Moran Lake monarch wintering habitat.
>
> The grove of eucalyptus at the southeastern end of Moran Lake—the Southeastern Grove, which includes the Moran Way Windrow—in addition to providing critical wind protection for

the lake area, functions intermittently as refuge/bivouac habitat and occasionally supports small clusters during periods when monarchs are migrating and winds are relatively calm."

Figure 5 Monarch Butterfly Roost and Windbreak Areas



4.3 Roosting and Basking Sites

The entire management area and adjacent sensitive habitat provide the overwintering habitat for the monarch butterflies, which has been broken into distinct roost and windbreak areas for ease of discussion (Figure 4). The southeast eucalyptus grove, which includes the Moran Way Windrow, provides critical wind protection for the lake. The areas south and more coastal of the southeastern grove function intermittently as refuge/bivouac habitat and occasionally supports small clusters during periods when monarchs are migrating and when winds are relatively calm (J. Dayton, personal communication, December 2023). The eucalyptus trees and structures on either side of the lake provide critical windbreak to the site. The eucalyptus trees provide upper canopy windbreak, and the higher topography along the southeastern side of the lake provides low and mid-level wind break. Figure 5 shows an overview of the core zone/roosting sites.

North of Moran Lake, the main eucalyptus grove surrounds the Santa Cruz Sanitation District's D.A. Porath Facility and comprises the primary roosting areas. Within the main grove, there are three distinct roost areas where the monarchs cluster and overwinter during the coldest and most inclement weather of the year and are shown in Figures 4 and 5: the creek side roost area (CSRA), the northeast corner roost area (NECRA), and the west groove roost area (WGRA) (J. Dayton, personal communication, December 2024). CSRA serves as an autumnal roost area, and NECRA and WGRA serve as the two winter roost areas, where the most protection is provided. Each roost area includes both trees that support clusters and that are typically located in the interior of the groves with the most wind protection, and trees that support basking aggregations and that are typically located on the edges of the grove where more sunlight is available. Monarchs bask in the sun to get warm and to reach the temperature at which they are able to fly. The basking areas are located toward the inner edge of the roost area adjacent to the Sanitation District facility, where more sunlight is available. (Note that basking aggregations may become clusters during appropriate weather conditions.) The interior roost (cluster) trees at NECRA and WGRA are not necessarily both used each year; typically, interior clusters form only in one of the two areas each year (J. Dayton, personal communication, December 2023). For example, the interior roost trees at the WGRA were not used in the 2021–22 wintering period, whereas the WGRA basking aggregation trees were used, even though most of the population remained clustered at NECRA, mostly above the road, but also including some clusters in the interior area (J. Dayton, personal communication, December 2023).

Figure 6 Moran Lake Monarch Buttterfly Roosting Site/Core Zone

Source: John Dayton, 12/2023.

4.4 Current Habitat Condition

An ideal overwintering site should have trees in good condition that are evenly spaced out and have healthy foliage and good vigor. An ideal overwintering site will also have saplings in the understory to replace trees as they die and a continuous, well-stratified canopy at the outer edges to offer wind protection. However, the canopy will not be so dense to prevent the entry of the necessary amount of direct and dappled insolating light. Insolation is primarily a factor on the southerly exposures.

Tree health was assessed and reported in the 2022 Arborist Report. This plan addresses the trees, habitat, management area, and the grove as a whole. When discussing the condition of the habitat, individual tree health is always considered, but equally and possibly more important is the management of the trees collectively. The creek's wet soils, ponds and puddles provide the water for the monarchs to drink. The late fall and winter blooming eucalyptus tree flowers provide critical nectar for the monarchs to consume while they overwinter.

4.4.1 Roosting and Basking Habitat (Sanitation District and County-Owned Land)

The north, northeastern, and northwestern portion of the main eucalyptus grove on Sanitation Facility land that is home to the Northeast Corner Roost Area (NECRA), the Creekside Roost Area (CSRA), and the West Grove Roost Area (WGRA) is well-established with spaced-out trees that are generally in good health. Young saplings are distributed naturally throughout. Blue gums to the south and western sides of the grove are generally in fair health. The nature of blue gums includes shedding bark and branch and limb loss, and it is not unusual for the species to be rated with fair to poor health.

One area at the southern corner of the Sanitation Facility immediately south of the small pump station in the Critical Windbreak Area H is missing a tree canopy wind break. This gap in canopy creates the opportunity for wind and cold temperatures to blow into the roosting and basking areas and should be filled. Additionally, there are gaps in the Critical Windbreak Area H along Placer Street that should be planted with replacement trees. The narrowness of this area presents a particular challenge because there is limited space to plant windbreak trees.

Grove specific measurements, including, but not limited to, an assessment of wind measurements, light exposure, and canopy height and structure derived from hemispherical photographs and LiDAR are provided in Appendix A. These measurements represent why the main cluster site is suitable for overwintering monarchs.

Currently, the Creekside Roost Area (CSRA) is one of the areas most in need of repair and to enhance with mitigation planting. Recent tree failures and removals have exposed this area to disturbance by east-southeast winds and excessive sun exposure. Approximately 1,000 monarchs roosted in this area during much of November 2021 (J. Dayton, Personal Communication, December 2023).

4.4.2 North and South Lakeside Habitat (County-Owned Land)

As mentioned, the eucalyptus trees, hillside, vegetation, and structures along the southeastern and eastern side of the lake provide an important wind break to the management area, as do the trees, vegetation and structures on the western side of the lake.

Eucalyptus trees have died or have been removed in the past in the North and South Lakeside areas, without replacement, which has led to reduced wind protection and stands that are comprised of mostly mature trees with minimal mid-level wind protection and high canopies that are exposed to windthrow. Eucalyptus along the North and South Lakeside areas have experienced die back likely related to ponded water and saturated soils in low areas along the trail and at the base of the trees. This area is in need of drainage improvements and replacement plantings to enhance the windbreak and ensure long-term survival of the trees.

A portion of the North Lakeside habitat on the east side of the creek, where eucalyptus trees are absent, is comprised of a low-lying riparian meadow where a bed of grasses and other herbaceous species are present and offers the potential for nectar planting.

4.4.3 Southeast Grove and 40 Moran Way Habitat (County- and Privately Owned Land)

The Southeast Grove is located on the southeast side of the County-owned Moral Lake property, and on private parcels along Moran Way and the recently built Ryan's Way. As development of the private property in this area has progressed over the years, this area has lost many of its trees. The remaining portion of the grove still functions in providing wind protection—though substantially diminished—for the lake and the trees at the Lode Street habitat. However, it only very rarely provides wind protected roost habitat for Fall migrants; it is currently too open to wind and sun to support roosting monarchs in the Fall (J. Dayton, Personal Communication, December 2023).

More recently, during development of this HMP update, the February 2024 high-wind event resulted in the failure of 20 trees on the 40 Moran Way parcel, which further degraded the ability of this area to function as a windbreak.

4.5 Nectar Sources

Monarchs are less likely to use nectar plants in deep shade, so the forest understory near the main clustering sites are poor places for nectar plants. The most important nectar plants are those that bloom in the fall (October through November), because they help retain monarchs at the site, which in turn attracts more butterflies that are passing by.

The main sources of nectar plants for monarchs at Moran Lake are the blue gum eucalyptus flowers. Nectar for early to mid-fall is from introduced plants. The most common introduced nectar plants on-site, along with their bloom periods, are listed in order of abundance in Table 3 below. English ivy (*Hedera helix*) and Cape ivy (*Delairea odorata*) are found growing throughout the understory of the eucalyptus groves, and some have climbed up the trunks of trees where they function as important nectar sources for the monarchs. Ivy on the ground has limited utility as a monarch nectar source due to heavy shade. Ice plant (*Carpobrotus edulis*) and pride-of-Madeira (*Echium candicans*) are found growing adjacent to the parking lot and the Park's hiking trail.

Bermuda sorrel is present on the site, but is rarely used by monarchs when other, preferable nectar sources are present. Wild radish and jointed charlock are present near the Moran Lake Park parking area—and are often used as nectar sources by monarchs at other sites—but are too far from the roost areas for practical use at Moran Lake (J. Dayton, personal communication, December 2023).

Table 3 Fall and Winter Monarch Nectar Plants in the Management Area

Species	Bloom Period
Blue gum eucalyptus (*Eucalyptus globulus*)	December through March
English ivy (*Hedera helix*)	October through November
Cape ivy (*Delairea odorata*)	Variable bloom period depends on sun/shade availability, usually December-January
Ice plant (*Carpobrotus edulis*)	Typically October-March
Pride-of-Madeira (*Echium candicans*)	Late February-March

The existing Cape ivy, English ivy, ice plant, and pride-of-Madeira within the management area provide an important and abundant supply of nectar for fall returning and overwintering monarchs, which is currently not supplied in the management area, or its vicinity, by native plants (See Table 3). Due to its importance as a nectar supply, Ivy requires careful management, rather than wholesale removal. Both species of Ivy only bloom when they receive sufficient sun exposure. English Ivy only blooms when it has climbed up a structure (tree).

4.6 Hazardous Trees

The eucalyptus trees provide the overwintering habitat, but all trees have risk or liability. An ISA certified arborist with the ISA's Tree Risk Assessment Qualification assessed the trees in the management area for risk in 2022, using the diagnostic techniques developed by ISA. A tree risk assessment is conducted to identify and manage the risk of trees for safety. The results of the assessment are included in the Arborist Report. Risks are evaluated based on a number of elements, including structural deficiencies and visible presence of disease or rot, etc. Seven potentially hazardous trees were identified during the 2022 arborist survey. Three of these trees (tree numbers 3058, 3063, and 3076) are located within the Sanitation Facility grove. The remaining four potentially hazardous trees (tree numbers 1045, 1258, 1285, and 1342) are located south of the Sanitation Facility grove in Roost Areas A and B adjacent to the bike path and hiking trail, respectively. Dead trees within the Sanitation Facility grove were observed in the natural area with low to no human traffic; however, the dead trees and leafless branches do not contribute to monarch habitat and are a liability to nearby trees when they fall, which could decrease monarch roosting habitat and expose the grove to wind penetration. The locations of all potentially hazardous trees, as well as specific notes regarding each potentially hazardous tree and their removal or hazard pruning recommendation, are provided in the appendix of the Existing Conditions Report which is Appendix A of this Habitat Management Plan.

4.7 Fire Risk Assessment

Managing the habitat and fire risk should be done in coordination with the fire department and the monarch butterfly specialist or entomologist. Research conducted in California show that species that produce oily resins, such as blue gum, are far more ignitable than those that do not. On a scale of 1 to 10 for ignition potential, with 1 representing species most easy to ignite and 10 most difficult, blue gum scored 1 to 2 (very high ignition potential). For comparison, oak/bay woodland received a score of 6 to 8, redwood 8, scrub vegetation 4 to 8, and annual grassland vegetation 1 to 3 (LSA Associates 2009).

Ladder fuels are one of the most important considerations for the spread of fire. The monarch habitat contains very little ladder fuel, and the understory is generally sparse and contains poison oak, Cape ivy, and English ivy, when present. These are evergreen species and are generally nonflammable. Due to the lack of ladder fuels within the management area (as a result of ongoing site management by the Sanitation District), the urban/developed surroundings, and the persistent summer coastal fog, the risk of a severe crown fire spreading into or originating within the site is relatively low.

4.8 Monarch Predators

While the monarch's distinctive colors are known to display to others that they are distasteful and toxic, predators affect monarchs as eggs, caterpillars, and adults. Predators include ants, spiders, and wasps, as well as birds and rats. Predators at the Moran Lake site are not well documented or understood. However, it is likely that they are present and impact the overwintering adult population to some degree. When winds blow the monarchs onto the ground, overnight or during cool temperatures, their bodies are not warm enough to fly and predation increases. Understory brush and vegetation located beneath aggregation and transitory sites can be instrumental in limiting predation by catching the monarchs prior to landing on the ground and providing structure for them to climb off the ground.

5 Management Plan Actions

The actions recommended here focus on the preservation of the overwintering habitat, trees, and features that create them. The continued recommendations are to maintain the grove's spatial configuration and size and preserve and/or enhance windbreak trees, appropriate nectar and water sources and understory vegetation within the management area. A general recommended timeline to implement each action is provided in the tables at the end of each section. In the tables, Year 1 means the action is recommended for action now; Every Year means now and each year after unless otherwise stated in the section, and Every 3 to 5 Years means beginning in 3 years and no later than 5 years from now, depending upon the situation.

5.1 Monarch Surveys

Assessing overwintering monarchs' use of the management area will be crucial to assessing the effectiveness of this site management plan and to adapting habitat restoration and enhancement techniques. Volunteers and biologists monitor the overwintering clusters at Moran Lake, as well as other local overwintering sites and collect important data as part of the Xerces Western Monarch Thanksgiving Count and New Year's Count.

Additional monitoring (ideally twice monthly from October through March) for a minimum of 1 year after major management actions would provide the information needed to track how monarchs respond to changes in grove conditions. Recording monarch clusters' size and location over the course of the overwintering season will help refine the current understanding of monarchs' use of the site and can directly inform management actions in future years.

An approach for conducting surveys is to train and use the County's maintenance staff, who are on-site regularly, to conduct the twice-monthly surveys. Staff would need to be trained to:

- Know where historic roosting and basking sites are located
- Know how to conduct counts by attending the virtual trainings for the Western Monarch Count at the Xerces' Help Count Monarchs website
- Coordinate with the Xerces Regional Coordinator once annually, in the early part of the overwintering season, to calibrate counting with Xerces
- Record information for each count in a consistent way and post the results so that the public can access the information

Action	Year 1	Every Year	Every 3 to 5 Years
Monarch Surveys and Monitoring	X	X	

5.2 Monarch Habitat Monitoring

Annual monitoring of the grove's suitability for monarchs will be conducted to identify potential grove issues as soon as possible. Any additional threats or conservation issues (e.g., new tree fall, pest infestations) will be added to the management records and incorporated into the management plan. This will help managers plan future management actions (at both short-and long-term time scales) and obtain funding as needed.

County Parks' monarch specialists and ISA-certified arborists will continue to assess the management area at least once a year to identify any potential issues and develop strategies for planting or replanting of trees that comprise the habitat.

The management area will be monitored for a change in predators, such as increased rat dens and observations of Steller's jays. If predators increase the County will consult with the monarch specialist regarding changes that can be made. The management area will continue to be kept clear of trash and food.

Tools that can be used as the standard protocols and data sheets for assessing grove health (Habitat Assessments) are available at www.westernmonarchcount.org and are included in Appendix D.

Action	Year 1	Every Year	Every 3 to 5 Years
Monarch Habitat Monitoring	X	X	

5.3 Habitat/Forest Management

Management of the overwintering habitat will be approached as a forest versus single trees and in compliance with Section 2.1.3. above. The forest is comprised of thousands of trees; it is dynamic and changes continually due to a number of factors, including weather and storm events. As discussed in Section 4.3, the spacing and composition of the tree canopy is what creates the overwintering habitat and wind protection for the monarchs. Because of this, replacing trees that have been removed or succumb to die-off with another single tree may or may not be advisable. The number, placement, and species of the replacement trees will be determined in collaboration with a certified arborist and the County's monarch specialist. This will be done with the primary goal of maintaining the health and wind protection dynamics of the management area.

The recommendations below for Year 1 have been developed in collaboration with County Parks staff, the County's ISA-certified arborists, and the County's monarch butterfly specialists and entomologists after viewing the management area conditions and dynamics as a group in December 2023. Figure 6 shows the general approach for planting replacement trees and nectaring plants, and locations where drainage management is needed.

The most important forest management action is to plant trees that will add/replace canopy that was previously lost or is absent in the eucalyptus groves and windbreaks. Specific management recommendations are addressed in subsections below that correspond to the different areas shown on Figures 4 and 5.

Hazardous trees will be addressed as quickly as possible by removing or trimming the trees to alleviate risk to the public and the roosting and basking sites. If, at some time in the future the trees become crowded, forest thinning could be considered to promote an increase in the health condition and vigor in the grove. Thinning will only be done with the input of the certified arborist and monarch butterfly specialist. Nectaring plants will be planted to boost overwintering population numbers. A simple drainage system will be created at the southeastern windrow, at the 40 Moran Way parcel, and in other problematic areas around the margins of the lagoon to reduce ponding water and saturated soils at the tree bases. See section 5.3.5 for more information on drainage.

Figure 7 Recommended Overall Management Actions

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Fig 6 Planting Areas

Tortoise beetles and eucalyptus long-horned beetles are two major pests that can damage or kill blue gum eucalyptus trees. While an effective control for these pests has not yet been developed, the County should proactively remove dead wood from the eucalyptus groves, since the presence of dead wood has been shown to increase infestations. The County Parks staff should be informed about how to identify these and other local pests and the damage they can cause. County Parks staff should report observations of infestations observed to their supervisor and the information should be shared with the County-approved arborist immediately.

Overwintering Habitat on Private Property

Trees and vegetation on private property adjacent to the management area, shown in Figure 3, will be designated by the County as Sensitive Habitat. This will serve to clarify where Sensitive Habitat restrictions are to be applied for adjacent development. This clarification was required by the County Board of Supervisors by amendment at the 2011 adoption of the 2010 Plan.

Action	Year 1	Every Year	Every 3 to 5 Years
Forest Management	X	X	X

5.3.1 Tree Planting and Management

Recommendations for planting for Year 1 were developed by Creekside Science's Dr. Stu Weiss and in collaboration with the County's consulting team of certified arborists and monarch butterfly specialist. Past reports with recommendations from the County's arborist and monarch specialist also address issues discussed in this section and applicable recommendations from past documents are included in this section for continuity. Appendix D provides past studies and reports for the management area. Tree planting location recommendations are shown in Figure 6, and recommended tree species to be planted in each area are shown in Table 4 below.

Eucalyptus replacement trees will be either blue gums or red ironbark *(Eucalyptus sideroxylon)* in the core zone. The species selection will depend upon the canopy need. Blue gums will be used when the replacements are made in or within 50 feet of the roosting and basking areas and when canopy roughly 50-feet high or more is needed. Red ironbark will be used to replace blue gums when canopy roughly 25- to 50-feet high is needed. County Parks has requested input from California Polytechnic State University's (Cal Poly) eucalyptus tree expert, Dr. Matt Ritter, for additional input regarding additional eucalyptus or other appropriate tree species that have a high-survival rate in similar ecosystems. Blue gums provide consistency in canopy structure and red ironbark trees have been observed to be more drought resistant in the region. Red ironbark also serve to diversify the species of the grove.

When existing blue gum trees fail, or become hazardous and need to be removed, their removal can negatively impact the monarch habitat. In areas where blue gums have experienced consistent failures, the County could explore planting different species and/or a more diverse palette of tree species that are less prone to failure, thereby reducing the risk of negative impacts to the habitat.

Shorter stature trees that can withstand wind and coastal pressure, such as toyon, will be planted along the southwestern boundary of the management area, between the parking lot and the management area boundary.

Determining what tree species **not** to plant is as important as outlining recommended species. Section 7 of this plan contains a table documenting the species, location, and observations for tree

species which have been planted at Moran Lake and which have failed (Table 7). The County should systematically track this information so that it can be used to inform future tree planting efforts.

Table 4 Tree Species for Specific Habitat Zones

Zones E, F, & G – Main Eucalyptus Groves & Roosting and Basking Areas		
Species	**~~Height~~ Canopy Replacement**	**Notes**
Blue gum eucalyptus (*Eucalyptus globulus*)	Upper, highest canopy in habitat area	Compatible with existing BGE in groves. Important nectar source for Monarchs. Plant w/in 50' of roosting or basking areas and where canopy higher than 50' is needed
Red ironbark (*Eucalyptus sideroxylon*)	Mid to upper canopy, typically not as high as blue gum	Use to replace BGE where canopy 25-50' is needed.
Monterey Cypress	Mid-canopy, varies based on age and location but typically lower than red ironbark (can grow higher)	Plant along north and east edges of main grove as windbreak. Regional native. Good salinity, coastal, and wind tolerance.
Zone H – Critical Windbreak (along Placer Way)		
Species	**Canopy Replacement**	**Notes**
Monterey cypress	See above	Plant to fill in mid-canopy gaps along the southern boundary of the Sanitation District facility and the fence.
Blue gum eucalyptus (*Eucalyptus globulus*)	See above	Plant where highest canopy replacement is needed
Other tall Eucalyptus		TBD pending input from Dr. Matt Ritter
Zones B & C – South and North Lakeside		
Species	**Canopy Replacement**	**Notes**
Monterey Cypress	Mid-canopy, varies based on age and location but typically lower than red ironbark (can grow higher)	Plant along north and east edges of main grove as windbreak. Regional native. Good salinity, coastal, and wind tolerance.
Broad Leaved Paper Bark (*Melaleuca xx*)	Lower to mid canopy	Good salinity and coastal tolerance, wind resistance
Holly Oak (*Quercus ilex*)	Lower to mid-canopy	Good salinity and coastal tolerance, wind resistance

The following recommendations update the guidelines in the 2010 Plan on page 20 under New Tree Planting and Monitoring Guidelines.

Tree removals must be considered with the input of a certified arborist and the monarch specialist and replaced immediately with a tree that will fulfill the functional need of the overwintering habitat and the forest. The previous recommendation to replace every removed tree with a minimum of two trees is not viable within the management area. The limiting factor is space; there is not enough space to double the number of trees on-site and maintain a healthy forest and functional overwintering habitat.

At this time and based on input from the County's certified arborists and monarch butterfly specialists, the recommended replacement eucalyptus trees species are blue gums and red ironbark for upper-canopy wind protection particularly within the roosting and basking areas (the core zone). Monterey cypress and coast live oaks will be considered for future for mid-canopy wind protection, but only in areas that are not shaded for coast live oaks, and Canary Island pine where they suit the

situation for a single-trunk species (within the support zone). Additional eucalyptus tree species are being considered at this time and may need to modified over time. Replacing and maintaining the tree wind shelter around the perimeter of the management area is also essential to the site's longevity.

Eucalyptus trees are generally not available for purchase in the nursery trade; therefore, a contract to grow the replacement eucalyptus will be pursued and agreed upon with an entity such as Cal Poly or UC Santa Cruz, which hve the expertise and ability to grow them on a regular basis.

Trees will be either 5 gallons or 15 gallons in size, largely due to expense and difficulty planting a larger tree in the forest. The trees will always be inspected by a certified arborist to ensure they are in good health. The contract with the tree grower will specify that root bound trees will not be accepted.

The exact location, species, and number of replacement trees to be planted will be determined in collaboration with County staff, certified arborist, and monarch specialist prior to or immediately following (within 15 working days) of a tree removal. Plantings will be consistent with the 2010 Plan Section 2.2 General Recommendations Notes but will be:

- Staked with two lodge pole stakes per tree and secured with flexible ties
- Mulched with a 3-inch-deep layer of wood chips at a minimum radius of 6 feet from the trunk, contingent on their locations and surrounding growing conditions. Mulch material must also be set back at least 4 inches from the trunk.
- Irrigated or hand watered for a minimum period of 2-3 years in order to grow at optimal rates, with either a ring of Netafim Irrigation Tubing placed over the root ball or with two emitters per tree

Maintenance of the replacement trees is also critical to ensure tree survival and to optimize tree growth. Either the County Parks staff or a landscape contractor will:

- Conduct twice-monthly inspections to ensure that the irrigation system is functioning and that weed competition is eradicated around the new trees
- Replenish the wood chip mulch around the trees periodically
- Remove the tree support stakes 3 years after installation and ties must be adjusted annually as not to girdle the tree where it's tied to the stakes
- The irrigation system will be adjusted over time to correctly be placed over tree root zones and to adjust the volume of water required to ensure optimal tree growth.

If tree replacement plantings fail (die), they must be replaced with a tree that fulfills the need of the overwintering habitat. Tree failures should be investigated to determine cause of death and records kept of successful and unsuccessful trees species to improve long-term management of the habitat.

Replacing and maintaining the trees that create the wind shelter around the perimeter of the management area is also essential to the site's longevity.

Specific Area Recommendations for Management Areas

Northeast Corner Roost Area – Area F

- Plant Monterey cypress to fill the gaps between eucalyptus rows at the outer northeast and northwest edges of the area, surrounding the Sanitation Facility. There is some concern about

maintaining sightlines into the grove to detect occupancy by unhoused people so close coordination with public safety agencies is important.

- Plant Monterey cypress in the Sanitation District's 'Boneyard' area (northeast of the main eucalyptus grove) to block low and mid-level wind.
- Encourage blue gum saplings to grow and do not remove them within the roosting sites when they serve to provide canopies in the open row spaces.
- Maintain a partially open canopy along the boundary of the yard so that direct sunlight can penetrate from the yard edge for basking. This is one of the most important habitat improvements and will allow the butterflies to remain in the interior when strong northerly winds occur.
- Keeping the future option of selective precise thinning of specific parts of the grove is important. Maintaining individual tree health in the face of aridification may require reduction of basal area. The remaining trees will fill in the canopy, as water and light availability allow.

Critical Windbreak – Area H

- Plant a small stand of Monterey cypress at the southwest side of the Sanitation Facility, just south of the small, separate pump station, opposite the trail opening, to close the canopy gap and prevent northerly winds that penetrate into the grove along the trail and drive the monarchs away from the interior cluster site.
- Maintaining wind shelter along the southwest boundary of the entire grove in the District's land is crucial for the monarchs clustering on the opposite side of the Sanitation Facility, particularly along Placer Street where the windbreak is narrow and there is limited space to plant trees. Some of the trees pose risks to the neighboring residential structure. Tree risks will be considered regularly and if topping trees and removing hazard branches in this area is necessary, it will be done in collaboration with the County's monarch butterfly specialist and arborist to minimize impacts to the windbreak. Trees that have posed risks to the neighbors have been topped in the past, to reduce the risk while still maintaining the trees' ability to function as a windbreak. These topped trees will require more frequent maintenance and assessment by an arborist. Management of this windbreak should focus on preserving and creating a semi-permeable barrier of vegetation to allow for moderation of wind. Blue gum eucalyptus or other tall eucalyptus should be planted in this area where there are gaps in the windbreak.
- Redwood trees were planted at this location in the past, but did not successfully establish due to a lack of irrigation.

North and South Creekside Roost Area – Areas D and E

- In the Creekside Area, maintain and fill-in the row of trees southeast of the creek on the County-owned parcel that is east of the Creek and north of the Humphrey's parcel (APN 028-29-157). The public property is dominated by shrubs, including blackberries and other shrubs. Interplanting trees, such as redwoods, will reinforce existing wind shelter. However, care will be taken over the long run to not deeply shade the cluster sites along the creek.
- There are several eucalyptus trees that have previously been topped in the area east of the Humphrey's parcel. These trees should be monitored by an arborist for future management needs.

- There are several redwoods on the Sanitation Facility side of the drainage ditch at the southeast corner of the yard, that appear to be in poor to fair health. Monitor their progress, and if they do not maintain a healthy canopy or if they fail, replace them with blue gum or red iron bark eucalyptus for high-canopy wind shelter and Monterey cypress for mid-canopy wind shelter.

North and South Lakeside Roost Areas – Areas B and C

- Past failures of blue gums between the trail and adjacent private properties in the North and South Lakeside areas have reduced the functionality of the windbreak and have exposed the remaining trees to additional wind loads. To mitigate this, and to expand the functionality of the windbreak, drainage features will be created so that water ponding doesn't occur along the trail and at the base of the trees. This is a critical action for the survival of trees at this location. See section 5.3.5 below for more information regarding drainage.
- For Area B, Monterey cypress will be planted between the lagoon and the trail for additional mid-level wind protection. This species has proven to do well in the immediate area.
- For Area C primarily, plant nectar plants of various species (listed in 2010 draft plan and in the Xerces Society lists) in areas that receive the morning sun, or in spots with dappled light. The moist soil here allows for many species to thrive, as there are a variety of microhabitats available including marshy areas, creekbanks, and open grassy fields. Other narrow zones, between the trail and water on the west side of the lagoon, should also be planted with nectaring plants. Table 5 below provides recommended nectaring plants.
- For trees on the eastern side of Area C, where soil conditions are appropriate (not too wet), shorter stature trees that can withstand wind and coastal pressure such as *Melaleuca quinquenervia*, (commonly known as the broad-leaved paperbark) and *Quercus ilex*, evergreen oak or holly oak could be planted.

Southeast Grove – Area A2

- This area includes the southeast shore of the lagoon where there is a large, low-lying roughly triangular shaped piece of land that is available for tree planting. This area should be planted to enhance the functionality of the existing windbreak. It is possible that soil in this area is too wet or saline for tree establishment. If the soil conditions allow tree roots to grow and succeed over time, evergreen trees Monterey Cypress and Monterey Pine (*Pinus radiata*) should be planted. If soil conditions are not appropriate for evergreen trees, California white alder (*Alnus rhombifolia*) and/or Red alder (*Alnus rubra*) should be planted. Both alder species were recommended trees species in the 2010 Plan.

Parcel at 40 Moran Way – Area A1

The eucalyptus trees on the parcel at 40 Moran Way have experienced fungus and pest infestations and some have fallen or been removed in the past. More recently, the February 2024 high-wind event caused 20 trees to fall and caused damage to adjacent private residences, property, and vehicles. Many of the remaining trees were weakened and four hazardous trees were removed as a result of the storm. Given the recent, large-scale failure of eucalyptus trees at this location, the property no longer functions as a viable windbreak. This assessment was provided by the County's certified arborist and a monarch butterfly specialist. Further, the widespread failure of trees indicates that this area cannot currently support trees with high canopies that are subject to windthrow due to the risk to adjacent property. The County will take steps to improve drainage in this area as an initial measure. After addressing the drainage, the County, in conjunction with a

certified arborist and monarch butterfly specialist, will assess the area's viability for tree planting and/or alternative monarch butterfly habitat enhancement possibilities, including nectar planting. Should the area prove capable of supporting trees with improved drainage, potential tree species to further explore at this location include the Canary Island Pine, Bishop Pine and other pitch canker resistant pines as well as red iron bark.

West of the Parking Lot

- In the area west of the parking lot and restrooms, shorter stature vegetation (small trees and large shrubs) that can withstand wind and coastal pressure, and that offer nectar or other habitat value should be planted.

Tree planting described above will be done in Year 1. Additional plantings in the future will be done in response to changes in the forest. A certified arborist and qualified entomologist will be consulted regarding future planting recommendations.

Action	Year 1	Every Year	Every 3 to 5 Years
Tree Planting	X		

5.3.2 Hazard Trees

If hazards are identified in or within 100 feet of the roosting and basking sites, special care will be taken in assessing urgency and targets of falling trees/branches, as well as potential for opening the cluster sites to wind. In other parts of the habitat, removal of single branches and individual trees will be routine if hazards are identified.

All tree work will occur outside of monarch overwintering season (October through March) unless a true emergency arises. If a hazardous tree must be removed during the overwintering season, then a qualified monarch butterfly specialist will be retained by the County to monitor and provide input regarding the tree maintenance activities prior to and during the removal.

Some of the trees along the southwest boundary of the main grove in the District's land pose risks with tree hazards to the neighbors. These trees are crucial for wind protection for the monarchs clustering on the opposite side of the yard. Tree risks will be considered regularly, and if topping trees and removing hazard branches in this area is necessary, it will be done in collaboration with the County's monarch butterfly specialist. Trees removed from this area will be replaced immediately with blue gums and Monterey cypress.

Care will be taken in assessing the urgency of all current and future hazardous trees within the Sanitation Facility grove. The potential for opening the cluster sites to wind if any of the trees or their branches are removed shall be assessed prior to removal. The smallest amount of the tree will be removed as feasible to reduce the hazard. Topping of trees is not recommended due to the weakly attached nature of epicormic shoots. Additionally, epicormic shoots generally do not grow as tall as other mature eucalyptus trees and may not provide adequate wind protection for overwintering monarchs. These trees, and all other hazardous trees, will be removed or pruned in a timely manner.

Removal and hazard pruning recommendations are based on the tree's health condition, structural integrity, and its hazard potential. In general, if the tree is dead or declining or possess a hazardous condition but is located within a natural area with low to no human traffic, the tree is not recommended for removal or hazard pruning. However, removal or pruning is recommended for

hazard trees that are located within a high-traffic area, in areas with sensitive infrastructure, and for dead trees within the Sanitation Facility grove.

Blue gums will be maintained regularly through trimming and limb removal when the trees pose a hazard to life and property. Removals will also be done to reduce risk of tree failure when trees are identified as hazardous. This may negate benefits of the tree for monarch habitat, but the County will prioritize life and property when determining the need for tree removals.

Removal of trees or branches of potentially hazardous trees outside of the Sanitation Facility grove will be routine if hazards are identified. Removal of these hazardous trees or their parts would likely not alter the microclimate conditions in such a way to negatively impact overwintering monarchs in the grove but the monarch specialist will confirm before the trees are removed and provide input and replacement planting recommendations. Table 5 provides the potential hazard and the recommended action for each hazard tree identified during the 2022 arborist survey. The locations of the potential hazard trees are depicted in Appendix A. All dead trees located within the Sanitation Facility grove are depicted in Appendix B.

Table 5 Recommended Actions for Hazard Trees in the Management Area

Tree Number	Species	Potential Hazard	Recommendation
1045	Blue gum	Long heavy branches leaning over pathway.	Trees are outside of the Sanitation Facility grove. Tree maintenance will not impact the microclimate conditions within the overwintering cluster sites. Hazardous branches will be pruned back, so they no longer overhang the pathway or hiking trail.
1258	Blue gum	Broken limb hanging over trail	
1285	Blue gum	Heavy codominant steam leaning over pathway.	
1342	Blue gum	Dead branches over hiking trail.	
3058	Blue gum	Dead tree that is significantly leaning over hiking trail.	Tree is within the Sanitation Facility grove, but it is dead with no canopy. Tree will be removed to eliminate the hazard.
3063	Blue gum	Fair health tree with a large heavy branch with included bark at its attachment overhanging the hiking trail.	Tree is within the Sanitation Facility grove, but the large overhanging branch presents a potential hazard to hikers. The branch will be removed at its conjunction with the tree's trunk.
3076	Blue gum	Tree is significantly leaning over the hiking trail (60 degrees)	The tree is within the Sanitation Facility grove but presents a hazard to hikers. The tree is generally a smaller understory tree in fair condition, removal will likely not significantly impact the microclimate conditions within the grove. Tree will be removed.

Hazardous tree removals will be done in Year 1 and each year after as needed to mitigate safety risk to the public, monarch habitat, and park resources.

Action	Year 1	Every Year	Every 3 to 5 Years
Hazardous Tree Removal	X	X	X

5.3.3 Fire Risk Abatement

Mid-story trees and shrubs can potentially create ladder fuels in the management area. However, the vertical continuity of fuels could be partially ameliorated by spatial separation of the shrub later from the mid-story tree layer, via offset plantings. Exact configurations of these wind shelterbelts

will require detailed field examination and will need to consider light availability and potential crowding. If a vertical continuity of fuels (i.e., ladder fuels) is created through the addition of mid-story trees and shrubs, the risk of a ground fire spreading into a high intensity canopy fire rises.

Blue gum limbs and trees that have naturally fallen throughout the management area will be actively removed to decrease fuel loading and eliminate ladder fuel within the understory of the groves on-site. If the Sanitation Facility groves' understory is sealed with mid-story trees and shrubs, they will be spatially separated from each other and the blue gum canopy by offsetting the plantings to avoid the creation of ladder fuels to the maximum extent feasible.

The existing plants will be maintained during Year 1 and until the new nectaring plants are planted, have established, and are flowering.

Action	Year 1	Every Year	Every 3 to 5 Years
Nectar Plant Management	X	X	

5.3.4 Nectaring Plants

Monarchs are less likely to use nectar plants in deep shade. Therefore, nectar plants of various species will be planted primarily in sunny areas, or in areas with dappled light outside the blue gum groves. Nectar plants of various species (listed in the 2010 draft plan and in the Xerces Society lists) will be planted primarily in areas that receive morning sun, or in spots with dappled light. Spring and summer nectar sources and milkweeds (*Asclepias* spp.) will not be planted in the management area. These plants disrupt the monarchs natural spring migration pattern. Disrupting the monarchs' natural migration pattern can lead to further conditions that may contribute to population decline. Although introduced plants also provide nectar for monarchs, native plants are recommended for planting due to the additional ecological value that they provide, as well as being adapted to their local environment (e.g., drought, coastal influence, soil).

Allowing Ivy to climb up trees without negatively impacting the health of the tree is an important management goal. Ivy that has climbed into tree canopies will be managed by cutting it back and removing it from the canopy. Starting at the tip of the ivy, it will be removed until it is no longer harming the health of the tree. Ivy will be retained on roughly 25 trees for nectar and will be trimmed regularly to prevent entry to the canopies. Ivy that is located on the east side of the grove where it receives morning insolation is likely to be preferred by monarchs.

North and South Lakeside – Areas B & C

The prime area for nectaring plants is on the east side of the creek in the sunny grassy area at the head of the lagoon. The moist soil here allows for many species to thrive, and on a microscale, the variety of habitats available including marshy areas, creekbanks, and open grassy fields. Other narrow zones between the trail and water on the west side of the lagoon will be considered. Table 6 provides a list of recommended nectar plants, their bloom periods, and species-specific notes for the Moran Creek Bank.

Table 6 Recommended Nectaring Plants

Moran Creek Banks		
Shrubs		
Species	**Bloom period**	**Notes**
Douglas' Baccharis (*Baccharis glutinosa*)	July through October	Likely entire genus is attractive to monarchs. Important nectar source for many insects
Mulefat (*Baccharis salicifolia*)	All year	
Perennial Herbaceous Plants		
Species	**Bloom period**	**Notes**
Coastal gumweed (*Grindelia stricta*)	May through October	-
Western goldenrod (*Euthamia occidentalis*)	July through November	Likely entire genus is attractive to monarchs
Canada goldenrod (*Solidago canadenis)*)	August through October	Likely the entire genus is attractive to monarchs. Great late season nectar source
Seaside daisy (*Erigeron glaucus*)	January through August	-

Nectaring plants will be planted in Year 1 and monitored for survival. If plants do not survive they will be replaced in-kind immediately. Some plants are likely to die-off over time. Plantings will be monitored annually and replanted when/as plants die-off.

Additional Recommended Nectaring Plants

The Xerces Society recommends nectaring plants for coastal California that should also be considered. The list, Appendix G, includes the blooming season of the plants. For the purposes of this plan, the County should plant those that bloom in the fall, winter and spring when monarchs are overwintering on site.

Action	Year 1	Every Year	Every 3 to 5 Years
Nectar Planting	X		X

5.3.5 Drainage Improvements

Several areas of the habitat management area suffer from poor drainage. This had led to saturated soils and water-ponding around the base of existing trees. The saturated soils and ponding has in turn likely contributed to tree failure. Therefore, improving drainage is a critical goal to prevent additional tree failures and improve the health of existing trees. In addition, some areas will require improved drainage before replacement trees can be successfully grown.

South Lakeside and North Lakeside – Areas B & C

When the D.A. Porath Sanitation Facility was built in 1953, a sewer line was also installed along the western margins of the lake. The installation of the sewer line modified drainage patterns along the western side of the lake, creating artificial mounds and low-spots that restrict runoff flowing toward the lake. These problems persist today.

Ponding water and saturated soils are present at the base of the eucalyptus windrow along the western boundary of the management area between the residences and the trail along Moran Lake. The wet condition within the critical root zone of the eucalyptus trees negatively impacts roots, has likely led to past root and tree failure, and is likely to cause future tree failure if not addressed. Simple drainages will be created to allow the water to flow to the lake. The drainages will be placed at the lowest points where ponding occurs and as shown in Figure 6.

40 Moran Way – Area A1

A majority of this parcel is poorly drained and experiences saturated soil conditions during the rainy season. This parcel experienced 20 tree failures during the February 2024 high-wind event. There is an existing drain inlet along East Cliff Drive at the southeastern corner of the parcel. The County will create swales or other drainage improvements to direct runoff toward the existing drain inlet to reduce ponding and soil saturation.

Action	Year 1	Every Year	Every 3 to 5 Years
Install Drainages	X		

6 Monitoring Plan

This plan serves to manage and maintain the overwintering habitat at Moran Lake. Table 1 provides the historic data and counts of overwintering monarchs here. The two factors to be monitored are the number of monarchs that overwinter at Moran Lake and the quality of the habitat that the management area provides. Data in Table 1 helps to display regional and state-wide fluctuations, and to understand if the Moran Lake overwintering counts are consistent with the other sites in the county or possibly if the Moran Lake site is playing a more, or less, important role over time.

In order to analyze the effectiveness of the Moran Lake habitat, annual counts at Moran should be compared to other sites across the state and the immediate region as monarch counts will inevitably fluctuate between years. The goal should be to ensure that Moran Lake is hosting numbers that are proportionally similar to, or above, other regional sites. This will help determine whether habitat quality at Moran is the limiting factor in increasing the population of overwintering Monarchs at Moran.

6.1 Monarch Surveys

Monarch surveys will be conducted at least twice annually, and twice monthly as possible, during the overwintering season (October 15 to March 15). Surveys will be consistent with the Xerces Society's standards. Results will be recorded, uploaded to the Western Monarch Count database, and included in the annual report for this management plan.

6.2 Habitat Assessments

The long-term functionality of the management area habitat depends on the replacement trees survival and resulting wind protection needed by the overwintering monarchs. Replacement tree establishment must be prioritized by County Parks.

Depending upon the size of the trees planted and planting conditions (soil, water availability, etc.), trees could take up to 20 years or longer to reach full maturity and height, and shrubs could take 5 to 10 years. The goal of the plantings is to provide wind protection in the management area and particularly at the roosting and basking areas. Wind penetration will be measured using current wind modeling technology and applications every 3 to 5 years to understand the effectiveness of the plantings.

Tree health will continue to be assessed and monitored annually to identify hazardous trees and to identify trees with declining health. Health will be monitored by County's certified arborist and could be monitored by County's maintenance staff regularly. County staff can collaborate with the certified arborist to be aware of and notify them of situations like insect infestation or new potential tree hazards, so the arborist can monitor anything of significance.

6.3 Monarch Predator Assessments

During monarch surveys any change in the presence or evidence of predators will be recorded and discussed with the monarch butterfly specialist to determine if and what action may be needed.

6.4 Annual Report

Monitoring the tree plantings, habitat health, establishment of nectaring plants and other forest management actions will be done in Year 1 and annually. An annual monitoring report detailing the progress and findings will be prepared. Logs documenting implementation of the forest management actions will be completed and saved by the County. The report will include, as an appendix, other reports from the County arborist and monarch specialist.

The report will be used to determine if changes in management actions are necessary. Any corrective actions implemented to address threats to monarch habitat (i.e., pests, diseases, flood/erosion) and changes to monarch habitat use will be detailed in an annual monitoring report. The report will be saved by the County and be available to the public and resource agencies upon request.

6.5 USFWS Monitoring and Reporting Requirements 2022

County Parks was awarded a $20,000 grant to prepare this MBHMP update. To meet the grant requirements, monitoring data and analyses will be summarized in annual performance report that will be submitted to the USFWS. The Work Plan is included as Appendix C. The annual performance reports will include:

- Year 1: A detailed description of activities completed by County Parks, including the scope of activities, the date(s) and the specific location(s) within the management area
- Year 2 and annually thereafter: A description of the activities completed since the last reporting period, with the specific dates, such as X day of X month during X year. Description with a figure or sketch specifying where all activities occurred during the time period. The report will include:
  - Photos, before and after (whatever is appropriate);
  - Statements explaining any problems or delays in implementing project tasks;
  - Lessons learned (if appropriate); and
  - Other Reporting: If submitting reports to other federal, State, and local agencies and the above annual report content met then submitting these reports is acceptable.

Additionally, a final report will be submitted to the USFWS that will include all the above information/headings with a synthesis of all project activities completed. Annual and final reports must be submitted to the USFWS Project Officer, whose contact information is provided below.

Samantha Marcum
Coastal Program Regional Coordinator
U.S. Fish and Wildlife Service
(916) 201-3938

7 Adaptive Management

The Moran Lake monarch butterfly overwintering habitat is regionally important, and care has been taken to preserve it. However, climate changes are impacting monarch habitat throughout coastal California that may require the County and other landowners and managers to respond and adjust to changes in real time. Monarch counts in the future are likely to fluctuate greatly, regionally, and at this site due to many factors, including climate change. At this time, preserving and managing the habitat so that it retains the key characteristics for overwintering is the objective of this management plan. Several recommendations for adaptive management are below. The County Park's arborist and entomologist will be consulted prior to initiating management actions.

- If the health of blue gums within the grove decreases and mass foliage losses occur at the cluster sites, the grove will be assessed for additional management actions.
- Soil amendments will be considered to encourage new vegetation growth, and a drip irrigation system could be installed to provide additional water, which is likely the greatest limiting resource.

This MBHMP update is an adaptive action taken to address the changing conditions and needs of the habitat. As discussed, tracking and adjusting replacement tree species and numbers is another adaption meant to more specifically address the changing needs of the site. Table 7 provides information about tree speices that did not thrive in the management area in the past. It will be important to track what species thrive and those that do not into the future and adjust accordingly.

Table 7 Tree Species Not Well-Suited to the Management Area

Tree Species	Location Planted in the Past	Observed issue
Pohutukawa	Between parking lot and lagoon	Poor growth, but the individual tree was planted in a very exposed location where no trees are currently thriving.
Coast redwood	Zones B and C – North and South Lakeside	Poor growth. This species is sensitive to salt spray and saline soils near the coast or tidal areas.
Coast Redwood	Zone H – Critical Windbreak along Placer Street	Trees died due to failed irrigation. May not be an appropriate area for coast redwoods due to lack of soil moisture.
Flooded-Gum Eucalyptus (*Eucalyptus rudis)*	North Lakeside	Infested by red-gum lerp psyllids.
Swamp gum	40 Moran Way	Insect infestation
California bay	Western margin of western grove, shaded area	Did not grow, potentially due to heavy shade, or competition from adjacent eucalyptus.

The 2010 Plan, Appendices 3.3 Recommended Plants for Overwintering Restoration, of included a list of species with their potential ecological role. Trees listed should be considered for planting in the appropriate locations and for the appropriate ecological role.

If plans or projects are developed in the future for Moran Lake, this plan will need to be incorporated into the plan with input from the County arborist and monarch specialist.

If the western monarch butterfly population is listed as a threatened or endangered by the USFWS, the agency will designate critical habitat for the species. It is likely the known or historic overwintering sites will be included as critical habitat. As a result, the regulatory setting for managing their habitat will become more complex and will include review and approval by USFWS. This management plan would very likely require an update or amendment to be consistent with the federal habitat protection requirements.

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