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CDP 3-12-050-A2 (OCEANO DUNES DUST CONTROL AMENDMENT)
APRIL 15, 2021
EXHIBITS

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OCEANO DUNES

Exhibit 1: Oceano Dunes Location Maps and Site Photos
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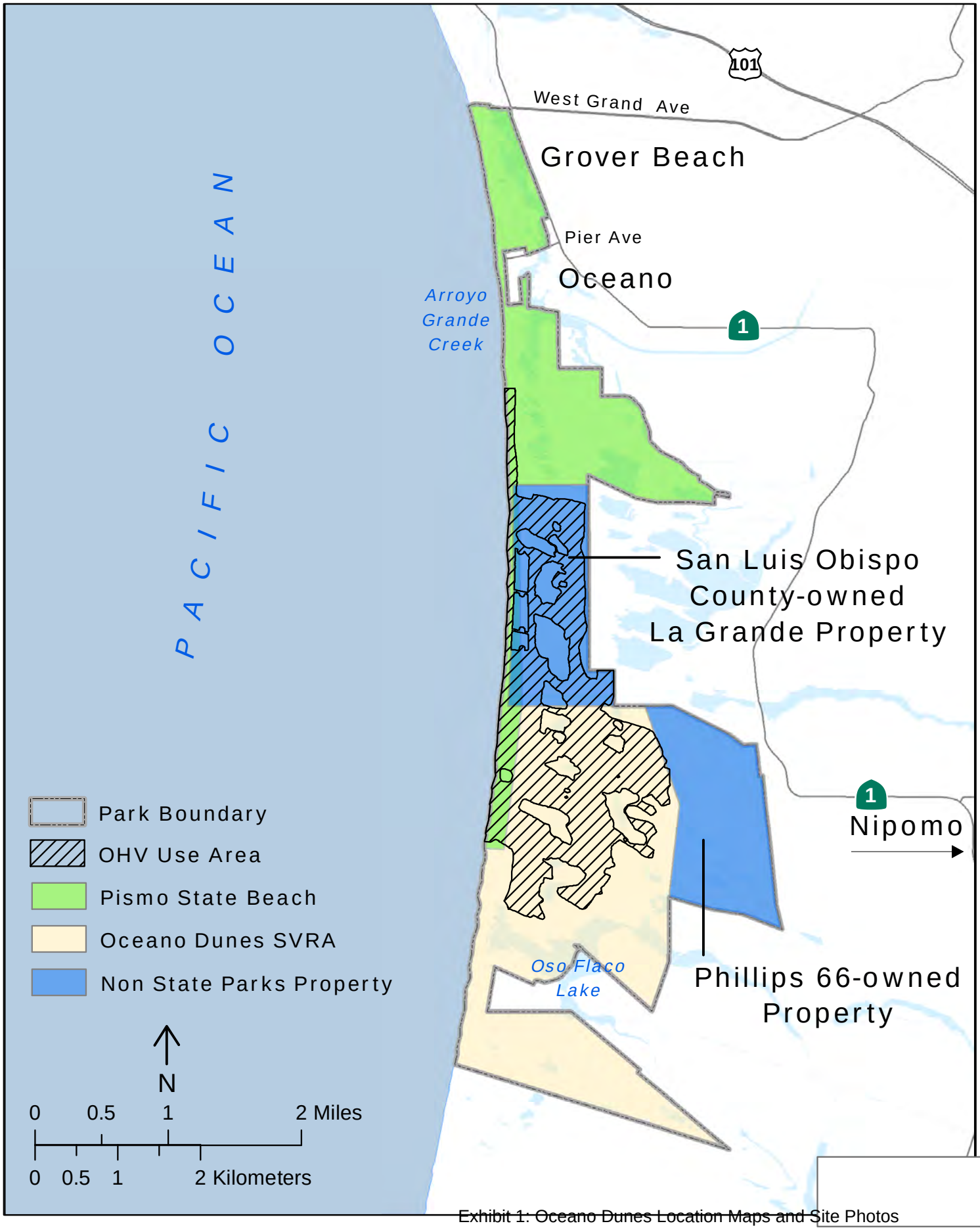
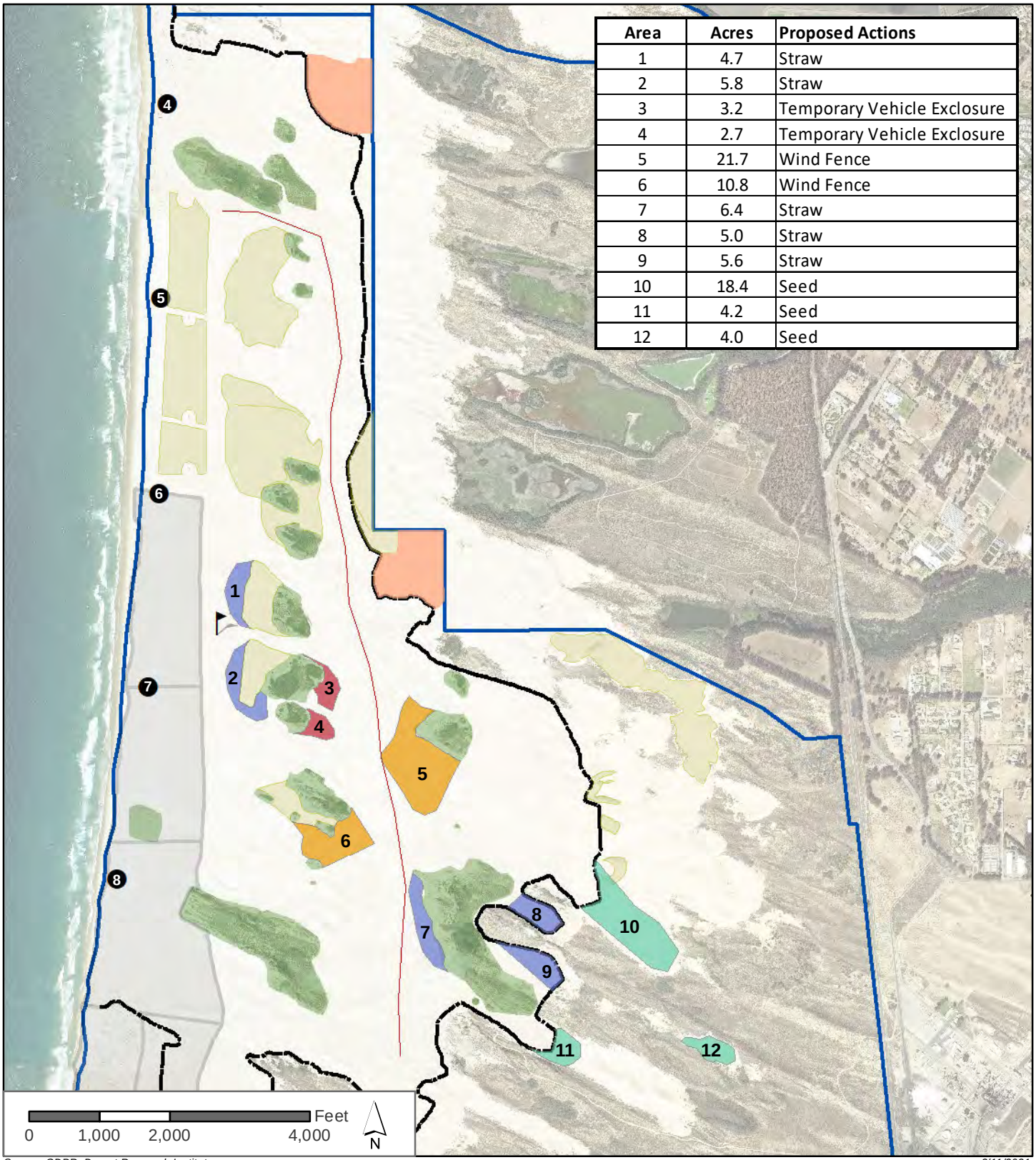
OCEANO DUNES - OWNERSHIP



Aerial of Open Riding Area



Area	Acres	Proposed Actions
1	4.7	Straw
2	5.8	Straw
3	3.2	Temporary Vehicle Exclosure
4	2.7	Temporary Vehicle Exclosure
5	21.7	Wind Fence
6	10.8	Wind Fence
7	6.4	Straw
8	5.0	Straw
9	5.6	Straw
10	18.4	Seed
11	4.2	Seed
12	4.0	Seed

Source: CDPR, Desert Research Institute

3/11/2021

- 2021 Proposed - Seed (native & sterile grain) (27 acres)
- 2021 Proposed - Straw (27 acres)
- 2021 Proposed - Temporary Vehicle Exclosure (6 acres)
- 2021 Proposed - Wind Fence (33 acres)
- Seasonal Wind Fencing Projects (2019-WF-01 and 2019-WF-02)
- Prior Vegetation Projects
- Existing fenced vegetation islands (186 acres)
- Open riding and camping area boundary fence
- Sand Highway, approx.
- Marker post
- Nesting exclosure
- Park boundary
- S1 wind tower

Exhibit A, Figure 2 - SOA Dust Control Treatment Areas

Oceano Dunes SVRA 2021

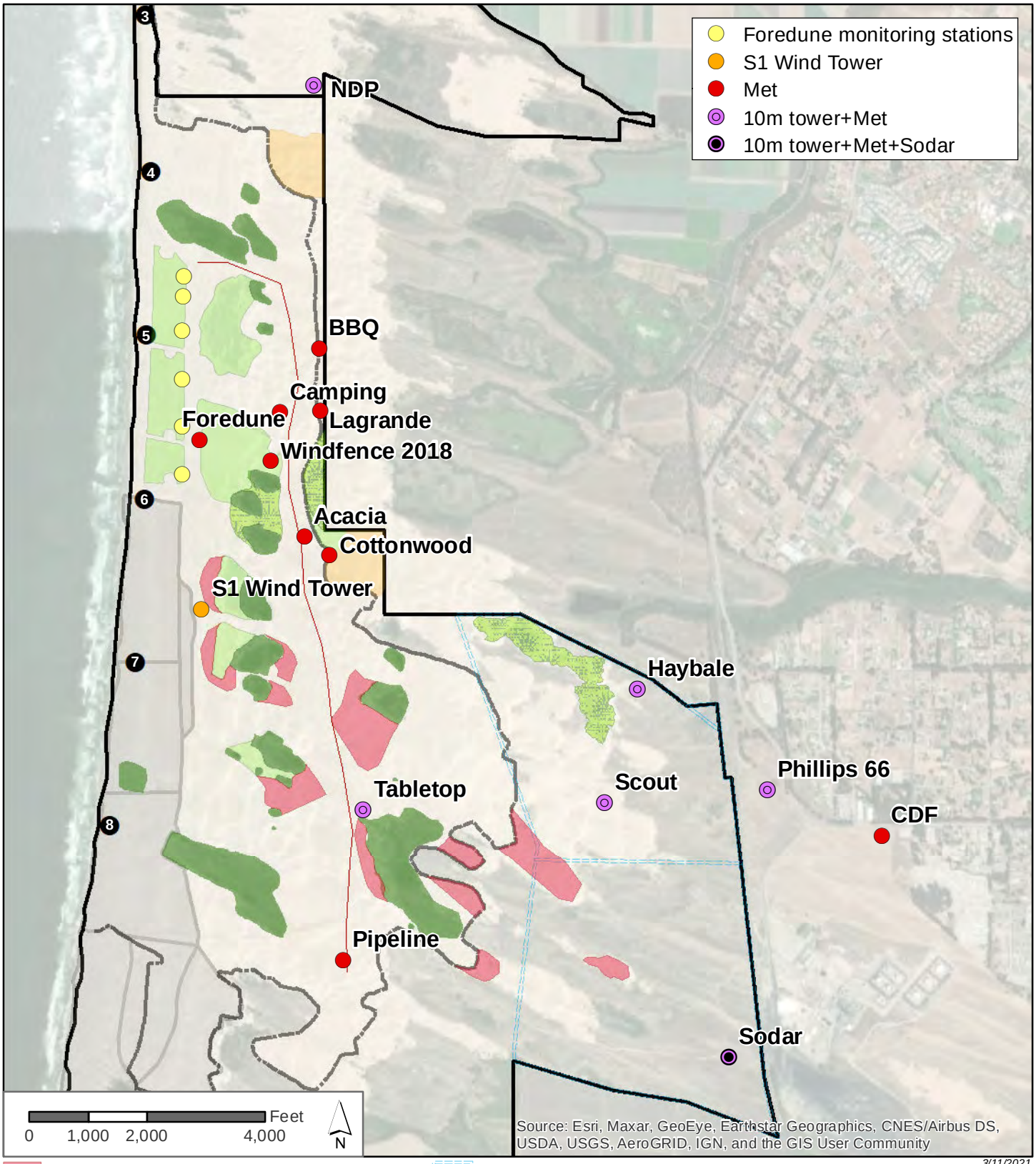


Exhibit A, Figure 3 - Locations of Monitoring Stations

Oceano Dunes SVRA 2021

Ecological Significance of Oceano Dunes

February 16, 2021

California Coastal Commission

Jonna Engel, PhD – Environmental Program Manager

Laurie Koteen, PhD – Senior Ecologist

Lauren Garske-Garcia, PhD – Senior Ecologist

Figure 1. Oceano Dunes in the Guadalupe-Nipomo Dunes Complex

EXECUTIVE SUMMARY

Guadalupe-Nipomo Dunes Complex

The Guadalupe-Nipomo Dunes Complex is approximately 22,000 acres in size, spans 18 miles along the coast from the City of Pismo Beach in the north to Point Sal in the south, and extends up to 5 miles inland. According to The Nature Conservancy, the Guadalupe-Nipomo Dunes Complex may be the largest coastal dune ecosystem on earth. Much of the Guadalupe-Nipomo Dunes Complex remains remarkably pristine and unfragmented. As a result, it supports several rare vegetation communities and hundreds of plants and animals, many of which are rare and some that are endemic (found nowhere else in the world). Three hundred twenty-one species of birds, 42 species of mammals, 25 species of reptiles and amphibians, and nearly 500 species of insects have been documented in the dunes. Of these, at least 52 are rare, including 18 that are state or federally listed as threatened or endangered.

Conservation International has named the California Floristic Province, that includes the Guadalupe-Nipomo Dunes Complex, as one of the world's 36 biodiversity hotspots. The US Department of the Interior named the Guadalupe-Nipomo Dunes Complex a National Natural Landmark in 1974 for being the largest, relatively undisturbed coastal dune ecosystem in California and for having one of the highest rates of endemism of any dunes in North America. In 1980 the US Fish and Wildlife Service conducted a sensitive species inventory of the Guadalupe-Nipomo Dunes Complex and described it as "the most unique and fragile ecosystem in the state…" and ranked it first on a list of 49 habitat areas in need of protection statewide. The Land Conservancy of San Luis Obispo County has long recognized the unique nature and ecological significance of the Guadalupe-Nipomo Dunes complex. It states that the dune complex:

> *"…is a large stretch of unbroken habitat and an important wildlife corridor. The ecosystem is dominated by coastal scrub and unique foredune habitats sprinkled with rare species. Riparian zones created around freshwater seeps and dune lakes offer oases for wildlife in the rugged coastal conditions. The uniqueness of this region makes it an important conservation goal worth long-term investment."*

Oceano Dunes: An Integral Component of the Guadalupe-Nipomo Dunes Complex

The Coastal Commission is reviewing State Park's managed activities within the Oceano Dunes component of the Guadalupe-Nipomo Dunes Complex. This report describes the ecological significance of the entire Guadalupe-Nipomo Dunes Complex and focuses specifically on Oceano Dunes and the area determined to be Environmentally Sensitive Habitat Area (ESHA)

under the California Coastal Act and the two LCPs that apply to Oceano Dunes (City of Grover Beach and San Luis Obispo County LCPs).

Oceano Dunes, which includes Pismo State Beach, Oceano Dunes State Vehicular Recreation Area, San Luis Obispo County property, and privately held lands (with a variety of use agreements with State Parks), is a 4,750-acre area managed by the California Department of Parks and Recreation. Oceano Dunes is an integral component of the Guadalupe-Nipomo Dunes Complex. Several landscapes elements are only found in Oceano Dunes including Arroyo Grande Creek and Lagoon, the Oso Flaco Lake area, and Big and Little Coreopsis Hills. Oceano Dunes supports almost all the habitats common to the Guadalupe-Nipomo Dune Complex, including sandy beach, coastal strand, foredunes, back dunes, wetlands, creeks, ponds, and lakes. Most of the hundreds of plant and animal species found in the Guadalupe-Nipomo Dunes Complex also occur in Oceano Dunes.

Threats to Oceano Dunes

Within the boundary of Oceano Dunes is a 1,305-acre area where off-highway vehicle (OHV)use occurs. Access to this area is from West Grand Avenue or Pier Avenue in the north. Street legal vehicles transporting OHVs travel approximately two miles along the beach, crossing Arroyo Grande Creek, even when it is flowing, to get to the OHV riding area. The area where riding occurs is a zone of no vegetation, unstable dune forms, and constantly moving sand. Interspersed are vegetated dune islands where riding is prohibited.

Numerous human activities and development threaten the relatively pristine and unfragmented Oceano Dunes and larger Guadalupe-Nipomo Dunes Complex. One of the most significant threats to Oceano Dunes is street legal vehicles and OHV use. Other threats include invasive species, beach grooming, and climate change.

Environmentally Sensitive Habitat Determination

All of the habitats within Oceano Dunes meet the definition of environmentally sensitive habitat area (ESHA). The area is teeming with rare vegetation communities and rare plants and animals. It also supports habitat that is especially valuable because of its special nature or role in the ecosystem. The Oceano Dunes habitats are threatened by development and human activities such as off-highway vehicle use. The only natural area in Oceano Dunes that is not considered environmentally sensitive habitat is the beach area of Pismo State Beach between West Grand Avenue and Arroyo Grande Creek.

Conclusion

Intact coastal dune ecosystems are extremely rare. Oceano Dunes is a component of one of the largest intact coastal dune ecosystems in the world and contains many rare habitats that support a great diversity of plants and animals, many of which are also rare. That is why Oceano Dunes is so unique and special, and a fundamental reason explaining why it is protected under the Coastal Act and the LCPs as ESHA. Experience tells us that maintaining, through conservation, intact natural processes and unfragmented ecosystems is orders of magnitude easier than restoring such ecosystems. At Oceano Dunes there is the opportunity to maintain, restore, and conserve this ecologically sensitive and biodiverse place now. If disruptive activities cease, this ecosystem will require only modest remediation and management. Oceano Dunes is a significant ESHA on the California coast that warrants the protection afforded to it under the Coastal Act and the LCPs.

Introduction

Positioned along continental margins, where the land and sea meet, intact beach and dune systems are among the rarest ecosystems on earth. There are numerous reasons for this. Coastlines are highly desirable areas for agriculture, industry, tourism, recreation, cities, and residential development (Nordstrom and Psuty, 1980), and in many littoral cells[1] the natural supply of sand for beaches and dunes is broken or impaired.[2] Added to this suite of impacts are rising sea levels (OPC, 2018). One result is coastal squeeze (Dugan et. al., 2008), where many beach and dune systems have either been completely lost or have become a shadow of their former selves. For the remaining beach and dune systems in developed areas, many have become highly fragmented and sand supply and transport have been interrupted.

When unconstrained, beaches and dunes integrate and manifest the geologic and ecological processes of both land and sea forming a complex, unique, and highly connected ecosystem. An array of physical processes involving wind, waves, currents, tides, and time interact and provide the material and energy that feed and form coastal dunes. Sediment that has eroded from coastal bluffs and sediment from the surrounding watershed that is delivered to the coast by rivers and creeks are added to the beach. From there, waves move sand and winds blow sand inland to form the basis of dune habitats. Such an unencumbered ecosystem connects the watershed, dunes, beach, and ocean through a dynamic conveyor belt of sediment transport and delivery.

Large watersheds with intact beach and dune systems, such as the Guadalupe-Nipomo Dunes Complex, support numerous inter-connected unique habitats with specialized plants and animals. These include the sandy beach, coastal strand, foredunes, and back dunes interspersed by features such as dune blowouts and dune swales. Vegetation communities within beach and dune systems reflect the strong environmental gradient with a small number of plants adapted to harsh conditions and strong dynamics close to the ocean and a larger number of plant species further inland where conditions are more stable. In and among the dunes are wetlands, ponds, and lakes while creeks and rivers wind around and through the dunes. A menagerie of animals, including invertebrates, amphibians, reptiles, birds, and mammals, live here.

Guadalupe-Nipomo Dunes Complex

Dune-backed beaches are one of California's rarest habitats, occupying an already small sliver of space that continues to shrink at an alarming rate (Dugan and Hubbard, 2010; Pickart and

[1] A littoral cell is a coastal compartment that contains a complete cycle of sedimentation including sources, transport paths, and sinks.

[2] Rivers and creeks, have been dammed and coastlines have been armored.

Barbour, 2007). In California, intact coastal dune ecosystems are rare because many have been paved over or built upon. The Guadalupe-Nipomo Dunes Complex is a notable exception. It is one of "the largest intact coastal dune ecosystems on Earth" (LCSLOC, 2018). According to The Nature Conservancy, the Guadalupe-Nipomo Dunes Complex may be *the* largest such coastal dune ecosystem on earth.[3] The Guadalupe-Nipomo Dunes Complex is approximately 22,000 acres in size, spans 18 miles along the coast from the City of Pismo Beach in the north to Point Sal in the south, and extends up to 5 miles inland (Figure 2). It is made up of both public and private land including the Pismo State Beach, Oceano Dunes State Vehicular Recreation Area, Pismo Dunes Natural Preserve, Dune Lakes, Black Lake Ecological Reserve, San Luis Obispo County dune property, Phillips 66 dune property, Guadalupe-Nipomo Dunes National Wildlife Refuge, Guadalupe Oil Fields, Rancho Guadalupe Dunes County Park, and Point Sal State Beach.

Much of the Guadalupe-Nipomo Dunes Complex remains remarkably pristine and unfragmented. As a result, it supports hundreds of plants and animals, many of which are rare and some that are endemic (found nowhere else in the world). The Guadalupe-Nipomo Dunes Complex supports several vegetation communities identified as rare by the California Department of Fish and Wildlife (CDFW) and 25 species of plants designated by the United States Fish and Wildlife Service (USFWS), CDFW, or the California Native Plant Society (CNPS) as endangered or threatened, or that have limited distribution. Three hundred twenty-one species of birds have been documented in the Guadalupe-Nipomo Dunes Complex. Eleven are federally listed and 39 have state rarity status. In addition, it is an important breeding area for 72 species of birds. Forty-two species of mammals live in or frequent the Guadalupe-Nipomo Dunes Complex, including eight with state rarity status and two federally listed as rare. Twenty-five species of reptiles and amphibians live in the Guadalupe-Nipomo Dunes Complex including five federal or state listed species[4]. Insects abound here. The Land Conservancy of San Luis Obispo Land County has compiled a list of nearly 500 species including five that are federally listed species of concern and three that are state special status species (LCSLOC, 2018; USFWS, 2016).

Conservation International has identified the California Floristic Province that includes the Central Western Ecoregion and the Guadalupe-Nipomo Dunes Complex, as one of the world's 36 biodiversity hotspots.[5] These biodiversity hotspots are Earth's most biologically rich, yet threatened, terrestrial regions. There are numerous reasons for the incredible biodiversity within the Guadalupe-Nipomo Dunes Complex. One of the most important factors accounting

[3] https://www.nature.org/en-us/get-involved/how-to-help/places-we-protect/guadalupe-nipomo-dunes/

[4] Plant and animal species numbers as reported from LCSLOC, 2018.

[5] Conservation International and the Critical Ecosystem Partnership Fund (CEPF) - https://www.cepf.net/our-work/biodiversity-hotspots/hotspots-defined; https://www.cepf.net/our-work/biodiversity-hotspots/california-floristic-province

for and maintaining the biodiversity is habitat connectivity. The relatively pristine condition of the Guadalupe-Nipomo Dunes Complex and its mosaic of interconnected habitats provides habitat resilience and promotes gene flow that contribute to the diversity and persistence of the dune species. Further, while the habitats and species within the Guadalupe-Nipomo Dunes Complex are interconnected, the dune ecosystem itself is isolated from other significant coastal dune ecosystems, paving the way for the evolution of endemic species.

The region straddles a biogeographic boundary at the confluence of northern and southern California climate and habitat types where many species at the northern- or southern-most extent of their population range converge, adding to the biodiversity of the area. Species at the edge of their ranges harbor valuable genetic diversity that confers enhanced resilience and adaptability to the larger population (Grayson and Johnson 2018; Sexton et al., 2009).

The number, size, and persistence of the lakes and ponds of the Dune Lakes area, embedded in this semi-arid dune landscape, is truly unique to the central coast of California. This area supports many species of plants and animals that wouldn't occur in the Guadalupe-Nipomo Dunes Complex but for the reliable source of water. Plants and animals inhabiting other areas of the dunes have evolved unique adaptations to survive physical constraints such as limited water resources and dry summers. The juxtaposition of wet and dry areas and the different species they support is another contributor to the biodiversity of this special place.

The Guadalupe-Nipomo Dunes Complex is divided into three topographical units, known as the Callender Dune Complex, which extends from Arroyo Grande Creek to Oso Flaco Lake, the Guadalupe Dune Complex, which extends from Oso Flaco Lake to the mouth of the Santa Maria River, and the Mussel Rock Complex, which extends southward from the Santa Maria River to Point Sal, (Figure 3). Each unit bears a slightly different geologic history and is composed of different combinations of pre-Flandrian and Flandrian (extending from 12,000 to 14,000 to the present) sediments (Cooper, 1967). The underlying sediments and the various dune shapes provide the physical setting that also contributes to the extraordinary biodiversity of the Guadalupe-Nipomo Dunes Complex (Worts and Thomasson, 1951).

In recognition of the rare and special nature of the Guadalupe-Nipomo Dunes Complex, the US Department of the Interior named the region a National Natural Landmark in 1974 for being the largest, relatively undisturbed coastal dune system in California and for having one of the highest rates of endemism of any dunes in North America (LCSLOC, 2018). In the 1980s, the US Fish and Wildlife Service conducted a sensitive species inventory of the Guadalupe-Nipomo Dunes Complex and described it as "the most unique and fragile ecosystem in the state…" and ranked it first on a list of 49 habitat areas in need of protection statewide (USFWS, 2016). To conserve this region the Guadalupe-Nipomo Dunes National Wildlife Refuge was established in

2000 (USFWS, 2000). The refuge is 2,553 acres immediately south and adjacent to Oceano Dunes.

The Land Conservancy of San Luis Obispo County has long recognized the unique nature and ecological significance of the Guadalupe-Nipomo Dunes complex. It states that the dune complex:

> *"…is a large stretch of unbroken habitat and an important wildlife corridor. The ecosystem is dominated by coastal scrub and unique foredune habitats sprinkled with rare species. Riparian zones created around freshwater seeps and dune lakes offer oases for wildlife in the rugged coastal conditions. The uniqueness of this region makes it an important conservation goal worth long-term investment."*[6]

The Land Conservancy has been investing time and money in studying and restoring the Dune Complex for the last 30 years. In 2018, it published *Dune Protected Areas Network 1.0 Creating a Blueprint for Restoration in the Guadalupe Nipomo Dunes Complex,* documenting four years of data collection and collaborative habitat restoration planning. With a team of over 32 technical experts, the Land Conservancy identified the most biologically unique and threatened areas within the Guadalupe-Nipomo Dunes Complex, designating them as Dune Protected Areas (DPAs). The final product is a collection of 14 ecological "core" and "hub" areas that represent priorities for conservation and restoration (Figure 4). The Land Conservancy describes their conservation approach as follows:

> *"Connectivity between and within the DPA networks is imperative to this conservation strategy, as it provides many of the necessary links in the core and hub concept. Connectivity throughout the Guadalupe-Nipomo Dunes Complex is important for migratory pathways, facilitating gene flow and strengthening adaptability to rapid and severe changes in climate."*

Oceano Dunes: An Integral Component of Guadalupe-Nipomo Dunes Complex

Oceano Dunes (Figure 5), which includes Pismo State Beach, Oceano Dunes State Vehicular Recreation Area, San Luis Obispo County property, and privately held lands (with a variety of use agreements with State Parks), is a 4,750-acre area managed by California Department of Parks and Recreation (Figure 6). Oceano Dunes is an integral and unique component of the Guadalupe-Nipomo Dunes Complex. In addition to habitats and species common to the overall Dune Complex, several important landscape elements are only found within Oceano Dunes. These include Arroyo Grande Creek and Lagoon, Oso Flaco Lake area, and Big and Little Coreopsis Hills. Five of the 14 dune protected areas identified and given individual names by

[6] Land Conservancy of San Luis Obispo County. 2018. Dune Protected Areas Network 1.0: Creation a Blueprint for Restoration in the Guadalupe Nipomo Dunes Complex. San Luis Obispo, California.

the Land Conservancy are in Oceano Dunes: Oceano Dunes Natural Preserve that includes Arroyo Grande Creek and Lagoon, Dune Islands, the Oso Flaco Lake Natural Area, Black Lake Ecological Area, and Nipomo Lupine. The Dune Lakes protected area is immediately adjacent to Oceano Dunes (Figure 7). The Land Conservancy found the Oso Flaco Lake area to be one of the most unique and threatened areas within the Guadalupe-Nipomo Dunes Complex (LCSLOC, 2018).

Within the boundary of Oceano Dunes is a 1,305-acre area where off-highway vehicle (OHV) use occurs. Access to this area is from West Grand or Pier Avenues in the north. Street legal vehicles transporting OHVs travel approximately two miles along the beach, crossing Arroyo Grande Creek, even when it is flowing, to get to the OHV riding area, where both street legal vehicles and off-highway vehicles drive on the beach and in the dunes. The area where riding occurs is a zone of no vegetation, unstable dune forms, and constantly moving sand. Interspersed are vegetated dune islands where riding is prohibited.

Using conservation connectivity software, California State Polytechnic University, San Luis Obispo student Lindsy Mobley created a habitat connectivity map for most of the Guadalupe-Nipomo Dunes Complex (Mobley, 2017). With expert opinion and further research, the linkages created by Ms. Mobley were further edited and analyzed by the Land Conservancy to create a more detailed habitat connectivity map (LCSLOC, 2018). Each protected area is connected by many corridors and linkages, which is ideal for wildlife movement and gene flow. The connectivity software edited by the Land Conservancy identified numerous linkages that cross the riding zone, making connections to the beach, dune islands, Arroyo Grande Creek and Lagoon, back dunes, and dune lakes (Figure 8). OHV riding, that occurs during the day and night, disrupts these linkages among habitats.

State Parks Species Management Activities

The beaches, coastal strand, and central foredunes of Oceano Dunes, including in the riding area, are extremely important habitats for the federally threatened and California Species of Special Concern (SSC) Western snowy plover (*Charadrius nivosus nivosus*).[7] One of the largest populations of breeding snowy plovers in the state of California occur here, including, on average, approximately 14% of the breeding adults in Recovery Unit 5, which spans the entirety of San Luis Obispo, Santa Barbara, and Ventura Counties (CDPR, 2019). In 2012, the USFWS designated these habitats south of Arroyo Grande Creek and within Pismo State Beach, the Oceano Dunes State Vehicular Recreation Area, and San Luis Obispo County owned dune property as snowy plover critical habitat because of its significance for foraging and nesting

[7] In addition, snowy plovers are also G3T3 S2S3 listed, USFWS Bird of Conservation Concern, and on the North American Bird Conservation Initiative Red Watch List. Federal listing only pertains to coastal populations whereas California Species of Special Concern status applies to both coastal and interior populations.

(USFWS, 2012) (Figure 9). In addition, Oceano Dunes is also important nesting habitat for the federally and state endangered California least tern (*Sternula antillarum browni*).[8]

Each year, State Parks commits resources (estimated by State Parks to be about $2 million annually) to protect Western snowy plover and California least tern habitat at Oceano Dunes and works with USFWS, CDFW and Point Blue Conservation Science[9] on its annual "*Nesting Season Management Plan to Avoid Take of the California Least Tern (CLT) and Western Snowy Plover at Oceano Dunes State Vehicular Recreation Area*." Such yearly plans generally identify a number of protective measures to guard against "take" of these state and federally listed species.[10] These measures are based on prior biological opinions and previous years' plans. These include buffers around nests outside the exclosure (installing protective fencing around individual nests, at least a 100-foot radius for snowy plover and 330 feet for least terns), seasonal fencing requirements, and monitoring, including banding individual chicks.

With respect to seasonal fencing, State Parks fences off a designated area during the March through September snowy plover and least tern nesting season. This area, called the southern exclosure, is a roughly 300-acre protected area closed to public entry, including OHV use.

State Parks also seasonally closes off to visitors, the coastal strand and foredunes south of the Oso Flaco Lake boardwalk, that is used by snowy plovers and least tern for breeding and nesting. However, the beach in this area remains available for public use year-round. OHV use is prohibited in this area. The somewhat arbitrary boundaries of the two exclosure areas do not encompass all the appropriate breeding habitat for these birds (Figure 10).

Habitats of Oceano Dunes

Morphology of Coastal Dunes

Beaches intersect with the ocean edge of dunes. Coastal strand begins at the upper edge of the dry beach and is characterized by low mounds and embryonic dunes. Gradual slopes continue inland, forming longitudinal dunes that run parallel to the prevailing wind, becoming foredunes. Foredunes are semi-stabilized features comprised of hummocks and hollows that run parallel to the shoreline. Within the foredunes, crests and ridges (high points running perpendicular to the shoreline) form alongside dune blowouts and dune swales where wind scour creates pockets of low elevation. Blowouts are unvegetated natural features that form among

[8] In addition, least terns are also G4T2T3Q S2 listed, CDFW Fully Protected Species, and on the North American Bird Conservation Initiative Red Watch List.

[9] Formerly Point Reyes Bird Observatory.

[10] "Take" is a federal term of art meaning "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

vegetated areas due to focused wind intensity. Dune swales are low areas that sit just above or intersect the water table. The foredunes give way to back dune areas composed of increasingly stable slopes, ridges, and flats that often take on a more parabolic shape. Further inland, back dunes continue to flatten into dune sheets. These habitats are part of a continuum linked by the dynamic migration of beach sand (Hunt, 1993).

Marine and Terrestrial Habitats

Sandy Beach

Sandy beaches occur along coastlines at the dynamic interface between the ocean and land with important connections to both, combining terrestrial and wetland characteristics. In addition to sand, the exchange of chemical and biological matter occurs across the ocean, beach, and dune ecotones.[11]

Waves and tides deposit enormous amounts of kelp, algae and other marine plants (e.g., surfgrass and eelgrass) on beaches that form a critical organic resource referred to as wrack. The wrack fuels a vast and diverse food web of beach macro-invertebrates (e.g., amphipods and insects).[12] As many of the macro-invertebrates break down and digest the kelp and algae, nutrients are cycled back to the substrate and returned to the ocean or transported with sand inland where it supports the establishment of dune vegetation. The abundant macro-invertebrates in the wrack provide an important food source for higher trophic levels including nearshore fish and shorebirds such as Western snowy plovers (Lowman et al., 2019; Dugan et al., 2011).

Southern and central California sandy beaches support some of the most diverse intertidal invertebrate infaunal (dwelling within the substrate) communities ever reported for beaches around the world (Dugan et al., 2000). Beach invertebrates provide diverse and abundant prey for a remarkably rich assemblage of shorebirds, averaging greater than 100 birds per kilometer year-round for some southern and central California beaches (Hubbard and Dugan, 2003). Shorebird use of beaches has been positively correlated with the availability of invertebrates and wrack as well as beach type, width, and condition (Dugan et al., 2008).

Along with the unique community of organisms, beaches provide ecological functions and services not supplied by any other open coast ecosystem (Schlacher et al. 2007; Dugan and Hubbard, 2016). These functions include filtering large volumes of seawater, accumulating and storing sand, wave dissipation and buffering, decomposition and recycling of organic matter, recycling of imported nutrients, supporting coastal fisheries, and providing critical habitats

[11] An ecotone is the transition area between two adjacent ecological communities.

[12] The wrack food web includes invertebrate herbivores, omnivores, and carnivores.

(pupping, nesting and foraging sites) for wildlife species such as marine mammals and birds. While sandy beaches are highly valued recreational areas that attract thousands of visitors and contribute greatly to coastal economies, their unique biodiversity and the ecological functions and resources supported by beaches are often under-appreciated (Schlacher et al., 2007).

In addition to sand and seaweed, alongshore currents provide a mechanism for delivery of salt-tolerant plant seeds (floating fruits from dune plants) to the shoreline, which are pushed to the back beach and embryonic dunes where they contribute to the formation of coastal strand and foredune vegetation communities. Salt spray is another important input from the ocean, as it limits the plants that can establish along the upper beach and the dunes nearest the ocean.

Snowy plover and least terns nest and rear their chicks on the beaches within Oceano Dunes and these areas are crucial foraging habitat for snowy plover adults and chicks. As discussed above, snowy plovers are the focus of considerable State Park management activity in the southern portion of the Oceano Dunes State Vehicular Recreational Area in the location of the exclosures.

Coastal Strand

Ocean proximity is an important driver of vegetation communities. Locations nearest to the ocean are directly exposed to the energy of the wind, waves, currents, and tides. This is a dynamic landscape where sand is constantly moving and salts are deposited on the dune surface through wave run-up and fine spray, slowly percolating down through root zones. Sand scour and saline conditions exclude establishment of all but the most hardy and salt-tolerant species. This zone where the highest tides reach and where the wrack, upper beach, and foredunes converge is where embryonic dunes form and a few uniquely adapted plants define the vegetation community known as coastal strand. The establishment of embryonic dunes and coastal strand habitat is often initiated by the presence of wrack, which traps sand, seeds, moisture, and nutrients (Pickart and Sawyer, 1998).

The plants that survive here are specially adapted to grow in salty, shifting sand, where they are occasionally bathed in salt water and where freshwater is scarce. These conditions are inhospitable to most plants, but the few species that live here thrive and do poorly elsewhere. These include native red sand verbena (*Abronia maritima* – CNPS 4.2),[13] beach-bur (*Ambrosia chamissonis*), beach saltbush (*Atriplex leucophylla),* and naturalized sea rocket (*Cakile maritima)*. These species grow close to the ground and have deep taproots and roots at their

[13] First published in 1974, the CNPS Inventory is a widely-accepted authoritative resource on California's rare and endangered plants... that directly guides rare plant protection, conservation planning, and land acquisition and management in California. CNPS 4 ranked plants are of limited distribution or infrequent throughout a broader area in California. 0.2 indicates "moderately threatened" in California (20-80% occurrences threatened/ moderate degree and immediacy of threat). https://www.cnps.org/rare-plants/cnps-inventory-of-rare-plants

nodes that allow them to spread, firmly anchor in the sand, and stabilize the sand against erosion.[14] Since desiccation is a threat, these species have small leathery leaves that hold moisture and are light green or greyish in color with small hairs that reflect sunlight.[15] Colonization and succession of this zone can be impacted by both natural and anthropogenic forces, including high winds, OHV use, or trampling (LCSLOC, 2018). Coastal strand vegetation is essential in the formation of hummocks that can become foredunes (Figure 11).

Central Foredunes

Just inland of the coastal strand and interspersed with areas of active dune migration are the foredunes that exhibit dune hollow and hummock morphology and form ridges perpendicular to the shoreline and the prevailing winds. The foredunes undergo periods of sand accretion and erosion due to the dynamic interplay of wind and high waves during storm events. While the windward slopes of foredunes only support a few species of plants (including members of coastal strand), the more protected leeward slopes support more species including taller growth forms and a diversity of other species characteristic of foredune communities.

At Oceano Dunes, the coastal strand community transitions to what is defined as pioneer dune communities by Holland and Keil (1995) and is also known as central foredunes. In the 2010 update to the status of the state's natural communities, CDFW assigned central foredune habitat the highest rarity ranking ("critically imperiled") of G1 S1.2 (CDFW, 2010).[16] Of the three regional foredune communities in California (northern, central, southern), central foredunes are the rarest. Oceano Dunes central foredune communities extend inland from the beach 500 to 1500 feet where they gradually intergrade into Oceano Dunes central dune scrub communities (LCSLOC, 2018).

In the 2nd Volume of the Manual of California Vegetation, the dominant vegetation community of the central foredunes is identified as "dune mat" or the *Abronia latifolia-Ambrosia chamissonis* herbaceous alliance (Sawyer et al., 2009).[17] This community is dominated by its

[14] https://explorebeaches.msi.ucsb.edu/sandy-beach-life/native-beach-plants

[15] *Ibid*.

[16] Global (G) and State (S) Level 1 communities or species are identified as "critically imperiled = at very high risk of extinction due to extreme rarity (often <5 populations), very steep declines, or other factors". Global (G) and State (S) Level 2 communities and species are identified as "imperiled = at high risk of extinction or elimination due to restricted range, few populations or occurrences (often < 20), steep declines, severe threats, or other factors. Global (G) and State (S) Level 3 communities and species are identified as "vulnerable = at moderate risk of extinction due to a restricted range, relatively few populations (often <80), recent and widespread declines, or other factors".

[17] The 2nd Volume of The Manual of California Vegetation (MCV2) employs the National Vegetation Classification System and has been widely adopted as the authoritative source on California Vegetation. The MCV2 vegetation categories are broken down into alliance and association levels and are presented in the volume at the alliance

namesakes, yellow sand verbena and silver beach bur, respectively, and is assigned a rarity ranking of G3 S3. Dune mat vegetation is characteristically found on hummocks within about a quarter mile of the surf zone.[18] Additional species found in Oceano Dunes central foredunes include dune morning glory (*Calystegia soldanella),* beach evening-primrose (*Camissoniopsis cheiranthifolia),* California sand aster (*Corethrogyne filaginifolia),* dunedelion (*Malacothrix incana* – CNPS 4.3), and dune ragwort (*Senecio blochmaniae* – CNPS 4.2) (Figure 11).

The two sensitive plants that occur within this vegetation community, at this location, are surf thistle (*Cirsium rhothophilum*) and beach spectaclepod (*Dithyrea maritima*). Both are extremely rare (state threatened (G1 S1) and CNPS (1B.2 and 1B.1, respectively) listed species).[19] Endemic surf thistle is only found in central foredunes and dune scrub between Pismo Beach and Point Conception. Beach spectaclepod is only found in dunes where the sand is relatively unstable in San Luis Obispo and Santa Barbara Counties, on San Nicolas and San Miguel islands, and Baja California.

Just a few animals reside full-time in Oceano Dunes central foredunes, including globose dune beetles (*Coelus globosus*) and silvery legless lizards (*Anniella pulchra).* Globose dune beetles have a rarity ranking of G1G2 S1S2 and are most commonly found beneath foredune vegetation. The silvery legless lizard has a rarity ranking of G3 S3 and a California Species of Special Concern. It is a burrowing lizard that looks like a snake, having adapted to a legless condition to allow it to live a subterranean life in loose, sandy soil. In dunes, legless lizards are typically associated with shrubs and leaf litter that provide refuge and is relatively abundant with insect prey.

Large areas of Oceano Dunes central foredunes are invaded by non-native European beach grass (*Ammophila arenaria)*. This pernicious invader excludes native plants from establishing, forms dense single species stands, and prevents dunes from naturally migrating. Invasive ice plant species including highway iceplant (*Carpobrotus edulis)* and sea fig *(C. chilensis*) are also found in areas of Oceano Dunes central foredunes, as well as other locations, and can similarly prevent colonization by native species.

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level which is best for identifying vegetation at regional and statewide levels because it is defined by characteristic plant species.

[18] https://cnpsslo.org/2020/02/a-few-rare-dune-natural-plant-communities/

[19] CNPS 1B ranked plants rare throughout their range with the majority of them endemic to California. CNPS 2B plants, except for being common beyond California, would be ranked 1B. 0.1 indicates "seriously threatened" in California (over 80% of occurrences threatened = high degree and immediacy of threat), and 0.2 indicates "moderately threatened" in California (20-80% occurrences threatened = moderate degree and immediacy of threat).

Central Dune Scrub

As one moves from the ocean landward, the marine influence is reduced, sand movement slows, and the dunes and associated vegetation become increasingly diverse and stable. Foredunes transition into back dunes where the vegetation becomes increasingly dominated by sub-shrubs and shrubs in a vegetation community known as central dune scrub (Holland, 1986). Compared to habitats closer to the ocean, central dune scrub is subject to less natural disturbance, lower salt inputs, and less extreme temperature fluctuations and is characterized by diverse species along more or less stabilized slopes, ridges, and flats that can extend inland three miles (USFWS, 2016). Central dune scrub intergrades with central foredune dune mat vegetation and inland chaparral and often occurs as dense scatterings of shrubs and non-woody plants, generally reaching less than 1 meter in height (Holland, 1986). Central dune scrub leaves its imprint over time, as greater vegetative cover leads to higher nutrient soils, a more stabilized dune sheet, higher soil organic matter content, and a shaded, less-reflective surface.

Like central foredunes, central dune scrub is a rare habitat with a ranking of G2 S2.2 (CDFW, 2010). The dominant vegetation community of central dune scrub is the silver dune lupine-mock heather scrub *(Lupinus chamissonis-Ericameria ericoides*) shrubland alliance, which has a rarity ranking of G3 S3 and is named after the dominant species (Sawyer et al., 2009). Associated species include sea cliff buckwheat (*Eriogonum parvifolium),* California sagebrush (*Artemisia californica),* coyote brush (*Baccharis pilularis),* , California poppy (*Eschscholzia californica),* seaside fiddleneck (*Amsinckia spectabilis),* and, occasionally, giant coreopsis (*Leptosyne gigantea)* (Figure 11).

Rare plant species found within this community at Oceano Dunes include Nipomo Mesa lupine (*Lupinus nipomensis* - state and federally endangered, G1 S1, CNPS 1B.1*)*, Blochman's leafy daisy (*Erigeron blochmaniae* - G2 S2, CNPS 1B.2), *dune larkspur (Delphinium parryi* ssp*. Blochmaniae* - S2, CNPS 1B.2*)*, Kellogg's horkelia (*Horkelia cuneata* ssp*. sericea* - CNPS 1B.1*)* and prickly phlox (*Leptodactylon californicum* ssp. *tomentosum* – G5T3 S3, CNPS 4.2). Nipomo Mesa lupine is extremely rare; it is endemic and only found within the Guadalupe-Nipomo Dunes Complex. Blockman's leafy daisy, dune larkspur, and Kellogg's horkelia are endemic to California. Blockman's leafy daisy and dune larkspur are limited to the coastline of San Luis Obispo and northern Santa Barbara Counties while Kellogg's horkelia is limited to the coastline between Marin and northern Santa Barbara Counties.[20]

Coast horned lizards (*Phrynosoma blainvillii* – G3G4 S3S4, SSC) are found in central dune scrub habitat. Their cryptic coloring enables them to blend into the background, making them difficult to spot. Their main diet is comprised of ants, but they also eat other insects. If cornered, they may employ the unique defense of spraying blood from the corners of their eyes. Silvery

[20] https://www.calflora.org/

legless lizards and burrowing owls (*Athene cunicularia* – G4 S3, SSC) also use back dune and dune scrub habitats.

Just north and south of Oso Flaco Lake, within the boundary of Oceano Dunes, and within the central dune scrub habitat, is a rare natural community called giant coreopsis scrub (*Coreopsis gigantea*) shrubland alliance that has a ranking of G3 S3 (Sawyer et al., 2009). The giant coreopsis scrub occurs on Little Coreopsis Hill, which is just north of Oso Flaco Lake and on Big Coreopsis Hill just south of Oso Flaco Lake (LCSLOC, 2018). These areas are the northernmost natural occurrence of giant coreoposis (now *Leptosyne gigantea)* in California. This community inhabits stabilized back dunes and typically co-occurs with mock heather, California sagebrush, and other silver dune lupine-mock heather central dune scrub species.

The presence of non-native invasive plants such as perennial veldt grass (*Ehrharta calycina),* European beach grass, and highway iceplant all present a threat to the continued existence of the Oceano Dunes central dune scrub and the active, unvegetated interior dunes.

Coastal Dune Riparian Woodland

Small patches of coastal dune riparian woodland are scattered along the creeks and around the marshy areas, ponds, and lakes in Oceano Dunes. These riparian woodlands are frequently composed of a very dense canopy of arroyo willow (*Salix lasiolepis)* interspersed with black cottonwood (*Populus trichocarpa),* red willow (*Salix laevigata),* and California wax myrtle (*Morella californica)*, and shrubs such as elderberry (*Sambucus nigra* ssp. *caerulea),* and coyote bush. The understory, where present, is predominantly a mix of herbaceous vegetation including giant horsetail (*Equisetum telmateia),* poison oak (*Toxicodendron diversilobum),* stinging nettle (*Urtica dioica* ssp. *holosericea),* California goldenrod (*Solidago velutina* ssp. *californica),* and brambles of California wild rose (*Rosa californica)* and California blackberry (*Rubus ursinus)* (Figure 11).

Arroyo willow is fast growing and spreading, and often forms a canopy over ponds and marshes, becoming the dominant species in these communities. When this occurs, often during extended periods of drought, marshes and ponds can dry up and turn into riparian woodlands. This continual evolution of plant communities is an example of the ongoing dynamics characteristic of coastal dune ecosystems (USFWS, 2016).

Wetland Habitats

Within the coastal dunes are several unique areas of brackish and freshwater including creeks and lagoons, coastal dune swale, and ponds and lakes.

Arroyo Grande Creek and Lagoon

Arroyo Grande Creek is a perennial creek that drains a 153-square-mile watershed. Within the last few miles to the ocean, the creek flows through an alluvial agricultural valley and then forms Arroyo Grande Lagoon behind the beach. The lagoon is typically closed by a sandbar during the summer months. Meadow Lagoon, formed by Meadow Creek, enters Arroyo Grande Lagoon just upstream of the Arroyo Grande Creek mouth. The lagoons are remnants of formerly extensive back dune wetland habitats and a large bay that once extended between Pismo Beach and Oceano Dunes, but that was drained by European settlers. Arroyo Grande Creek terminates at the lagoon within Oceano Dunes, south of Pier Avenue.

Arroyo Grande Lagoon is a perched lagoon[21] that is primarily made up of freshwater; however, wave overwash creates brackish conditions during some portions of the year. It is characterized by patches of submerged and emergent aquatic vegetation and mud, silt, and gravel substrate. The upper reach of the creek is lined with dense riparian vegetation, primarily willows (*Salix* spp.) and wax myrtle (*Morella californica),* along and overhanging the bank. Beaver dams are often present in the lower reach of the creek. The lagoon supports estuarine species such as the federally endangered tidewater goby (*Eucyclogobius newberryi),* Pacific staghorn sculpin (*Leptocottus armatus),* and three-spine stickleback (*Gasterosteus aculeatus)*. Federally threatened south-central California coast steelhead (*Onorhynchus mykiss* – G5T2Q S2*)* smolts are persistent in the lower creek and lagoon. Park biologists' surveys indicate that the tidewater goby populations may be locally extirpated by large flood events or abrupt breaching of the lagoon. Yet, there are also multiple records of goby re-colonizing the lagoon and the goby population has ranged from fewer than 10 individuals (Rischbeiter, 2012) to thousands (Rischbeiter, 2016).

When heavy rains fill the creek each year and breach the sandbar, Arroyo Grande Creek spills over the beach and connects to the ocean, usually for a period of several weeks. This area, where the creek flows into the ocean during winter and spring when the sandbar is breached, is also where vehicles access the Oceano Dunes riding area. Both tidewater gobies and south-central California coast steelhead are vulnerable to creek flushing when the lagoon naturally breaches or when street legal vehicles drive too close to the sand bar during critical parts of the year. The intersection of the creek and beach is also where the Western pond turtle (*Emys marmorata* – G3G4 S3, SCC), and the federally threatened California red-legged frog (*Rana draytonii* – G2G3 S2S3, SCC) are found. This zone is also identified by the USFWS as California red-legged frog critical habitat (Figure 9). In addition, beavers, which were introduced by early European settlers, tend to occupy and re-engineer stretches of the lower creek.

[21] A lagoon is considered "perched" when it is separated from the ocean by a sandbar and the water level in the lagoon is higher than in the ocean.

California red-legged frogs are primarily associated with aquatic habitat, which they require for breeding and refuge; however, several studies over the past two decades reveal that all ages of these frogs are reliant on upland habitat for prey, refuge from predation, and as dispersal routes between breeding sites. Further, their migration patterns, once thought to be primarily along riparian corridors, are now known to include migration overland, often along linear, habitually established corridors. As a result, these frogs may be killed by street legal vehicle and OHV use, especially at night when frogs migrate between aquatic sites, sometimes over considerable distances (Fellers and Kleeman, 2007; Bulger et al. 2003).

Coastal Dune Swale

Within Oceano Dunes back dunes and central dune scrub are dune slack wetlands, also known as dune swales. Dune swales are formed when scouring of loose dune sediments by wind creates depressions in the dune surface, bringing the surface elevation close to the water table. The bottoms of these dune swales range from a foot or two below the water table to a few feet above the water table (USFWS, 2016). Ecological connectivity with the water table allows roots access to freshwater and surface water ponding, leading to local oases and a unique mixed community of hydrophytic and dune scrub vegetation (Figure 11).

Coastal dune swales are transitional in nature, between wetland and upland plant communities. During the rainy season, the soils of some dune swales that are close to the water table exhibit saturated surface soil. During high rainfall periods, dune swales may be periodically inundated with surface water for at least a few weeks. Some species that inhabit these environments include sand dune sedge (*Carex pansa),* wedge-leaved horkelia (*Horkelia cuneata* spp. *sericea),* and salt rush (*Juncus lesceurii).* Unique to these moist dune swale areas are a number of phreatophytic species, or species that rely on a root system that maintains contact with the water table. Dune swale communities often are adjacent to, and grade into, riparian woodland communities and freshwater marsh. They are often dynamic, ephemeral landscape features that can fill in with sand over time and convert to dune scrub, or even reappear after periods of burial when winds re-sculpt dune topography (Figure 11).

The federally and state threatened California black rail (*Laterallus jamaicensis coturniculus* – G4G3T1 S1*),*[22] a salt marsh-associated species, whose population has contracted with the loss of tidal marsh habitat, is sometimes found in Oceano Dune swale areas.

Dune Lakes

Just to the east of Oceano Dunes are a series of lakes or freshwater marshy areas, the Dune Lakes, that provide an ample freshwater supply within the mostly semi-arid landscape of

[22] The Bureau of Land Management lists California Black Rail as a Sensitive Species and it is also included on the North American Bird Conservation Initiative Red Watch List.

Oceano Dunes (Figure 12). These lakes and marshes constitute the largest remaining complex of dune-associated freshwater lakes in the whole of coastal California (Smith et al., 1976) and contribute substantially to the uniqueness of the region as a whole. The year-round and spatially extensive availability of freshwater within a semi-arid landscape exists only in this location and contributes to the overall species abundance and biodiversity of the Guadalupe-Nipomo Dunes Complex as well as Oceano Dunes within it.

Although the water supply is intermittent, these large lakes contain both submerged areas and marshy areas populated with freshwater aquatic species such as bulrush (*Schoenoplectus californicus)* and cattails (*Typha latifolia).* Also present are several upland species such as Nuttall's milkvetch (*Astragalus nuttallii* var*. nuttallii* – CNPS 4.2*),* and several dune mint species (*Mondarella* spp.)*,* including the CNPS 1B.2 subspecies *Monardella sinuata* ssp. *sinuata.* The Lake complex is found entirely on private land that is extensively managed for both hunting and conservation. Water is supplied through precipitation, direct draw-down of groundwater to fill the lakes, and irrigation runoff from adjacent agricultural lands. In 2017, a large population of the federally and state endangered La Graciosa thistle (*Cirsium scariosum* var*. loncholepis)* was found in the vicinity of Big Twin Lake.

Among the dune lakes and wetlands alone, more than 86 species of aquatic birds have been sighted, including rails, geese, swans, ducks, pelicans, coots, grebes, cormorants, loons, gulls, terns, egrets and herons. Another 108 upland resident and migratory bird species are associated with the surrounding dunes, including numerous raptor species, swifts, woodpeckers, warblers, finches, flycatchers, and many others (Smith et al., 1976).

Black Lake and Oso Flaco Lakes

At the southern end of the Dune Lakes and at the foot of Black Lake Canyon is the Black Lake Ecological Area. This lake is separately managed under ownership of the Land Conservancy of San Luis Obispo County and is maintained in relatively pristine condition. While historically the deepest of the lakes, Black Lake, like the other dune lakes is becoming progressively shallower due to groundwater drawdown for neighboring agricultural lands. Black Lake is one of the only two areas where the Nipomo Mesa lupine, endemic to the Guadalupe-Nipomo Dunes Complex, is found. The other location is at the Oceano Dunes and Phillips 66 property boundary. The range of Nipomo Mesa lupine is so limited its entire distribution occurs only within and immediately adjacent to Oceano Dunes.

The southernmost and largest lake within Oceano Dunes is Oso Flaco Lake with over 40 acres of open water habitat. Oso Flaco Lake and Little Oso Flaco Lake are located behind active foredunes. Both lakes receive their water supply primarily from Oso Flaco Creek. Little Oso Flaco Lake is found along the length of Oso Flaco Creek and Oso Flaco Lake marks the creek's endpoint. The water within Oso Flaco Creek is supplied primarily from agricultural runoff and,

as a result, the creek and lakes have become contaminated with fertilizers, pesticides, and other agricultural chemicals and are classified as an impaired waterbody (CCRWQCB, 2012; USEPA, 2010; CCRWQCB, 2008).

Despite its degraded water quality, Oso Flaco Lake is an important habitat along the Pacific Flyway for migratory birds and is a major recreation area for birders. The list of special status bird species known to breed near Oso Flaco Lake is long and in addition to the snowy plover and least tern, includes many California Species of Special Concern: least bittern (*Ixobrychus exilis* – G4G5 S2), northern harrier (*Circus hudsonius* – G5 S3), loggerhead shrike (*Lanius ludovicianus* – G4 S4), black swift (*Cypseloides niger* – G4 S2), Vaux's swift (*Chaetura vauxi* – G5 S2S3), black tern (*Chlidonias niger* – G4 S2), American white pelican (*Pelecanus erythrorhynchus* – G4 S1S2), wood stork (*Mycteria americana* – G4 S2), olive-sided flycatcher (*Contopus cooperi* – G4 S4), burrowing owl (G4 S3), vermilion flycatcher (*Pyrocephalus rubinus* – G5 S2S3), purple martin (*Progene subis* – G5 S3), yellow-headed blackbird (*Xanthocephalus xanthocephalus* – G5 S3), yellow-breasted chat (*Icteria virens* – G5 S3), and summer tanager (*Piranga rubra* – G5 S1). Several rare invertebrate species that are associated with the dunes and surrounding wetland habitats occur here, including the Oso Flaco robber fly (*Ablautus schlinger* – G1 S1), the Oso Flaco flightless moth (*Areniscythris brachypteris* – G1 S1), the Oso Flaco patch butterfly (*Chlosyne leanira elegans* – G4G5T1T2 S1S2), the white sand bear scarab beetle (*Lichnanthe albipilosa* – G1 S1), the monarch butterfly (*Danaus plexippus* – G4T2T3 S2S3), and the Morro Bay blue butterfly (*Plebejus icariodies* – G5T2 S2) (MIG, Inc. 2020; Powell, 1978). California red-legged frogs and tidewater gobies are also found at Oso Flaco Lake, despite lacking an outlet to the ocean in the case of the goby. Oso Flaco Lake is USFWS designated critical habitat for tidewater gobies (USFWS, 2013) (Figure 9).

Two endemic state and federally endangered plant populations occur at Oso Flaco Lake: the only known extant wild population of marsh sandwort (*Arenaria paludicola* – CNPS 1B.1) and a population of La Graciosa thistle (*Cirsium scariosum var. loncholepis*). Marsh sandwort is an herbaceous perennial that was historically known to occur in marshes and near streams and creeks from central Washington to southern California (USFWS, 2008). La Graciosa thistle is a short-lived monocarpic perennial (a plant that blooms once, then dies) (Hendrickson 1990; Keil and Turner 1993; Teed 2003). It is currently known to exist in only four locations including the Dune Lakes, Oso Flaco Lake, an area within the southern end of the Guadalupe-Nipomo Dunes Complex, and along the Santa Maria River (USFWS, 2016). The Oso Flaco Lake and surrounding wetlands are identified as critical habitat for La Graciosa thistle (USFWS, 2009) (Figure 9). Gambel's watercress (*Nasturtium gambelii* – CNPS 1B.1), another federally endangered and state threatened species, may also occur at Oso Flaco Lake, although this population has likely hybridized with common watercress (*Nasturtium officinale).*

Threats to Oceano Dunes and Guadalupe-Nipomo Dunes Complex

Oceano Dunes is such an integral component of the Guadalupe-Nipomo Dunes Complex that any adverse impacts within Oceano Dunes affects not only habitats there, but also the habitat values of the Guadalupe-Nipomo-Dunes Complex.

Street Legal Vehicles and Off-Highway-Vehicles

One of the most significant threats to Oceano Dunes is street legal vehicle and off-highway vehicle (OHV) use (Figure 13). Street legal vehicles and OHVs compact the sand, kill beach macro-invertebrates, and destroy wrack and the associated invertebrate community that serve as food resources for shorebirds and fish. Street legal vehicles and OHVs also cause dune erosion, crush and eliminate dune vegetation, and prevent vegetation reestablishment. Over the years, many snowy plover and least tern deaths from collisions with vehicles have been documented (Iwanicha et al., 2020; Iwanicha et al. 2019).[23] Street legal vehicles and OHVs also break up the stiff surface layers that form on beaches and dunes, which facilitates the emission of particulate matter to downwind communities and erodes the dunes.

When foredunes and back dunes are impacted such that the vegetation is removed, the dunes revert to active moving dunes that often overtake and bury wetlands and other areas of sensitive dune habitat. This has happened in the area of street legal vehicle and OHV use at Oceano Dunes where wind erosion has resulted in blowouts larger than would naturally occur and masses of unstable sand now dominate the landscape. State Parks also uses heavy equipment to move sand for maintenance of vehicle riding areas, fences, and other facilities which interrupts natural coastal processes that would otherwise lead to the development of natural dune morphology, vegetation, and habitat functions.

This is consistent with results from a State Park's study conducted in the 1970s. Out of concern for Inglenook Fen, a rare wetland within The Ten Mile Dunes near Fort Bragg, State Parks conducted a study to prepare an action plan for preserving the biological integrity of the fen (Barry & Schlinger, 1977).

The report found that OHV (in the report referred to as "off-road vehicle") activities affected exposure of fine sand, caused changes in the shallow moisture that lends cohesiveness to dune sand, and changed dune surface roughness that affected wind flow and turbulence. In

[23] March 29 and December 22, 2016 USFWS letters to State Parks describe continuing snowy plover deaths with six documented and reference to other mortalities of snowy plover and least terns since 2001, all representing significant violations of the Federal and State ESA. In letters dated July 3, 2015 and March 3, 2016, CDFW identified seven least tern deaths in 2014 and at a minimum ten least tern mortalities over the preceding 15 years that all represent significant violations of the Federal and State ESA. In 2018 State Parks documented one least tern death and 36 snowy plover deaths, eight crushed and killed by OHVs. In 2019, three least terns and 26 plovers were killed, with several individuals found in tire tracks.

equilibrium: (1) the dune surface is made up of particles too large be entrained by wind. OHVs break this surface crust and smaller particles are entrained by the wind, promoting dune erosion; (2) Moisture is generally found within a foot of the dune surface due to the low thermal conductivity of sand. This moisture has a cohesive effect that reduces sand movement. When churned by OHVs, the sand dries out and becomes subject to being entrained by wind; and, (3) OHVs cause ruts that change surface roughness and induces turbulence in air motion that cause quarrying effects of the wind and increased dune erosion. In addition, OHVs were responsible for the destruction of plants in vegetated dunes, thereby destabilizing the dunes themselves, and causing more rapid dune movement. Rodents, insects, and spiders cannot live in destabilized dunes. This State Park report concluded that for these reasons, OHV activity should not be permitted in The Ten Mile Dunes. State Parks MacKerricher State Park unit (that contains the Ten Mile Dunes) no longer allows such uses.

Several recent studies corroborate the Inglenook Fen report's findings regarding the importance of sand surface stability and the persistence of vegetated dunes. Salt spray, sand, organic and inorganic detritus, seeds of dune plants, and wrack all play a role in stabilizing beach and dune surfaces (Dugan and Hubbard, 2010). The process involves microbes that colonize tidally or via wind-deposited organic debris and secrete sticky polysaccharides that bind sand particles together, yielding heavier sand aggregates that are less subject to entrainment by wind. Over time, these aggregates grow and increase in moisture and nutrient content, girding them further against wind erosion and leading to plant colonization of the beach or dune (Forster and Nicolson, 1981; Forster, 1979). The coastal strand and foredune plant roots and fungal hyphae contribute to sand stabilization both physically and via chemical secretions; plant canopies additionally intercept blowing sand, initiating formation of hummocks and foredunes. All of these processes are interrupted by street legal vehicle and OHV use.

A study comparing macro-invertebrate biodiversity at southern and central California beaches over decades (1970s to 2000s) included two sites (Oceano Dunes near Oso Flaco Lake and Arnold Road in Oxnard) where OHV use had been allowed but was shut down. The researchers documented increases in species richness (recovery) over the study period in these areas (Schooler et al., 2017) suggesting beach infauna are adversely impacted by street legal vehicular and OHV use but recover eventually after riding is eliminated.

A study examining the ecological recovery of disturbed beaches at Oceano Dunes compared wrack-associated invertebrates of reference areas where no street legal vehicles and OHVs are allowed at any time of year and at the snowy plover seasonal exclosure area, where wrack is destroyed during the five months when the area is open to street legal vehicles and OHV riding. The study found that the wrack-associated invertebrate community in impacted areas failed to

recover to levels observed in reference areas after seven months of OHV closure. The researchers suggest that the time required for full recovery of this invertebrate community, which is an extremely important prey source for shorebirds, including snowy plovers and their precocial chicks, likely exceeds two years. They also state that recolonization of important taxa is slow and may be limited by their dispersal abilities, which would then depend on the proximity of available source populations (Dugan et al., 2012). Other research in the San Diego area has examined invertebrate recovery patterns following episodes of beach nourishment and similarly found that these communities had still not fully recovered after 15 months post-disturbance (Wooldridge et al, 2016).

The 300-acre seasonal southern exclosure within the Oceano Dunes State Vehicular Recreational Area does not encompass the entire area that plovers use for foraging, breeding, and nesting (Figure 10). This was shown during the 2020 snowy plover breeding and nesting season when Oceano Dunes was closed to OHV use due to Covid-19 restrictions. Snowy plovers immediately expanded their territories beyond the normal bounds of the exclosure, initiating nest scrapes and sitting on active nests north of the exclosure and just south of Arroyo Grande Creek. Jeff Miller, Senior Conservation Advocate with the Center of Biological Diversity observed 146 adults and 27 chicks outside of any exclosures (between mile post 1 and mile post 6) between May 15 and July 7, 2020, during five separate visits. The maximum number of adults that he observed during any one survey was 48; the maximum number of chicks observed was eight. According to Mr. Miller, the adults were clearly with all of the chicks but he did not observe any actual nests (pers. comm., Jeff Miller, February 11, 2021). If street legal vehicles and OHV use ended, the snowy plovers, as demonstrated during the 2020 breeding season, would expand their foraging, breeding and nesting territories.

Invasive Species

Non-native invasive species pose one of the greatest threats to the biodiversity of Oceano Dunes and the broader Guadalupe-Nipomo Dunes Complex. Invasive plants are formally inventoried and assessed by the California Invasive Plant Council (Cal-IPC).[24] At Oceano Dunes, European beach grass (Cal-IPC: High), perennial veldt grass (Cal-IPC: High), highway iceplant (Cal-IPC: High), sea fig (Cal-IPC: Moderate), and saltcedar (*Tamarisk ramosissima* – Cal-IPC: High) are particularly problematic, currently overtaking and threatening hundreds of acres of native dune habitat. Two of the most detrimental are European beach grass and veldt grass.

[24] Plant species ranked by Cal-IPC as High have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure, and their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most species ranked as High are widely distributed ecologically. Species ranked as Moderate have substantial and apparent but less severe ecological impacts than those ranked High, their establishment is generally dependent upon ecological disturbance, and their ecological distribution may range from limited to widespread. Further detail is available at https://www.cal-ipc.org/plants/inventory/.

European beach grass has colonized much of the central foredunes in the northern area of Oceano Dunes, choking out and replacing natives to form dense monotypic stands, and inhibiting dune migration. Beach grass responds to burial by extending its shoots rapidly, trapping sand, and causing foredunes to grow abnormally tall and steep, which consequently, starves back dune areas of mobilized sand.

For example, at the Tomales Dunes in northern California, sand accretion due to beach grass has resulted in a foredune that is tens of feet high while converting the back dunes to a deflation plain for lack of sand. Wave action in areas with dense European beach grass can result in rapid scarping and erosion of a dune face that would otherwise be gradual and function to dissipate wave energy; thus, infestations of European beach grass can compromise coastal resiliency in multiple ways. Threatening from the more inland side of the dune complex, perennial veldt grass infestations are concentrated in back dunes areas where it forms "bunch grass" monocultures replacing the silver-dune lupine-mock heather dune scrub community and displaces many associated animals.

Native and non-native animals are also a problem in the Guadalupe-Nipomo Dunes Complex. Growing populations of feral pigs tear up native habitat and pose a threat to nesting shorebirds. Bullfrogs threaten California red-legged frog populations by way of both predation and competition for limited resources (LCSLOC, 2018).

Beach Grooming

Beach grooming is a practice that often has adverse environmental impacts. State Parks actively grooms park beaches during the day using a tractor-towed sand cleaning device to collect nails, broken glass, and other debris from open sand areas that may pose a hazard to visitors or wildlife (CDPR, 2020). Grooming also indiscriminately removes ecologically important beach wrack. State Parks' Public Works Plan does not detail the frequency of grooming but does state that "mechanical trash removal may be implemented year-round." According to State Parks, the grooming is focused on a 200 to 300-foot-wide band that totals approximately 140 acres above the mean high tide line extending some five miles along the shoreline from West Grand Avenue to mile post 6 (to the northern boundary of the southern exclosure). State Park indicates that it avoids grooming established protected areas (e.g., fenced and vegetated areas) and areas within 500 feet of any known snowy plover or least tern nesting areas.

The band where grooming occurs includes upper beach, wrack, and coastal strand habitat where snowy plovers and least terns typically roost and snowy plovers forage. The macro-invertebrates that rely on wrack for food and shelter are a primary food source for snowy plovers and are eliminated when wrack is removed by grooming. The entire area south of Arroyo Grande Creek where grooming occurs (roughly three miles of shoreline) is identified by

the USFWS as snowy plover critical habitat (Figure 9). Studies comparing a large number of groomed and ungroomed central and southern California beaches have documented high invertebrate macro-faunal abundance and significantly greater species diversity on ungroomed beaches than on groomed beaches. For example, an average of 21 species of macro-invertebrates were found on ungroomed beaches with high wrack abundance, with a high of 37 species, while only four species on average were observed on beaches that had been groomed and were devoid of wrack (Schooler et al., 2019; Dugan et al. 2003, Dugan et al. 2000).

Climate Change

Climate change is a threat to ecosystems around the world including Oceano Dunes. Situated between the sea and inland areas, coastal dunes provide valuable natural infrastructure to safeguard against sea level rise and erosion (Dugan and Hubbard, 2016; Alpert, 2016; Defeo et al., 2009). Dunes act as topographic barriers to flooding and provide space for inland migration of habitats. Degradation of coastal dunes that accelerates their erosion and compromises their topography renders them less effective in these roles. As a result of climate change, in addition to sea level rise, California is expected to experience increased precipitation fluctuations characterized by intensified droughts and wetter winters, increased land and sea temperatures, ocean acidification, and intensified storm patterns, each of which will have deleterious effects on the dune habitats and species (Morim et al., 2019; Meyers et al. 2019; He et al., 2018; Pierce et al., 2018; Camus et al., 2017; Erikson et al. 2015). Sea level rise itself will encroach on the most shoreward habitats, including those used for nesting by snowy plovers and least terns

Climate change not only imposes stress on physical habitats, it also places additional physiological stress on plants and animals. For example, during the predicted longer and more intense periods of drought, plants may experience slowed growth and attenuated reproductive capacity, and seed banks may go dormant and fail to express. Wetland and groundwater-dependent ecosystems may contract or vanish in the absence of a regularly replenished water table. Warmer, acidifying, and nutrient-depleted marine systems may result in reduced biological productivity, which in turn, results in stress among higher trophic levels, such as shorebird species relying on marine food sources.

Oceano Dunes is both vulnerable to the impacts of climate change and necessary for fostering ecological resilience to climate change. Although climate effects cannot be directly controlled or readily mitigated, alleviation of other stressors imposed on the ecosystem will improve its ability to respond and continue supporting the vegetation communities, plant and animal species, and processes occurring here into the future.

Other

While agriculture is an important use protected under the Coastal Act and the LCPs, it can also result in significant habitat impacts, and agricultural activities are another serious threat to the

biodiversity and health of the dune complex here. Thousands of acres of former dune habitat have been converted to agricultural fields and agricultural fields border miles of the landward edge of the dune complex. The primary threats from agricultural activities include impaired water quality from run-off that contains pesticides and fertilizer and over-pumping of groundwater aquifers to the detriment of the dune swale, creeks, lagoons, ponds, and lakes in the dune complex.

Additional threats across the Guadalupe-Nipomo Dunes Complex include ongoing development pressure, noise which is known to affect the presence and reproduction of birds and marine mammals, artificial lighting from night driving and camping, and trash in open containers and camp sites that attracts avian and mammalian predators that prey on snowy plovers (LCSLOC, 2018).

Environmentally Sensitive Habitat (ESHA) Protection Policies

Oceano Dunes is under the planning and permitting jurisdiction of several agencies. The Coastal Act, administered by the Coastal Commission, is the standard of review for the Commission's retained jurisdiction that includes all areas below the mean high tide line, which is comprised of the wet sand beaches, as well as former tidelands and public trust lands at the Arroyo Grande Creek mouth and Meadow Creek lagoon complex. All other areas of Oceano Dunes are regulated under local coastal programs. The City of Grover Beach Commission certified LCP regulates the beach and dune areas beginning at the West Grand Avenue entrance in the north to the City limit roughly a half-mile south and about halfway between the West Grand and Pier Avenue entrances. The San Luis Obispo County Commission certified LCP regulates all areas south of the Grover Beach City limits, including the Pier Avenue entrance, the OHV riding area, the La Grande and Phillips 66 properties, and the Oso Flaco Lake day-use area in the south.

Coastal Act Section 30107.5 defines environmentally sensitive habitat, or ESHA, as:

> *"Any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments. (emphasis added)"*

The San Luis Obispo County LCP similarly defines ESHA as follows (Implementation Plan Section 23.11.030):

> *"A type of Sensitive Resource Area where plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an*

ecosystem and which could be easily disturbed or degraded by human activities and development. They include wetlands, coastal streams and riparian vegetation, terrestrial and marine habitats…"

As does the City of Grover Beach LCP (Implementation Plan Section 9.10.030):

"Any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments."

The definitions invoke a three-part test (1a, 1b, and 2):

1a. Is the habitat rare or does the habitat support rare plants or animals?

The Commission has historically made rarity determinations for habitats and species by utilizing the expert biological guidance from the state and federal resource agencies (CDFW, USFWS) as well as from other expert groups (e.g., CNPS). Habitats and species that are rare include:

- Global or State 1, 2, or 3 ranked habitats (natural communities) or species[25]
- Federal (ESA) or State (CESA) endangered or threatened species
- California Native Plant Society (CNPS) 1B and 2B ranked plants[26]
- California Species of Special Concern and Fully Protected Species
- Candidate endangered or threatened species

1b. Is the habitat, or the plant or animal species in the habitat, especially valuable because of their "special nature" or because they play an "especially valuable" role in a habitat or ecosystem?

A special determination may be made based on an area constituting "especially valuable habitat" when it is of a special nature such as providing a pristine example of a habitat type or representing an unusual species assemblage or ecotone. A special determination may also be made based on an area's special role in the ecosystem (e.g., supporting important ecological linkages, representing the edges of species' ranges that harbor genetic diversity, or tree groves supporting nesting raptors or monarch butterfly colonies).

[25] http://www.natureserve.org/conservation-tools/conservation-status-assessment

[26] https://www.cnps.org/rare-plants/cnps-rare-plant-ranks

2. *Lastly, is the habitat, or the rare plant or animal species in the habitat, easily disturbed or degraded?*

   Once an area has been determined to support habitat or species that are rare or especially valuable, those resources are considered in terms of their sensitivity to disturbance and degradation from human activities and developments. Habitat fragmentation is an example of how human activity can degrade natural resources, as is removal of major vegetation, grading, alteration of landforms, noise, artificial, and invasive, non-native species.

The San Luis Obispo County LCP builds on the Coastal Act ESHA definition by categorically identifying certain habitat types considered ESHA as including "wetlands, coastal streams and riparian vegetation, terrestrial and marine habitats", with dunes listed as a specific type of terrestrial ESHA. Further, the South County Area Plan, a component of the LCP's Land Use Plan, maps all of Oceano Dunes beaches and dunes south of Arroyo Grande Creek (with the exception of the agricultural fields at Oso Flaco Lake) as "Coastal Zone-Environmentally Sensitive Habitats, Terrestrial Habitat" (see the South County Area Plan's Coastal Planning Area Combining Designation Map).

Once a habitat is designated ESHA, Coastal Act Section 30240 applies. It states:

> *"(a) Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on those resources shall be allowed within those areas.*
>
> *(b) Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade those areas, and shall be compatible with the continuance of those habitat and recreation areas."*

Section 30240(a)[27] only allows resource dependent uses to occur within ESHA (such as habitat restoration, nature study and scientific education and research, and low-impact public access and recreation such as hiking trails and primitive and interpretive camping) and requires those resource dependent uses to protect against any significant disruption of ESHA habitat values. In

[27] And corresponding policies in the two LCPs. San Luis Obispo County LCP LUP Coastal Plan Environmentally Sensitive Habitats Policy 1 states: *Land Uses Within or Adjacent to Environmentally Sensitive Habitats. New development within or adjacent to locations of environmentally sensitive habitats (within 100 feet unless sites further removed would significantly disrupt the habitat) shall not significantly disrupt the resource. Within an existing resource, only those uses dependent on such resources shall be allowed within the area.*
And Grover Beach LUP Policy 2.1.5.B.5 states: *Policy: Environmentally sensitive habitat areas (ESHA) shall be protected against any significant disruption of habitat values, and only uses dependent on those resources shall be allowed within those areas.*

addition, 30240(b) requires that areas adjacent to ESHA be protected from development and activities that would significantly degrade the ESHA and that would not be compatible with its continuance. This is typically provided by buffers of a necessary size to ensure no adverse impacts to the ESHA.

The Commission routinely protects marine resources including beaches, rocky intertidal areas, and kelp forests under sections 30230 and section 30231 of the Coastal Act and not under the Coastal Act's ESHA provisions. However, some counties and cities have identified specific sections of beach or offshore areas as ESHA in their LCPs for their historic value, biodiversity, or consistent use as bird or mammal rookeries.

In this case, the Commission certified San Luis Obispo County LCP identifies the stretch of beach from Arroyo Grande Creek to the southern border of Oceano Dunes as ESHA because of its importance as foraging and nesting habitat for Western snowy plover, its status as designated and mapped snowy plover critical habitat under the Federal Endangered Species Act (ESA) (USFWS, 2012), and its unbroken connection to miles of dune habitat. Oso Flaco Lake is also identified as ESHA due to the abundance of listed bird species that visit it annually and because it is designated critical habitat under the Federal ESA for tidewater goby (USFWS, 2013).

ESHA Determination

In a 2019 memorandum, Commission Senior Ecologist Dr. Laurie Koteen determined that the Oceano Dunes State Vehicular Recreation Area rises to the level of ESHA (Koteen, 2019)[28]. That determination noted that the Coastal Commission had certified LCPs that identify the area as ESHA, and that the Commission itself had found the area to be ESHA through multiple reviews and actions, including actions related to CDP 4-82-300 and its reviews over the years, as well as CDPs related to State Parks dust control efforts. Further, as indicated above, the San Luis Obispo County LCP explicitly maps and identifies almost the entire Oceano Dunes as ESHA (Figure 14). The only areas not explicitly mapped and identified as ESHA in the County LCP are the sandy beach areas (that are not dune) at Pismo State Beach north of Arroyo Grande Creek to the City of Grover Beach city limits, and the two active agricultural areas in the Oso Flaco Lake area. Similarly, the only areas that do not constitute ESHA under the City of Grover Beach LCP (the northern reach of Oceano Dunes) are the sandy beach areas (that are not dune) at Pismo State Beach between the City limit line and West Grand Avenue.

The information presented here corroborates the findings by Dr. Koteen and the LCPs that, with limited exceptions, the Oceano Dunes component of the Guadalupe-Nipomo Dunes Complex

[28] In 2019 the Commission interpreted the Oceano Dunes State Vehicular Recreation Area to include the portion of Pismo State Beach south of Arroyo Grande Creek.

meets the definition of an Environmentally Sensitive Habitat Area under the California Coastal Act (Figure 15).

The area determined to be ESHA at Oceano Dunes meets all three requirements to be found ESHA. First, it is teeming with rare vegetation communities, rare plants, and rare animals as detailed above (Figures 16 and 17). Second, Oceano Dunes supports habitat that is especially valuable because of its special nature or special role in the ecosystem. Some examples include:

1) Arroyo Grande Creek and Lagoon provide an essential connection between the watershed and the sea, particularly for anadromous species that rely on natural lagoon formation during sensitive life history phases.

2) Oso Flaco Lake area supports hundreds of species of resident and migratory birds, is an important stop-over for birds migrating along the Pacific Flyway, has a rare self-sustaining population of federally listed tidewater goby, and the highly endemic federally listed La Graciosa thistle and the last known extant population of marsh sandwort are found here.

3) Big and Little Coreopsis Hills, which support the northern-most population of the rare giant coreopsis scrub community, representing a gene pool significant to the species' persistence under changing climate conditions.

4) The entirety of Oceano Dunes consists of an ecosystem rich in unique vegetation communities, wetlands, and plants and animals unencumbered by physical barriers with the inherent capacity to adapt to climate change.

Last, the Oceano Dunes ecosystem is easily disturbed by human activities and development. Examples include the hundreds of acres lost to urban development and agriculture, the hundreds of acres of eroded landforms and loss of native dune vegetation resulting from street legal vehicular and OHV use, and the beach macro-invertebrate abundance and diversity significantly reduced as a result of street legal vehicular OHV impacts.

Oceano Dunes clearly rises to the level of ESHA. In fact, the ecological significance of Oceano Dunes and the over-all Guadalupe-Nipomo Dunes Complex has been broadly acknowledged and can hardly be over-estimated.[29]

[29] The US Department of the Interior named the Guadalupe-Nipomo Dunes Complex a National Natural Landmark in 1974 for being the largest, relatively undisturbed coastal dune ecosystem in California and for having one of the highest rates of endemism of any dunes in North America. In 1980 the US Fish and Wildlife Service conducted a sensitive species inventory of the Guadalupe-Nipomo Dunes Complex and described it as "the most unique and fragile ecosystem in the state…" and ranked it first on a list of 49 habitat areas in need of protection statewide. Conservation International has named the California Floristic Province, that includes the Guadalupe-Nipomo Dunes Complex, as one of the world's 36 biodiversity hotspots.

Conclusion

Intact coastal dune ecosystems are extremely rare. Oceano Dunes is a component of one of the largest intact coastal dune ecosystems in the world and contains many rare habitats that support a great diversity of plants and animals, many of which are also rare. That is why Oceano Dunes is so unique and special, and a fundamental reason explaining why it is protected under the Coastal Act and the LCPs as ESHA. Experience tells us that maintaining, through conservation, intact natural processes and unfragmented ecosystems is orders of magnitude easier than restoring such ecosystems. At Oceano Dunes there is the opportunity to maintain, restore, and conserve this ecologically sensitive and biodiverse place now. If disruptive activities cease, this ecosystem will require only modest remediation and management. Ocean Dunes is a significant ESHA on the California coast that warrants the protection afforded to it under the Coastal Act and the LCPs.

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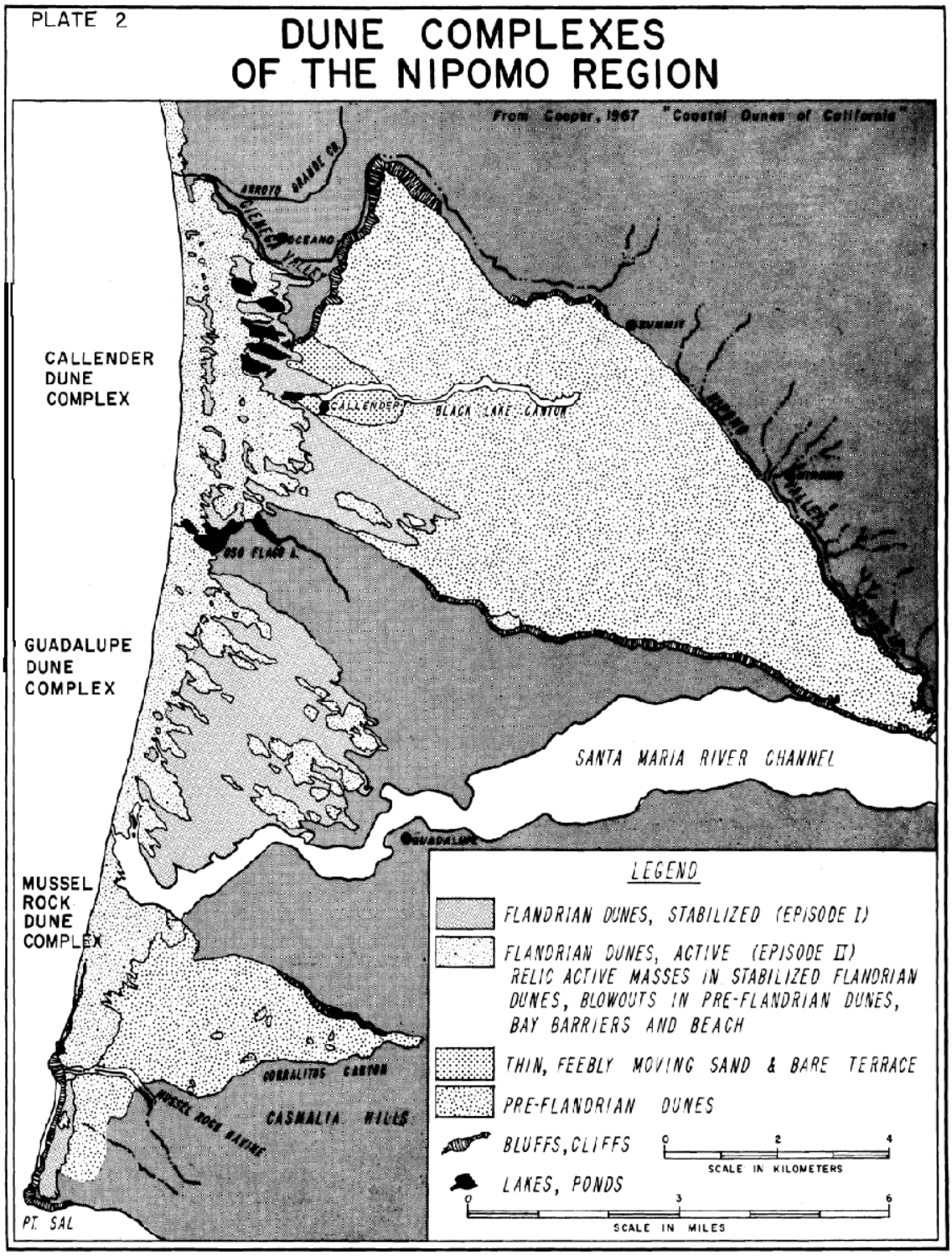

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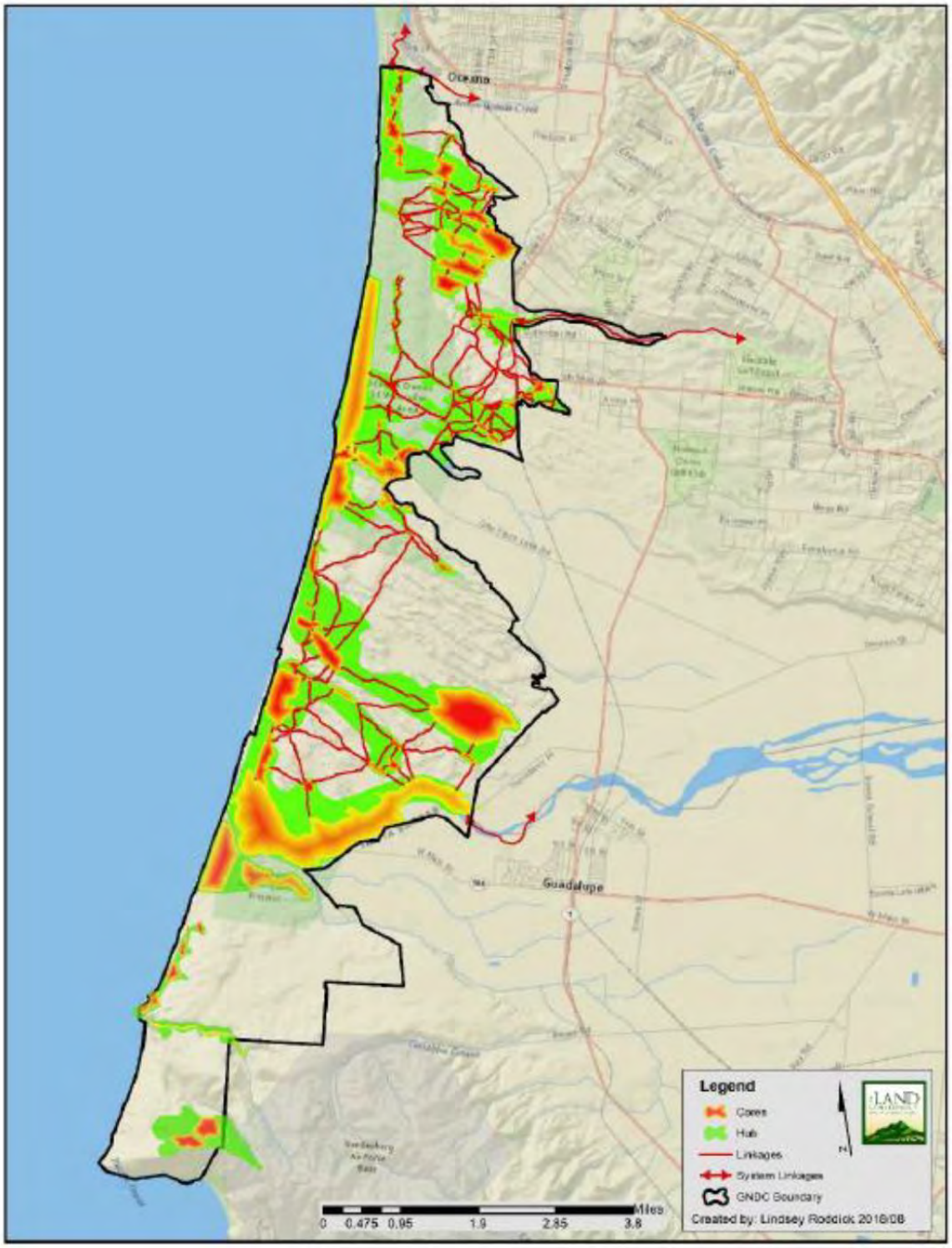

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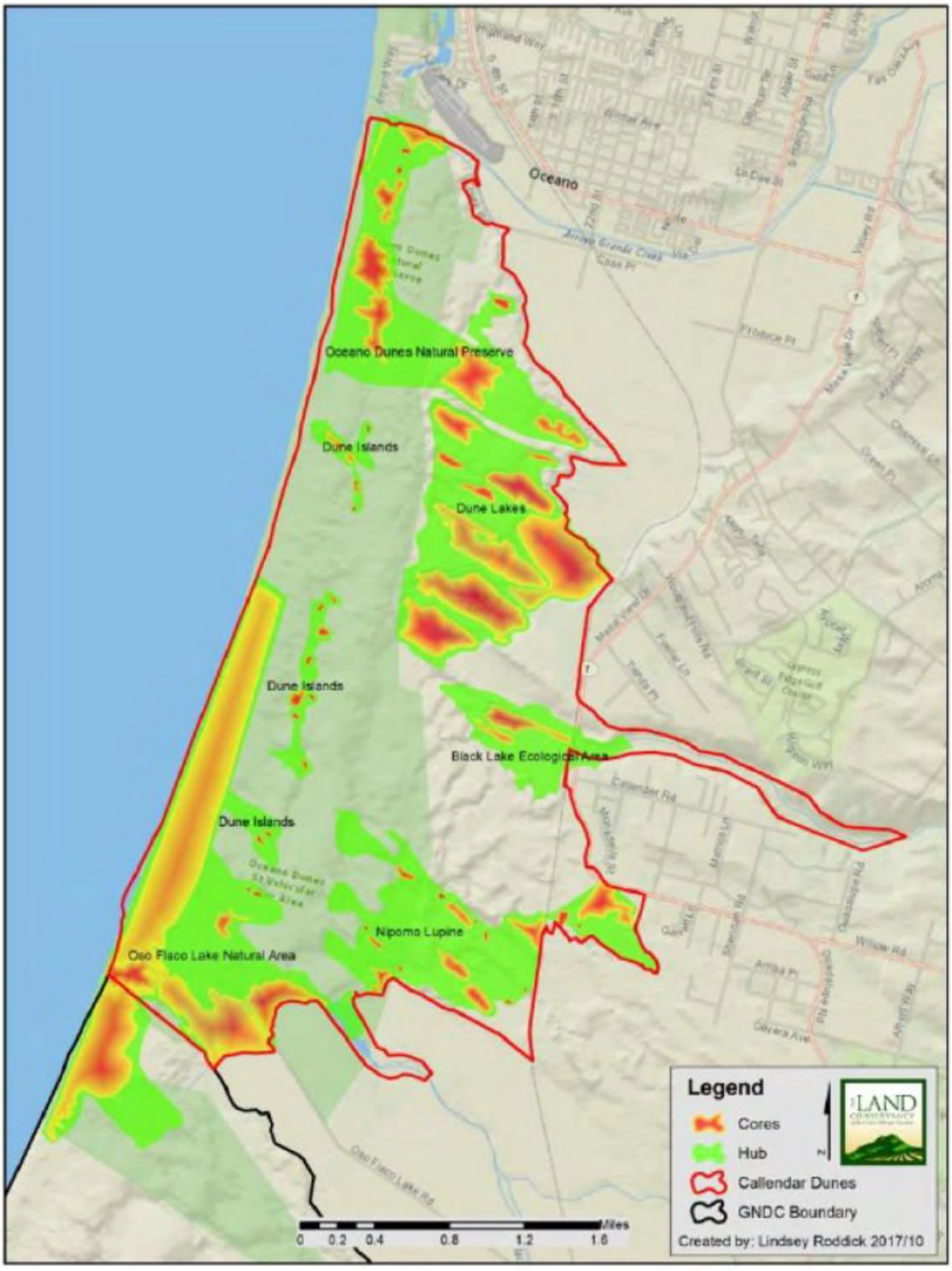

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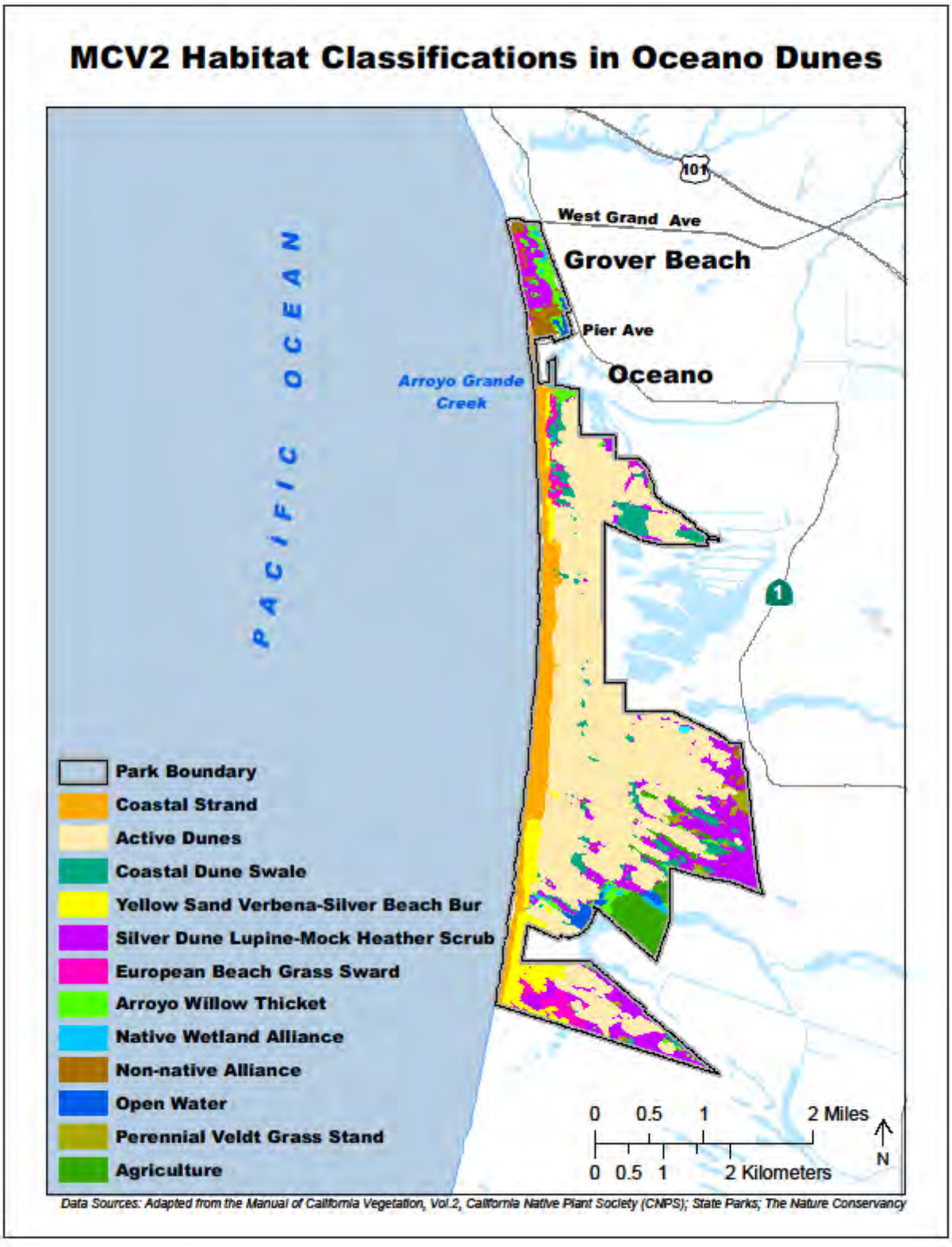

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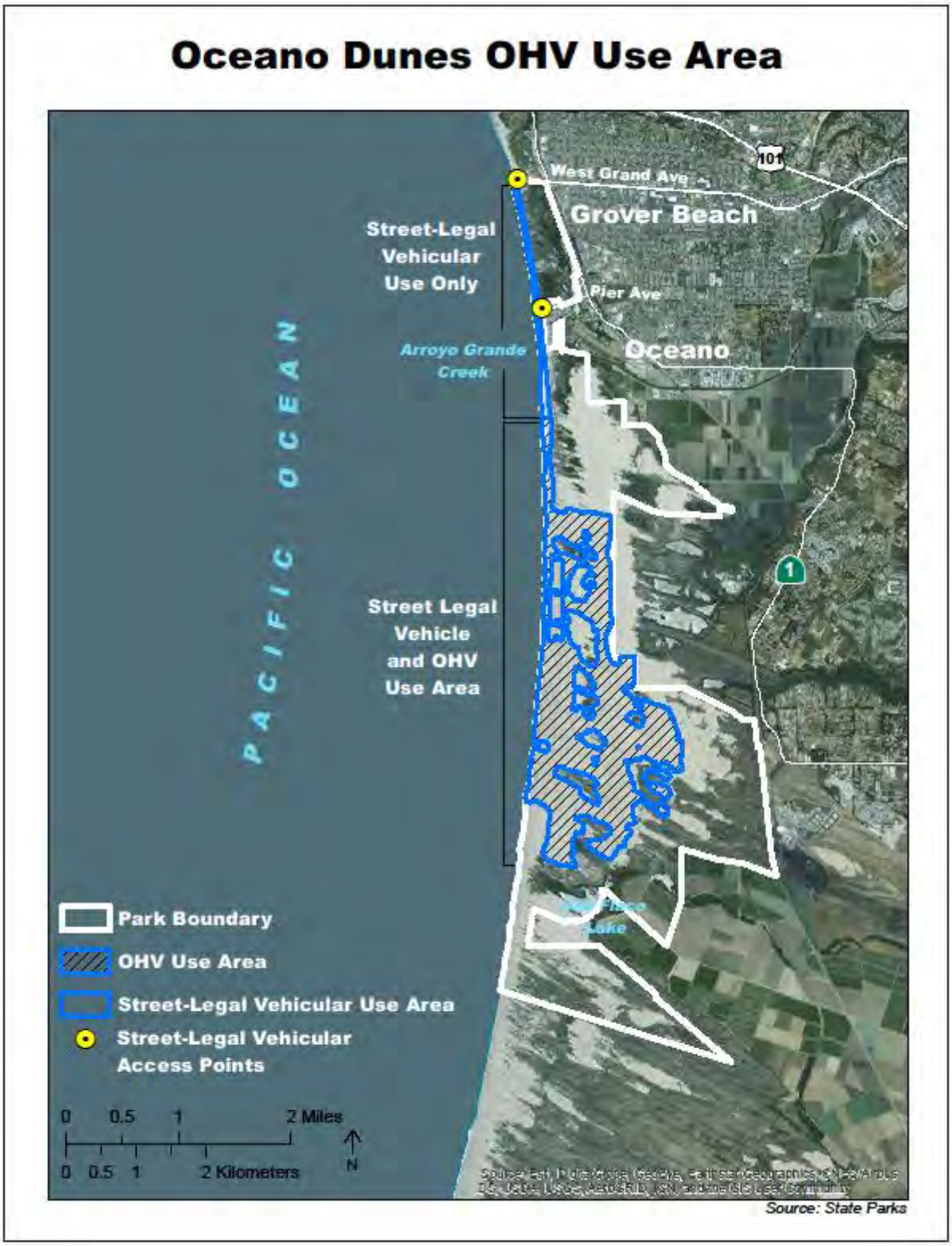

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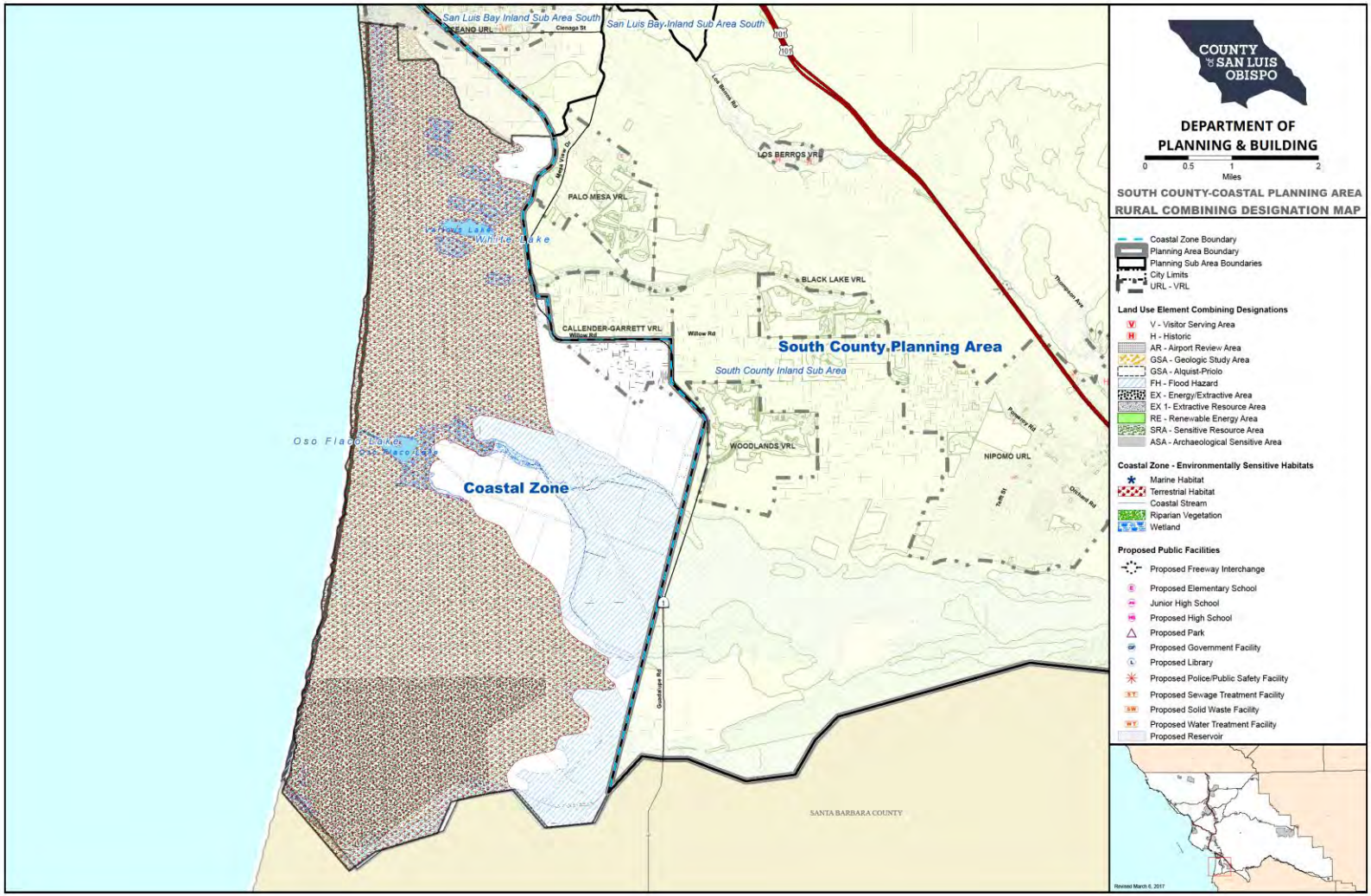

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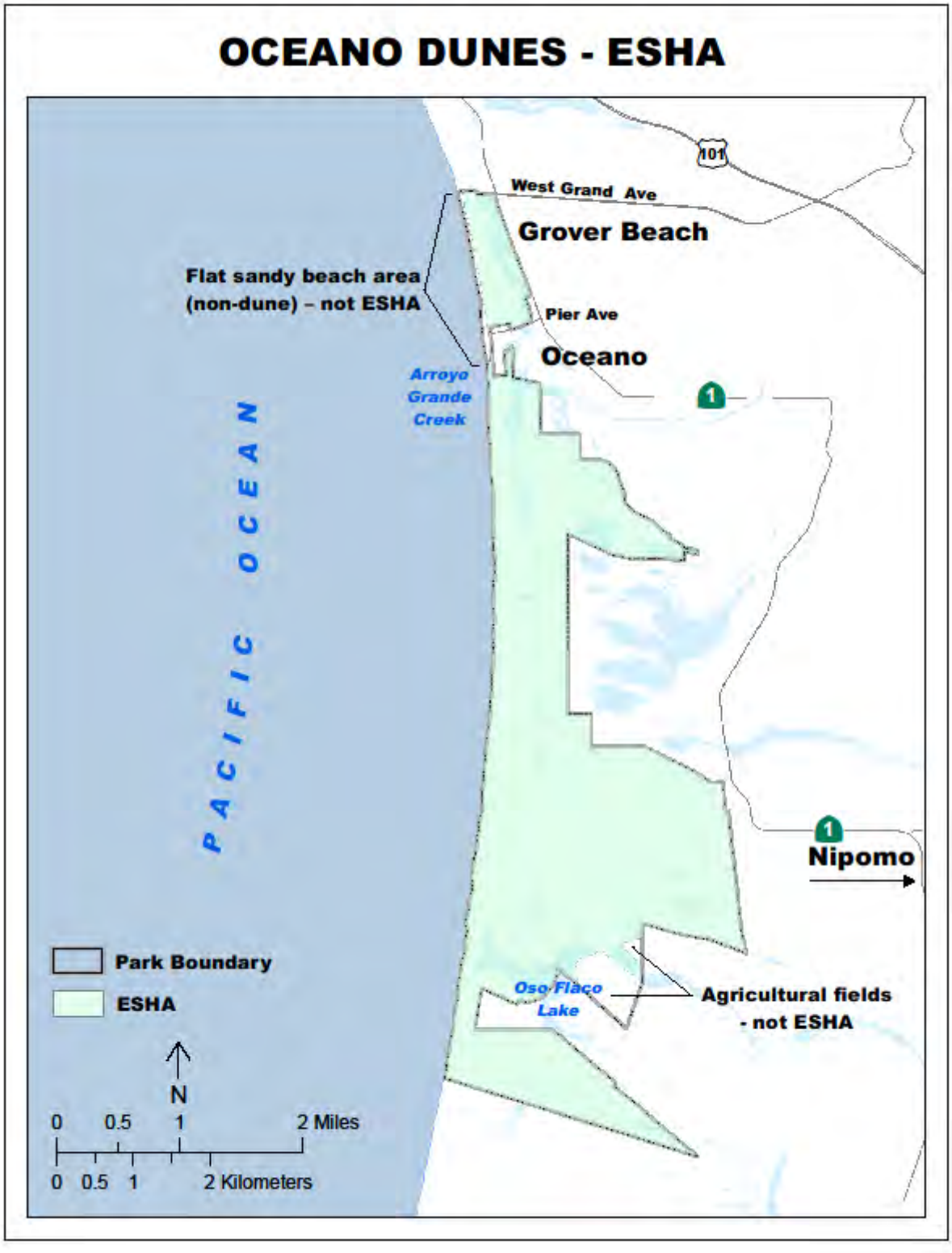

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