

Chapter 3. Affected Environment

Introduction

This chapter provides an understanding of both the general environmental setting of the project area and a focused description of those resources that could be affected by the implementation of the FEIS alternatives. The Affected Environment is required (by the Council on Environmental Quality NEPA regulations, sec. 1502.15) to succinctly describe the environment of the areas likely to be affected by the alternatives under consideration, and focus efforts and attention on important issues.

The project area encompasses all of Point Reyes National Seashore (PRNS) and the northern lands of Golden Gate National Recreational Area (GGNRA) administered by PRNS.

Project Site Description

The project area is located in central California, in western Marin County, approximately 40 miles northwest of the City of San Francisco (see Figure 2). It is comprised of federal lands managed by the Point Reyes National Seashore, a unit of the National Park System, and is within 50 miles of the nine-county San Francisco Bay Area, the 5th largest metropolitan area in the United States.

Generally, the more developed regions of the bay area surround the bay itself, with smaller cities, towns, open space, and agricultural areas in an outer ring around the urban core. Forty-eight percent (159,044 acres) of the 332,800 acres in Marin County is held as parks, open space, and watershed (Marin County 2002). Thirty-six percent (119,808 acres) is in agricultural use. Developed lands constitute only 11% of the county while 5% of the county has future development potential.

While eastern Marin is heavily developed along the Highway 101 corridor, western Marin is primarily rural with scattered small, unincorporated towns that serve agriculture, local residents, and tourism. Roughly 90% of the quarter of a million residents of Marin County live in the eastern half of the County along the major transportation corridor, State Highway 101.

Regional Context and Surrounding Communities

The project area consists of 71,000 acres of the Point Reyes National Seashore and 19,265 acres of Golden Gate National Recreation Area, as well as 86 miles of shoreline on both the Pacific Ocean and Tomales Bay (see Figure 2). The Seashore includes beaches, coastal cliffs and headlands, marine terraces, coastal uplands, woodlands, and forests on the Point Reyes Peninsula.

PRNS is bounded to the north, west, and southwest by the Pacific Ocean and to the east by the residential communities of Inverness, Inverness Park, Point Reyes Station, Olema, and Dogtown (see Figure 2). The town of Bolinas is south of PRNS at the southern tip of the Peninsula. An estimated 3,800 permanent residents live in the towns and communities close to the project area from the tip of Tomales Bay in the north to Stinson Beach in the south (U.S. Census Bureau 2000). The census population figure does not count the many part-time residents of western Marin who maintain second homes in the project area.

Through a memorandum of agreement between the two national parks, PRNS manages the 19,265 acres of Bolinas Ridge for GGNRA (NPS 1988b). Bolinas Ridge is a northwest/southeast trending ridge paralleling the Olema Creek valley and the San Andreas Fault zone. The northwest-facing slope of the

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Ridge is primarily grassland and shrub with east facing slopes forested with Douglas fir and coast redwood.

A number of private inholdings exist within the Seashore, including 2,143 acres in Olema Valley, owned and managed by the Vedanta Society. East of the project area, land use is a mix of private residential and agricultural lands, publicly held watershed, and parks and open space. Adjacent to the park are areas managed by Audubon Canyon Ranch, Marin Municipal Water District, Tomales Bay and Samuel P. Taylor State Parks, and Marin County open space lands. Marine boundaries are shared with the Gulf of the Farallones and the Cordell Bank National Marine Sanctuaries, and Tomales Bay State Park. Some agricultural parcels are part of the Marin Agricultural Land Trust to which the owners have deeded development rights to protect rural agriculture from development pressures.

FIGURE 2: MAP OF THE PROJECT AREA



Park Management Zoning

PRNS and GGNRA share a general management plan (NPS 1980), which uses the following zoning designations to guide park management.

Project area lands fall under one of two management zones: Natural Resource Zones or Historic Resource Zones. The Natural Resource Zone covers pastoral lands, natural landscape areas, sensitive resources, designated wilderness, and marine reserves. Historic ranches, the Point Reyes lighthouse, and the lifesaving station are included in the Historic Resource Zone.

Natural Resource Zones

Pastoral Lands (northern Olema Valley and northern Point Reyes peninsula). Approximately 17,000 acres of PRNS have been retained in agricultural production supporting beef and dairy production. The Northern District of GGNRA contains an additional 10,500 acres leased for cattle grazing. Pastoral operations presently include seven dairy and ten beef cattle ranches. The general management plan (GMP) for the Seashore indicates that at a minimum, agricultural buildings and open grasslands would be retained in these areas, and where feasible, livestock grazing would continue within the limits of carefully monitored range capacities (NPS 1980, p. 18). The GMP also indicates that future resource management studies could substantially alter the configuration of this zone.

Natural Landscape Areas (southern Olema Valley and Bolinas Ridge, Limantour Road corridor and Limantour Beach, Tomales Bay shoreline north of the State Park, Bear Valley, recreational beaches, road corridors, and select trail corridors). Natural Landscape Areas contain important natural resources that are not within the designated wilderness of PRNS. The largest track is the southern half of the Bolinas Ridge, lands buffering Limantour Road and Limantour Beach, and the Marshall Beach area north of Tomales Bay State Park. GMP direction for these areas is that natural resources and processes remain as undisturbed as possible given a relatively high level of park use (NPS 1980, p. 18). The Olema Valley is managed to maintain the visual contrast between woodland and open grassland (NPS 1980, p. 96).

Special Protection Areas (Philip Burton Wilderness Area, Gulf of the Farallones National Marine Sanctuary, State of California Marine Reserves, shorelines, and riparian corridors). Special Protection Areas includes lands that have received legislative or special administrative recognition of exceptional natural qualities requiring strict protection measures. They include wilderness and areas of particularly sensitive natural resources.

Wilderness

The purpose of wilderness in the national parks includes the preservation of wilderness character and wilderness resources in an unimpaired condition, as well as for the purposes of recreational, scenic, scientific, educational, conservation, and historical use. Management includes the protection of the areas, the preservation of the wilderness character, and the gathering and dissemination of information regarding their use and enjoyment as wilderness.

The Wilderness Act requires that, except as necessary to meet the minimum requirements for the administration of a wilderness area, “there shall be no temporary roads, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, or no other form of mechanical transport, and no structure or installation” within the wilderness (16 U.S.C. 1131). As required by the Wilderness Act, actions necessary to prepare and execute resource enhancement projects must be examined to assure that they are necessary. If the park deems a project necessary, it is required to use the least intrusive methods

possible to carry out the needed actions. This “minimum requirement” process is designed to ensure the least disturbance and disruption of wilderness values and maximum protection of natural and cultural resources. At PRNS, the examination of minimum requirements is undertaken and documented by the interdisciplinary team reviewing projects for compliance to the National Environmental Policy Act. The procedure for determining the minimum requirement for each alternative is described in Appendix A (Wilderness Minimum Requirement Guide) and in the section Actions Common to All Alternatives.

The laws that established the Point Reyes Wilderness Area (90 Stat. 2515 and 90 Stat. 2692; 16 U.S.C.) mandated that it be managed “...without impairment of its natural values, in a manner which provides for such recreational, educational, historic preservation, interpretation, and scientific research opportunities as are consistent with, based upon, and supportive of the maximum protection, restoration, and preservation of the natural environment within the area.”

The majority of the Wilderness is in the southern half of PRNS, from Mount Vision south to Palomarin, including Inverness Ridge. The wilderness supports primarily Douglas fir and mixed hardwood forests, riparian areas, coastal bluffs, and beaches. Elevations range from sea level to 1,407 at Mt. Wittenberg. While axis deer are currently not believed to inhabit wilderness areas in the study area, about one-third of the known fallow deer range (or about 8,000 acres) is inside wilderness boundaries.

More than half of PRNS is designated or proposed wilderness, and must be managed in conformance with the 1964 Wilderness Act, NPS *Management Policies* 2001 (Chapter 6), the Director’s Order, and Reference Manual 41 for Wilderness Preservation and Management. As directed in NPS *Management Policies* 2001 (Section 6.3), natural resources management activities in wilderness areas:

- must conform to the basic purposes of wilderness,
- must apply the principle of non-degradation; each wilderness area’s condition would be measured and assessed against its own unimpaired standard, and
- should seek to sustain the natural distribution, numbers, population composition, and interaction of indigenous species.

The NPS *Management Policies* 2001 also confirm that scientific activities in wilderness areas must use the “minimum requirement” concept, a process of identifying the least damaging tools or activities, to protect natural and cultural resources, and minimize any lasting impacts. Analysis of transitory effects upon wilderness values are focused on determining whether they are outweighed by the benefits to be derived for the long-term preservation of wilderness character.

Some lands at PRNS are particularly sensitive to human use or are especially valuable from an ecological or scientific point of view. Most of the areas are watercourses or bodies of water recognized for their importance in sustaining wildlife and vegetation. The GMP states that use and development in these areas would be either discouraged or mitigated sufficiently to avoid major levels of deterioration.

Other Significant Area Designations

Due to the interface of the Seashore with the Pacific Ocean and its importance to wildlife, the Seashore coordinates and cooperates with an increasing number of agencies and organizations including the National Marine Fisheries Service (NMFS), U.S. Geological Survey (USGS), Gulf of the Farallones National Marine Sanctuary, Golden Gate Biosphere Reserve members, U.S. Fish and Wildlife Service (USFWS), the Audubon Society, California Department of Parks and Recreation, Point Reyes Bird Observatory, Marine Mammal Center, and CDFG.

In 1988, UNESCO Man in the Biosphere program designated the Central California Coast Biosphere Reserve under the International Biosphere Program. The Central California Coast Biosphere Reserve includes the entire Seashore, the Golden Gate National Recreation Area, and other public lands in the region. In addition, the State of California designated three “Areas of Special Biological Significance” within the Seashore: Tomales Point, Point Reyes Headlands, and Double Point. These designations add to the need to maintain or return the Seashore to as natural state as possible.

Climate

Cool wet winters and warm dry summers, influenced by low-lying fog and strong sea breezes, characterize the coastal Mediterranean climate of the study area. The climate is unusual in that temperatures remain fairly consistent throughout the year. Temperatures rarely exceed 90° or drop below 40° F. Thick, rapidly moving fogbanks shift from offshore to on shore in a predictable pattern throughout the summer. The approach of the fogbank can cause temperatures to change rapidly dependent on proximity to the ocean and elevation. The ocean temperature averages 55° year-round. The cold ocean waters and low fog mitigate the summer heat common in eastern Marin County where temperatures are often in the 90s. Typically, as one moves away from the coast the climate usually becomes warmer and drier, especially in the summer.

On average, ninety-one percent of the annual precipitation falls between October and March. Precipitation at the Lighthouse or near the Pacific shore may be less than half of that recorded on Inverness Ridge, Olema, or in Inverness. The 1,000 to 1,500-foot Inverness Ridge provides an orographic effect – wringing the clouds of their moisture. Annual rainfall averages range from 18 inches at the Point Reyes Lighthouse to 40 inches at Inverness Ridge and Bear Valley (Evens 1993)

The summer months are prone to fog as the vacuum created by warming air and low pressure in the Central Valley draws the moist marine air inland. Fog drip is most prevalent at the higher elevations where wind blows the saturated air over the ridgeline and into the Olema Valley. The needles of Douglas fir and Bishop pine trees capture moisture, which accumulates and drops to the soil below. Research shows that fog drip is proportional to the surface area of the individual trees. In some areas of PRNS as much as 20 inches of precipitation can be extracted annually from the fog by individual trees, with that water supporting the lush understory and growth of the woody vegetation. Fog drip augments the groundwater supply, reducing stress on the aquifers, and possibly increasing the baseflow of the streams. Summer winds are usually from the northwest and often are strong and steady at 10 to 20 knots (12–23 miles per hours).

Fall weather patterns are typically dryer, with onshore high pressure resulting in an offshore, reverse flow. Winds blowing from the hot desert interior of the west and south, similar to the infamous Mono and Santa Ana winds, bring hot, dry conditions and high fire hazard.

Air Resources

By virtue of the presence of the Phillip Burton wilderness, PRNS is a Class 1 Air Quality Area and is to be managed to protect and preserve clean air values. The Clean Air Act (42 U.S.C. 7401-7671q) provides a legal framework for the NPS to preserve and protect parks’ air quality related values from pollution sources emanating from within and outside park boundaries. Class I park areas, those containing legislated wilderness, are to be provided the highest level of protection to prevent significant deterioration of air quality related values.

Air quality at PRNS is generally excellent throughout much of the year due to a stationary marine high-pressure system. During fall, as high pressure systems move off the coast, stagnant polluted air from the metropolitan San Francisco Bay Area can affect the Point Reyes area for a number of weeks. The NPS began air quality monitoring for criteria (O₃) gasses, particulate matter, and visibility in 1987. Criteria monitoring was discontinued in 1992 due to lack of funding. An IMPROVE sampler and visibility camera remain in operation. Long-term vista monitoring is accomplished every five years.

Geology and Topography

The character of the Point Reyes Peninsula has been shaped and defined by its association with the San Andreas Fault. The Peninsula, lying west of the fault, is a fragment of the Pacific Plate that is shifting northwest in relation to the continental North American plate. It is now widely accepted that the total slip on the San Andreas and its main branches in Southern California is about 205 miles. The Salinian granite bedrock of the Peninsula is most closely related to that observed at Montara Mountain in San Mateo County. Bolinas Ridge and lands east of the fault are underlain by Franciscan formation sedimentary rock. The geomorphology, hydrology, weather, soils, and plant communities east of the fault zone differ in many ways from that of the Peninsula.

Granite bedrock commonly called granodiorite underlies the entire Peninsula and is exposed in areas of the Inverness Ridge, Tomales Point, and the Point Reyes Headlands. Granite is overlain by Monterey Shale in the southern part of the Peninsula and is exposed along the coastline from Drakes Bay southward. Coastal wave cut benches and flooded valleys are the result of sea level fluctuations during the Pleistocene and tectonic uplift. The Point Reyes Plain extending from Inverness Ridge west to the Headlands is underlain by siltstone and mudstone of the Drakes Bay Formation. The Headlands present the most unique exposed formation within the park – the Point Reyes Conglomerate – comprised of cobbles of chert, volcanic rock, and granite. It is best exposed along the Lighthouse steps, and is most similar in composition to a conglomerate that occurs on the Monterey Peninsula, 100 miles to the south (Evens 1993). It is thought that the Point Reyes conglomerate was carried northward by the San Gregorio fault (Kingsmark 1998).

The Olema Valley, extending from Bolinas Lagoon to Tomales Bay, is associated with movement along the San Andreas Fault. The fault zone is 0.5 to 1.0 mile wide in the valley. Past movements have created fault topography, including linear ridges, offset stream drainages, offset rows of trees, and sagponds. The surface rupture caused by the 1906 earthquake ran from Bolinas Lagoon to Tomales Bay with a maximum displacement of 14 to 16 feet in the Point Reyes area.

Bedrock east of the fault (generally east of Highway 1) is a Franciscan assemblage that underlies much of California's Coast Range. Franciscan rocks consist primarily of shale and sandstone with occasional beds of limestone and chert along with intrusions of igneous serpentine (Evens 1993). The Franciscan formation is highly unstable, and known for slope instability, thin soils, and high runoff rates.

The current topography of the project area is also defined by numerous stream courses. Drainage patterns are primarily dendritic, resembling the pattern made by the branches of a tree or veins of a leaf. Dendritic drainages may develop in areas with consistent soil types such as the Bolinas Ridge. A number of drainages, however, have drastically altered courses attributed to the combination of stream capture and alterations of the topography caused by fault movement. In the Olema Valley, Olema Creek and Pine Gulch Creek run parallel, but in opposite directions for over two miles. Near the north end of the Valley, Bear Valley Creek runs at an acute angle through the ridge line, then makes an abrupt ninety degree turn to run parallel to Olema Creek until they discharge into the Lagunitas Creek.

Inverness Ridge forms the backbone of the Point Reyes peninsula, reaching a height of 1,407 feet at Mount Wittenberg. The ridge is characterized by relatively consistent upland elevation with sharp precipices dropping down into the river valleys. The only interruption in the ridge, between Bolinas and Tomales Point is the 400-foot pass between Bear Valley and Coast Creek drainages. Most of the perennial streams within PRNS originate from the ridge. South of Laguna Creek, the ridge merges with the Bolinas Mesa, an uplifted, wave-cut Monterey Shale bench. This terrace is intersected by a number of steep ravines caused by drainages cut down to the current sea level. Some of the most spectacular landmarks in PRNS, including Arch Rock and Alamere Falls, are on this terrace.

Bolinas Ridge to the east rises to approximately 800 feet in elevation. Due to soil type and climate, conditions are far drier on these west-facing slopes. Ridges are primarily grasslands with the steep tributary valleys dominated by oak and bay laurel.

Resources that May be Affected

This section describes the type of resources that may be affected or changed by actions in any of the alternatives and their current condition.

Water Resources and Water Quality

The water resources within the project area include a substantial number of perennial and intermittent streams, human-made impoundments, wetlands, natural lakes, and sag ponds. A general map of the watersheds within the project area is shown above. The water resources support a variety of threatened and endangered species including coho salmon, steelhead trout, California freshwater shrimp, and California red-legged frog.

Tomales Bay Watershed. The Tomales Bay watershed includes over 200 square miles, much of which is managed as public land by the NPS, Marin Municipal Water District, California State Parks, and Marin County Open Space. Though it accounts for only 50% of the Tomales Bay Watershed, Lagunitas Creek, including Olema and Bear Valley creeks, contributes more than 65% of the freshwater flow to Tomales Bay. Walker Creek accounts for approximately 1/3 of the watershed area and 35% of the freshwater inflow to Tomales Bay. The remaining watersheds east and west of the Bay make up more than 15% of the land area but contribute only 10% of the freshwater inflow (Fischer et al. 1996) to the west. Small watersheds draining from the east and west sides of the Bay account for only 10% of the overall freshwater contribution to the Bay.

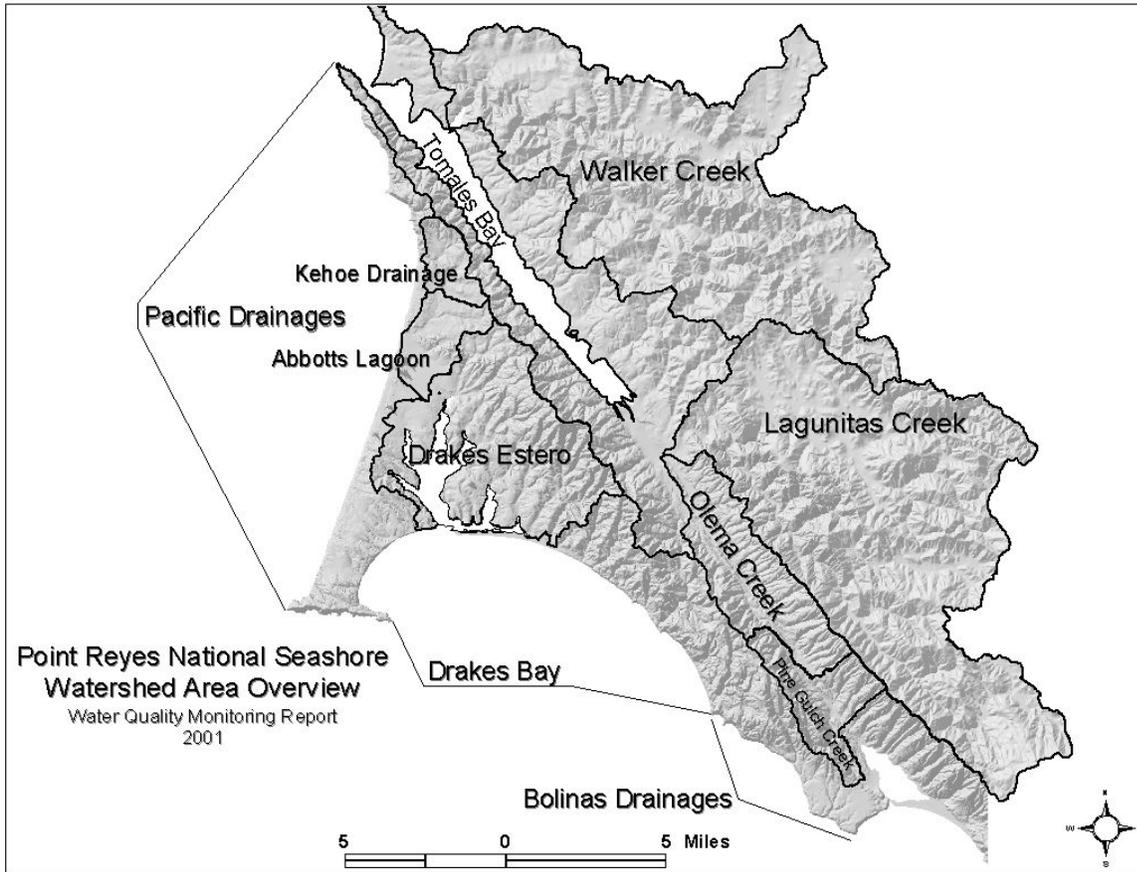
Tomales Bay and Drakes Estero are home to a number of oyster production operations accounting for nearly 35% of the oyster production in the state of California. In 2000, Tomales Bay was identified as impaired by sediment, nutrients, and fecal coliform by the San Francisco Bay Regional Water Quality Control Board. The Board also identified Lagunitas Creek as impaired by the same constituents.

Lagunitas Creek Watershed. Lagunitas Creek drains to the head of Tomales Bay. The 88 square mile watershed is the major supplier of water to most of Marin County through the Marin Municipal Water District. Four dams with storage in excess of 60,000 acre-feet have substantially altered both the hydrology and condition of anadromous populations. The damming of Lagunitas and Nicasio creeks has eliminated nearly two thirds of the spawning habitat of these threatened populations.

The major undammed tributaries heading upstream include Bear Valley Creek, Olema Creek, McIsaac Gulch, Cheda Creek, Devils Gulch, and San Geronimo Creek. The watershed is important as it supports viable populations of federally endangered coho salmon (*Oncorhynchus kisutch*) and steelhead trout.

Other federal threatened and endangered species including California red-legged frog (*Rana aurora draytonii*) and California freshwater shrimp (*Syncharis pacifica*) occur in the watershed.

FIGURE 3: MAP OF THE WATERSHEDS LOCATED WITHIN THE PROJECT AREA.



The 14.5 square mile Olema Creek watershed supports viable populations of federally Endangered coho salmon and steelhead trout. Olema Creek has been the subject of extensive monitoring to determine the effectiveness of various stream protection measures – including riparian exclusion fencing and habitat restoration.

Drake’s Bay Watersheds. Drake’s Estero and the Estero de Limantour comprise a complex estuarine system capturing flow from more than 35 square kilometers and draining through the Estero inlet. Major watersheds contributing to this system are Laguna, Muddy Hollow, Glenbrook, Home Ranch, East and North Schooner Creek, also support populations of steelhead trout. Other watersheds flowing to the system, but not likely to support salmonids include Creamery Creek, Limantour Creek, North Home Ranch, and Berries Bay Creek. The Estero is susceptible to nutrient and other inputs from adjacent ranches and dairies.

Other Drake’s Bay watersheds are characterized as rather small, steep drainages, discharging directly to the beach. In most cases, the wave action forms a seasonal lagoon at the mouth of the stream. The primary watersheds south of Drakes Estero include Coast Camp, Santa Maria (Machado), Coast, Wildcat, and Alamere Creeks. Minor watersheds include Elk Gulch, Woodward Valley, and Kelham Creek. Watersheds east of the Estero include Horseshoe (D Ranch), Drakes Beach, C Ranch, B Ranch, and A Ranch.

Pacific Ocean Watersheds. The primary watersheds draining to the open ocean are from the north, and include McClures, Kehoe North, Kehoe South, E Ranch and Lighthouse. There are a large number of drainages north of Kehoe Beach that drain to the ocean including Elk Fence, White Gulch East, and others. There are also a number of intermittent dune watersheds that are not included in this list but occasionally drain to the ocean across the ten-mile beach. North and South Kehoe Creeks converge approximately ¼ mile upstream of Kehoe Lagoon.

The Abbott's Lagoon watershed drains across gently sloping terrain and into a unique lagoon environment. A human-made pond and a dual chambered lagoon separated by a bedrock sill provide a unique combination of brackish and freshwater environments in a system that often has the same surface water elevation. The lagoon does not breach regularly, remaining closed for years at a time.

Bolinas Drainages. The Bolinas drainages include Double Point, Arroyo Hondo, and RCA. In the late 1970s, arrangements regarding water supply to the town of Bolinas were made with the NPS. To protect streamflow of the Pine Gulch Creek watershed, an agreement with the Bolinas Community Public Utilities District was made that transferred water rights to the Arroyo Hondo Creek. The sole Bolinas Community Public Utilities District water supply, the Arroyo Hondo watershed is the most remote in the Seashore.

Pine Gulch Creek. Pine Gulch Creek is the largest watershed draining to the Bolinas Lagoon. Within the project area, the watershed was the most heavily logged with impacts spread over approximately 100 years. The lagoon is the subject of an intensive study, and a restoration plan coordinated through the US Army Corps of Engineers. Of greatest concern in this watershed is the protection of the stream and lagoon from excess sediment mobilization and deposition, along with the documented return of coho salmon to the watershed.

Impoundments, Natural Lakes, and Sag Ponds

The project area contains more than 125 impoundments or sag ponds known to support the California red-legged frog. Most of these facilities were constructed by former landowners for stock watering or development. The condition of these ponds is not well known although the stability of many is likely compromised by the presence of brush and trees on the dam structure.

Within the Olema Valley, a number of sag ponds associated with the San Andreas Fault provide unique aquatic habitat. The southwestern part of the project area, from Palomarin to Double Point is dotted with ponds and lakes derived from massive slope failure events. These water bodies, such as Bass, Pelican, and Crystal Lake are naturally occurring. A number of smaller ponds occur along Coast Trail from Palomarin.

Soils

The soils of the project area west of the San Andreas Fault are broadly classified with relation to underlying lithology (Evens 1993) as described below:

The Kehoe-Sheridan soils are about three feet deep, well drained, strongly acidic, and are derived from sandstone and quartz diorite. Located on the north flank of Inverness Ridge from Tomales Point south to Tomales Bay State Park, these soils support the bishop pine forests.

The Palomarin-Wittenberg complex is five feet or more deep, well drained, strongly acidic, and is derived from sandstone and shale. These soils occur on the southern half of Inverness Ridge, and support primarily Douglas fir forest.

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The Tomales-Steinbeck soils are comprised of fine clays or silts, are slightly to moderately acidic, and are derived from the soft sandstone of the Drake's Bay Formation. They occur from outer Point Reyes south to Point Resistance, and surround Drake's and Limantour Esteros. They support primarily grassland and coastal scrub.

The Pablo-Bayview soils are well drained, shallow (10–20 inches deep), and are derived from weathered shale and sandstone. They occur in a narrow band at the base of the western slope of Inverness Ridge.

The Dune-Sirdrak soils are the wind-blown sands that comprise the dunes. They can be up to six feet deep and have little ability to hold water.

The Cronkhite-Dipsea-Centissima soils are approximately five feet deep and are derived from sandstone and shale. They occur at the Bolinas Mesa at the southern end of the peninsula.

Sand dunes border the ocean around much of the Seashore. In some areas the dunes may extend inland for up to a mile. This soil type is highly susceptible to wind and water erosion, although these processes are part of the natural environmental forces. In the last few decades, European dunegrass was planted in an attempt to control the expansion of dunes into grasslands used for grazing. There is currently a large-scale restoration project to remove this dunegrass and restore natural dune function to the system.

Soils east of the San Andreas Fault (primarily in GGNRA North District) are derived of Franciscan lithology. The Tocaloma and Sheridan soils are moderately deep, well-drained soils. Though well drained, there is no underlying lithology to store the water.

Vegetation

PRNS owes much of its distinctive character to the assemblage of plants that occur on the peninsula. Plant communities create patterns over the Seashore's landscape that reflect the underlying influences of geologic formations and soils, and the overlying influences of a moist, maritime climate. The location of the project area at the midpoint of the Pacific Coast places it at a boundary of two climatic provinces, which results in abundant and varied plant life. The Seashore is known to support over 900 plant species, including approximately 300 non-native species, and 50 species of concern to park managers. The latter include the federally endangered beach layia (*Layia carnosa*), Tidestrom's lupine (*Lupinus tidestromii*), Sonoma alopecurus (*Alopecurus aequalis* var. *sonomensis*), Sonoma spineflower (*Chorizanthe valida*), and robust spineflower (*Chorizanthe robusta*).

Vegetation in the project area has been subject to human activities for 7,000 – 10,000 years, since the Coast Miwok first occupied the land. Although data are not available on the effects of Miwok activities on vegetation, it is assumed that they gathered plants for food and shelter materials, and probably used fire to manipulate the growth of plant species (Cook 1943). Beginning in the mid-nineteenth century and continuing into the present, activities such as land clearing, logging, cultivation, cropping, road building, commercial development, and livestock grazing have markedly affected the vegetation.

For purposes of analysis, the project area has been divided into 9 broad vegetation types. Acreage estimated for each type in the project area and brief descriptions are presented below. Acreage was estimated from the Point Reyes vegetation map and is rounded to the nearest 100 acres. Vegetation types correspond most closely to the community level in the vegetation map classification hierarchy.

Forest/Woodland Types

1. Bishop Pine (3,700 acres) – Bishop pine (*Pinus muricata*) is the dominant tree in the forest canopy. Madrone (*Arbutus menziesii*), tanoak (*Lithocarpus densiflorus*), coast live oak (*Quercus agrifolia*), or California bay (*Umbellularia californica*) are often present in substantial cover. Huckleberry (*Vaccinium ovatum*) is important to dominant in the shrub layer. Other species common in the understory include salal (*Gaultheria shallon*) and swordfern (*Polystichum munitum*). Stands of bishop pine tend to be even-aged, usually originating after stand destroying fires. The bishop pine forests in the project area are mature forests except for those that burned in the Vision Fire of 1995. Bishop pine forests occur on the northern portions of Inverness Ridge. Approximately 35% of these forests burned in the Vision Fire. These burned bishop pine forests are characterized by a patchwork of extremely dense stands of 12-15 ft. tall trees, as of this report, regenerating pines alternating with extremely dense stands of blue blossom (*Ceanothus thrysiflorus*) and Marin manzanita (*Arctostaphylos virgata*).

This vegetation type also includes a small amount of non-native Monterey pine/Monterey cypress stands; less than 5% of total acreage. These stands are characterized by planted groves dominated by either Monterey pine (*Pinus radiata*) or Monterey cypress (*Cupressus macrocarpa*), invasive in some areas, usually with sparse to low shrub and herbaceous cover. Understory species are often non-native.

2. Douglas fir/Coast Redwood (18,700 acres) – These are forests of giant pointed-crowned conifers with a maximum height approaching 50-70 meters dominated by Douglas fir (*Pseudotsuga menziesii*) or coast redwood (*Sequoia sempervirens*). Approximately 90% of these forests are dominated by fir, with redwood forests making up the remaining 10% or so of this type.

Douglas fir forest in the project area is characterized by Douglas fir dominant canopy often with a strong component of hardwood trees, usually California Bay (*Umbellularia californica*), but tanoak (*Lithocarpus densiflorus*) or individual coast live oaks (*Quercus agrifolia*) may be present. Fir is the most common forest in the project area with a highly variable tree canopy cover that may be as low as 15%. The shrub understory is also highly variable, but is usually moderate to very dense. Coffeeberry (*Rhamnus californica*), huckleberry (*Vaccinium ovatum*), California hazel (*Corylus cornuta*), poison oak (*Toxicodendron diversilobum*), and coyote brush (*Baccharis pilularis*) are the most common shrubs. Swordfern (*Polystichum munitum*) often dominates the herbaceous layer.

Where redwood is dominant in the forest canopy, tanoak is often a major component, sometimes co-dominating with redwood. California bay or Pacific madrone (*Arbutus menziesii*) are also often present in substantial cover. California hazel and huckleberry are the most common understory shrubs, with shrub cover usually sparse to moderate. Sword fern often dominates the herbaceous layer.

3. Hardwood Forest (7,500 acres) – This type includes forests dominated by hardwood species such as California bay (*Umbellularia californica*), coast live oak (*Quercus agrifolia*), eucalyptus (*Eucalyptus globulus*), tanoak (*Lithocarpus densiflorus*), madrone (*Arbutus menziesii*), or giant chinquapin (*Chrysolepis chrysophylla*). California bay is by far the most abundant forest comprising roughly 75% of this type. Coast live oak makes up about 20% of the type, with the two species often associating with each other. Of the remaining forest, eucalyptus is less than 5% and tanoak, madrone, and giant chinquapin are each less than 1% of this type.

California bay forest canopy is dominated by California bay or co-dominated by bay and coast live oak with each species comprising 30-60% relative canopy cover. Tanoak, Douglas fir (*Pseudotsuga menziesii*), or California buckeye (*Aesculus californica*) may have substantial cover. The understory is variable; it can be a moderately dense shrub understory often dominated by hazel (*Corylus cornuta*), coffeeberry (*Rhamnus californica*), elderberry (*Sambucus racemosa*), and/or poison oak (*Toxicodendron*

diversilobum). If there is no substantial shrub cover, swordfern (*Polystichum munitum*) usually dominates understory.

Coast live oak woodlands are dominated by coast live oak usually with a major component of California Bay, sometimes co-dominating with bay. Douglas fir individuals may be present. Understory is usually open to moderate with poison oak being the most commonly found shrub, often fairly high in cover. Coffeeberry, coyote brush (*Baccharis pilularis*), toyon (*Heteromeles arbutifolia*), and hazel can be present. Herb cover is usually low.

Eucalyptus forests are dominated by the non-native blue gum eucalyptus. These have been planted or have invaded native communities. Eucalyptus is usually very dominant in the canopy. Monterey pine (*Pinus radiata*)/Cypress (*Cupressus macrocarpa*) or individuals of Douglas fir, California bay, or coast live oak may be present. Understory is usually sparse, often including remnants of the native community. Poison oak and non-native or native berry (*Rubus spp.*) are common shrubs. Other non-native shrubs and herbs are often present in low cover. Eucalyptus forests are characterized by a thick litter layer formed by this species distinctive peeling bark, and tendency to drop seedpods, twigs, and branches.

4. Riparian Forest/Shrubland (2,300 acres) – These are streamside forests and shrublands dominated by broad-leaved deciduous trees or shrubs: red alder (*Alnus rubra*), mixed willows, and arroyo willows (*Salix lasiolepis*). Red alder forest is the most abundant of this type; it makes up approximately 70% of riparian areas. Red alder dominates the canopy with California bay (*Umbellularia californica*) often present in substantial cover. Arroyo willow may form a subcanopy to the alder. Understory is usually moderate to dense. Berry species (salmonberry—*Rubus spectabilis*, thimbleberry—*R. parviflorus*, California blackberry—*R. ursinus*), and red elderberry (*Sambucus racemosa*) are the common shrubs. Hedgenettle (*Stachys ajugoides*), sedges (*Carex spp.*), rushes (*Juncus spp.*), small-fruited bulrush (*Scirpus microcarpus*), and ferns (sword fern—*Polystichum munitum*, lady fern—*Athyrium felix-femina*) dominate the herbaceous layer.

Other forested riparian areas are dominated by mixed willow forest, which in the project area is represented by yellow willow (*Salix lucida*), often associating with other willows. Mixed willow forest makes up less than 5% of riparian areas.

Arroyo willow shrublands make up approximately 25% of the riparian type. Arroyo willow in its shrub form, usually 5-7 meters in height, strongly dominates the canopy. Other taller willows, or alder may be present in small quantities. The understory is usually extremely dense because of the thicket-forming growth habits of this species. Shrubs such as berry species (*Rubus parviflorus*, *R. spectabilis*, *R. ursinus*) are most commonly found woven through the understory. Wax myrtle (*Myrica californica*) or poison oak (*Toxicodendron diversilobum*) may be present. Sedges, rushes, small-fruited bulrush along with hedgenettle, beeplant (*Scrophularia californica*) and the ferns (Lady fern, bracken fern—*Pteridium aquilinum*) dominate the herbaceous layer.

Scrub Types

5. Coastal scrub (17,800 acres) – This vegetation type is highly variable and includes all of the shrublands of the study area as well as a small amount of chaparral. Approximately 90% of coastal scrub is dominated by coyote brush (*Baccharis pilularis*), a small-leaved evergreen shrub. Coyote brush scrub is highly diverse and variable, ranging from fairly low open areas where coyote brush associates with grasses, to tall dense multi-species scrubs. Coyote brush scrub can be roughly equally divided in the project area between these open and dense variations. In its more open variation coyote brush commonly associates with non-native and native grasses and California blackberry (*Rubus ursinus*). It may also be found in association with sedges (*Carex spp.*) and rushes (*Juncus spp.*). In its taller, denser variation,

poison oak (*Toxicodendron diversilobum*) is the most commonly associating shrub, often in fairly high cover. Coffeeberry (*Rhamnus californica*), thimbleberry (*Rubus parviflorus*), California blackberry, and California sagebrush (*Artemisia californica*) are also common associates in dense coyote brush scrub. An additional 5% or so of coastal scrub is dominated by a diverse list of shrub species that includes coffeeberry, yellow bush lupine (*Lupinus arboreus*), hazel (*Corylus cornuta*), and blue blossom (*Ceanothus thrysiflorus*).

Chaparral accounts for less than 5% of the coastal scrub type. The manzanitas (*Arctostaphylos spp.*), primarily Eastwood manzanita (*Arctostaphylos glandulosa*), and chamise (*Adenostoma fasciculatum*) are the dominant shrubs here. These evergreen species tend to be in the hotter, drier areas with the largest occurrences in the project area found on the western slope of Bolinas Ridge and within the Vision Fire burn area on Inverness Ridge.

Herbaceous Types

6. Grassland (20,300 acres) – This variable vegetation type is dominated by non-native or native grasses, much of which are grazed by cattle, and may have up to 15% shrub cover. Roughly 80% is dominated by non-native grasses, the remaining 20% or so by native grasses. Purple velvet grass (*Holcus lanatus*) is the dominant non-native perennial grass in the project area. Italian wild rye (*Lolium perenne*) is also important. Non-native European dunegrass (*Ammophila arenaria*) is included in the coastal dune type. Dominant non-native annuals are annual Italian wild rye (*Lolium multiflorum*), Farmer’s foxtail (*Hordeum murinum*), and rattail fescue spp. (*Vulpia spp.*). Non-native grasses are usually found in association with coyote brush (*Baccharis pilularis*), California blackberry (*Rubus ursinus*), native and weedy herbs, and often remnant native grasses.

Pacific reedgrass (*Calamagrostis nutkaensis*) is the most common native grass in the project area, along with tufted hairgrass (*Deschampsia cespitosa*), California oatgrass (*Danthonia californica*), meadow barley (*Hordeum brachyantherum*), and California brome (*Bromus carinatus*). Where Pacific reedgrass is in association with rushes (*Juncus spp.*) and sedges (*Carex spp.*) it is included in the wetland vegetation type. Native grasses are often found in association with annual non-native grasses, coyote brush, California blackberry, and a variety of native and weedy herbs.

7. Pasture (3,900 acres) – These areas are used as enclosed pastures to graze cattle or horses and are managed to produce silage for cattle; or are fields used for other agricultural purposes. This is an artificial vegetation type and is distinguished from grazed grasslands and other grazed naturally occurring vegetation types in the project area.

8. Coastal Dunes (1,900 acres) – The majority of dune habitat has been completely dominated by the non-native species European beachgrass (*Ammophila arenaria*), consisting of roughly 50% of this type, or iceplant (*Carpobrotus edulis*), consisting of roughly 25% of this type. In areas where these two species dominate, they form dense monocultures, with little to no other species present.

The remaining 25% of this type are remnant patches of native habitat, which commonly support primarily dune sagebrush (*Artemisia pycnocephala*), coast buckwheat (*Eriogonum latifolium*), dune lupine (*Lupinus chamissonis*), or goldenbush (*Ericameria ericoides*), often with substantial cover of the two invasive species, European beach grass and/or iceplant. Total vegetation cover is often low and interspersed with bare sand.

9. Wetlands (2,900 acres) – This is a varied group that includes moist herbaceous wetlands, salt marshes, and freshwater marshes. Moist herbaceous wetlands, dominated by rushes (*Juncus spp.*), sedges (*Carex spp.*), small-fruited bulrush (*Scirpus microcarpus*), and Pacific reedgrass (*Calamagrostis nutkaensis*) in

association with these wetland species, make up approximately 70% of this type. Any of these species may dominate, however they are often found in swales in a patchwork pattern. Common dominants are rush (*Juncus effusus*), slough sedge (*Carex obnupta*), small-fruited bulrush, and Pacific reedgrass often associating with other rush or sedge species. Other associating species include purple velvet grass (*Holcus lanatus*) and California blackberry (*Rubus ursinus*) in the drier areas, potentilla (*Potentilla anserina*), hedgenettle (*Stachys ajugoides*), lady fern (*Athyrium felix-femina*), and horsetail (*Equisetum spp.*) in the moister areas.

Salt marshes make up roughly 30% of wetlands in the project area. Pickleweed (*Salicornia virginica*) is the most common dominant, as well as saltgrass (*Distichlis spicata*); these species often co-dominate. Jaumea (*Jaumea carnosa*) is the most common associate. Sea lavender (*Limonium californicum*), arrowgrass (*Triglochin concinna*), alkali heath (*Frankenia salina*), and bird's beak (*Cordylanthus maritimus*) are often associates as well.

Freshwater marshes account for less than 5% of this type. Dominant species are the tall California bulrush (*Scirpus californicus*) and cattails (*Typha spp.*). These species are found in the wettest areas in or at the edge of standing water such as marshes or stock ponds. Bur-reed (*Sparganium spp.*) and water parsley (*Oenanthe sarmentosa*) are common associates.

Wildlife

The project area supports a wide diversity of wildlife species, including 28 species of reptiles and amphibians, 65 species of mammals, over 470 bird species (representing 45% of the avian fauna documented in the United States), and uncounted invertebrates. The waters of the Pacific Ocean and Tomales Bay support rich and diverse fisheries. The US Fish and Wildlife Service and/or the State of California list many of the wildlife species present in the study area. The Marine Mammal Protection Act and the Migratory Bird Treaty Act afford additional protection.

Mammals. A rich diversity of terrestrial mammals occupies the many habitats of the project area. These include mountain lion (*Felis concolor*), bobcat (*Lynx rufus*), gray fox (*Urocyon cinereoargenteus*), black-tailed deer (*Odocoileus hemionus columbianus*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), mink (*Mustela vison*), and the Point Reyes mountain beaver (*Aplodontia rufa phaea*). Some large mammals have been extirpated, including grizzly bear (*Ursus horribilis*) and wolf (*Canis lupus*), while others such as the coyote (*Canis latrans*) are beginning to reappear. Some extirpated species, such as the tule elk (*Cervus elaphus nannodes*) have been reintroduced. See below for a more detailed description of native ungulates.

Marine mammals, many of which are endangered under the Marine Mammal Protection Act (e.g., southern sea otter [*Enhydra lutris nereis*], and Steller sea lion [*Eumetopais jubatus*]), inhabit or transit the waters off of Point Reyes. Twenty percent of California's breeding population of harbor seals (*Phoca vitulina*) occur at Point Reyes. In 1981, northern elephant seals (*Mirounga angustirostris*) colonized the Point Reyes Headlands and the colony is growing. Gray whales (*Eschrichtius robustus*) are numerous during winter and spring migrations, and humpback (*Megaptera novaeangliae*), and blue (*Balaenoptera musculus*) whales are frequently observed in summer and fall.

Amphibians and Reptiles. Federally threatened California red-legged frogs (*Rana aurora draytonii*) occur within the project area, as do bullfrogs (*Rana caesbeiana*), California newts (*Taricha torosa*), and rough-skinned newts (*Taricha granulosa*). It is not uncommon to find the Pacific giant salamander (*Dicamptodon enstatus*) near streams.