Cultural Resources

While public awareness of the importance of wetlands appears to be a relatively recent phenomena, this awareness really reflects more of a reacquaintance with the functions, values, and "services" provided by wetlands – values and functions that were recognized for hundreds to thousands of years prior to European settlement. The bountiful resources of the Pacific Ocean and sheltered bays encouraged settlement by Native American tribes that relied on open water areas and wetlands for fish, game, shellfish, and other food resources. Many of these same peoples actually created and/or managed wetland features for specific functions and services. The Omiomi Coastal Miwok appeared to have developed large tidal marsh ponds near Novato in Marin County for waterfowl hunting, and the Yrgin Ohlone managed salt pannes in Hayward in east San Francisco Bay for salt harvesting (Goals Project 1999). These same resources were highly prized by English and Spanish explorers and later by settlers who moved into the San Francisco Bay and Point Reyes regions.

Background and Regulatory and Policy Setting

The Seashore's history of Native American settlement, European exploration, and eventual colonization by Spaniards and Americans left it a legacy of important archeological and historic resources. A more detailed summary description of the history of the Project Area can be found at the beginning of this chapter.

Since the early 1900s, a number of laws and policies have been enacted to protect cultural resources such as these for the enjoyment of future generations of park visitors. The Antiquities Act of 1906 (16 USC §432) mandated protection of historic or prehistoric remains "or any antiquity" on federal lands, including historic monuments and ruins. It was superseded by the Archeological Resources Protection Act of 1979 (16 USC §470aa et seq.) as an alternative federal tool for prosecution of antiquities violations on public lands. In addition to protecting resources, the Archeological Resources Protection Act regulates excavation and collection on public and Indian lands and requires notification of Indian tribes that may consider a site of religious or cultural importance prior to issuing a permit. The importance of consulting with Native American tribes was bolstered by passage of the American Indian Religious Freedom Act (42 USC §1996), which stresses that religious concerns should be accommodated or addressed under NEPA or other appropriate statutes. The Archeological Resources Protection Act was amended in 1988 to require the development of plans for surveying public lands for archeological resources and systems for reporting incidents of suspected violations.

The National Historic Preservation Act of 1966, as amended (16 USC §470 et seq.) requires agencies to take into account the effects of their actions on properties listed in or eligible for listing in the National Register of Historic Places. The Advisory Council on Historic Preservation has developed implementing regulations (36 CFR 800), which allow agencies to develop agreements for consideration of these historic properties. The Park Service, in consultation with the Advisory Council, the California State Historic Preservation Officer (SHPO), Native American tribes, and the public, has developed a Programmatic Agreement for operations and maintenance activities on historic structures. This 1995 Programmatic Agreement provides a process for compliance with the National Historic Preservation Act and includes stipulations for identification, evaluation, treatment, and mitigation of adverse effects for actions affecting historic properties.

In addition to federal and state laws governing protection of cultural resources, Executive Order 11593 instructs all federal agencies to support the preservation of cultural properties. It directs them to identify and nominate cultural properties under their jurisdiction to the National Register of Historic Places and to "exercise caution… to assure that any federally owned property that might qualify for nomination is not inadvertently transferred, sold, demolished, or substantially altered." The Park Service incorporated direction from law and federal policy into development of the Cultural Resources Management Guidelines (NPS 1998a), which recognizes five types of cultural resources: archeological resources, historic structures, ethnographic resources, cultural landscapes, and museum objects.

In California, authority for NHPA has been transferred to California's Office of Historic Preservation. The Office of Historic Preservation also is responsible for oversight of California Pubic Resources Codes Section 21083.2-21084.1, which requires state and local agencies to evaluate impacts of proposed projects to archaeological and historic structure resources. Federal and federally-sponsored programs and projects are reviewed pursuant to Sections 106 and 110 of the NHPA. Section 106 of the NHPA requires federal agencies to consider the effects of proposed federal undertakings on historic properties. NHPA requires federal agencies

to initiate consultation with the State Historic Preservation Officer (SHPO) as part of the Section 106 review process. The State Office of Historic Preservation maintains the California Register of Historic Places. The California Register includes resources listed in or formally determined eligible for listing in the National Register of Historic Places, as well as some California State Landmarks and Points of Historical Interest. Properties of local significance that have been designated under a local preservation ordinance (local landmarks or landmark districts) or that have been identified in a local historical resources inventory may be eligible for listing in the California Register and are presumed to be significant resources for purposes of CEQA unless a preponderance of evidence indicates otherwise (PRC Section 5024.1, 14 CCR § 4850).

Tribal Lands

The recently completed Point Reyes National Seashore Cultural Affiliation report (Emberson et. al. 1999) examining Native American affiliation at Point Reyes concluded that the Federated Coast Miwok people have a clear, exclusive affiliation with the lands managed by the Seashore extending back more than 2,000 years. The Federated Coast Miwok are politically recognized by the federal government as the Federated Indians of Graton Rancheria. A FIGR representative was present for most of the archeological survey conducted in the Project Area.

Archeological Resources

Park Setting

Archeological resources are "the remains of past human activity and records documenting the scientific analysis of these remains" (NPS 1998). These include artifacts, ecofacts, and features. Over 100 Native American archeological sites exist within the Seashore, primarily on the coastal lowlands. These known prehistoric sites are primarily shell middens, voluminous deposits of rich organic soil with a relatively high content of local shell, created by human habitation of the site. The Seashore also has approximately 90 historic terrestrial archeological sites. These sites typically reflect historic occupation and use of the peninsula, first by homesteaders and dairy ranch communities, and later by government lighthouse and lifesaving personnel and private radio telecommunication companies. They include discrete trash pits containing old bottles, tins, broken tools and crockery, buried corduroy roads, ruined ranch sites, and radio communication facilities. Almost 90 percent of the Seashore's lands have not yet been surveyed for archeological resources.

Archeological Resources within the Project Area

No archaeological resources or human remains were identified during surveys conducted in 2002 by the Anthropological Studies Center at Sonoma State University (Newland 2003).

Cultural Landscapes and Features

Park Setting

Cultural landscapes "are settings we have created in the natural world" (NPS 1998). In 1998, the Seashore started developing a cultural landscape inventory database. To date, the database has identified 12 historic cultural landscapes, with the dairy and cattle ranches on the Point Reyes Peninsula comprising the single largest landscape (Seashore 2001). The smallest is located at the 19th century lime kilns located in the Olema Valley (Seashore 2001). Landscapes can range in scale from historic sites to substantial districts (Seashore 2001). They may express a high level of design, as seen in the two former RCA / Marconi Wireless Stations on Point Reyes and Bolinas, or, conversely, they may be landscapes that have arisen from need or desire over time, rather than arising from measured designs (Seashore 2001). The ranches along Lagunitas Creek and the Olema Valley fall in this category (Seashore 2001).

In total, the Seashore manages 39 cultural landscapes: 23 are within the boundaries of the Seashore, and 16 are within the North District of the GGNRA. The landscape and landscape features primarily reflect the maritime, ranching, communications, and military history of the park. Two of these landscapes are considered historic districts. The Point Reyes Ranches Historic District is the largest and encompasses over 22,000 acres on the Point Reyes Peninsula with the oldest dairy operations (1857-1939) known as the "alphabet ranches."

The Seashore has rehabilitated the NHRP-listed Pierce Point Ranch in this district. Home Ranch is listed as a landscape feature integral to the Point Reyes Ranches Historic District Cultural Landscape. Home Ranch is one of the oldest and best preserved ranches on the Point Reyes Peninsula (Livingston 1994). The Olema Valley Ranches Historic District, including the Lagunitas Creek ranches, is a smaller, but comparable district with a broader range of architectural styles and site development influenced by a higher diversity of ownership and lack of standardization (Seashore 2001).

Several other landscape features have national significance. The 1927 Point Reyes Lifesaving Station is a National Historic Landmark, and the Marconi/RCA Wireless Stations sites are in the process of being nominated as a multiple property National Historic Landmark. The Point Reyes Light Station, which was built in 1870, is listed on the NRHP. The Olema Lime Kilns are listed as a California State Historical Landmark and also as a National Register of Historic Places property.

Cultural Landscapes and Features within the Project Area

The Project Area is not located in the Seashore's two historic ranching districts (Garcia and Associates 2004), although the Martinelli Ranch, which is owned by GGNRA and directly northeast of the Giacomini Ranch, is included in the Historic Resource Zone. Surveys of the Giacomini Ranch in 2002 identified two previously unrecorded cultural landscape features: a portion of the North Pacific Coast Railroad grade (ASC-69/01-01) and a historic-period levee system and dam (ASC-69/01-02; Newland 2003). The dam was a temporary gravel dam that the Giacominis installed each summer to provide freshwater for irrigation purposes. The Giacominis stopped summer dam installation in 1998 prior to selling the property to the Park Service. While the original levee system was constructed more than 50 years ago, the degree of alteration to this system due to repairs and reinforcement (e.g., rip-rapping) will probably reduce its value as a historic resource (Mark Rudo, Park Service, *pers. comm*.). The study determined that neither resource was eligible for listing on the National Register of Historic Places (Newland 2003). In 2004, four additional landscape features were recorded by Garcia and Associates (2004): two manure lagoons and two corrals in the main complex. The corrals are not on Park Service property. None of these features was considered eligible for National Register of Historic Places listing (Garcia and Associates 2004).

Historic Structures

Park Setting

Historic structures are "material assemblies that extend the limits of human capacity" and comprise such diverse objects as "buildings, bridges, vehicles, monuments, vessels, fences, and canals" (NPS 1998). More than 300 historic structures are found on land managed by the Seashore. The structures range from simple timber-framed barns to the cast-iron Point Reyes Lighthouse to the concrete Mission Revival Marconi transmitting station. Historic structures are found throughout most of the park, except for the Wilderness Area, and mark the built history of the Seashore. Approximately two-thirds of the Seashore's listed structures are ranch structures managed under leases and permits. The remaining structures reflect the park's maritime and radio communication history.

Four sites are listed in the National Register, including the Point Reyes Lifeboat Station, a National Historic Landmark. Three additional properties have been determined to be eligible for the National Register of Historic Places, and several additional properties are in review. Within the Seashore, 297 historic structures are on the List of Classified Structures, the Park Service inventory of historic and prehistoric structures.

Historic Structure Resources within the Project Area

Historic structure surveys were conducted in 2004 to evaluate the historic buildings, structures, and landscape features at the Giacomini Dairy Facility and a separate residence on Sir Francis Drake Boulevard in Inverness Park (Garcia and Associates 2004). The study determined that the Giacomini Ranch was much younger than many of the other Olema Valley and Point Reyes dairies that operated in the 19th century and that many of the buildings had been highly modified (Garcia and Associates 2004). Neither the Dairy Facility structures nor the Inverness Park residence appeared to meet any of the criteria for listing in the National Register of Historic Places (Garcia and Associates 2004).

Public Health and Safety

In addition to hydrologic and ecological functions, wetlands also provide social services, several of which directly relate to public health and safety. Wetlands reduce impacts from floods by providing floodwater storage and decreasing the destructive energy of flood flows. While the public has become more knowledgeable about the functions and services that wetlands offer, wetlands still labor to some degree with age-old misconceptions of wetlands as swamps filled with mosquitoes, dank water, and other nuisances and dangers. Unfortunately, this view has resurfaced with growing concern about the spread of West Nile Virus and other mosquito-borne diseases and the potential impact on public health. These concerns need to be balanced with a better and more scientific understanding of the diseases, their vectors, mode of transmission, and the relationship of wetlands and other habitats to disease vectors.

Flooding and Public Safety

Regulatory and Policy Setting

Flooding has historically had severe safety and economic impacts on both urban and rural communities and even parks. Federal and local regulations have been promulgated to reduce both the exposure of communities and parks to damaging flooding and the funds required to rebuild communities and parks following such major floods (Clearwater Hydrology and Nichols-Berman 2002). Until the early to mid-1980s, the flood control and reduction strategies that were typically applied in Marin and other Bay Area counties often had detrimental impacts on aquatic, riparian and wetland habitats (Clearwater Hydrology and Nichols-Berman 2002). Growth in the understanding of the linkage between hydraulic and fluvial geomorphological processes caused a re-evaluation of some of the commonly applied flood control techniques, such as use of concrete channel lining, channel straightening and the elimination of functional floodplain areas (Clearwater Hydrology and Nichols-Berman 2002). The current and evolving regulatory environment affecting flood control activities reflects this changed understanding of flood dynamics and the role of wetlands and riparian areas in regulating floods.

Flooding has historically had severe safety and economic impacts on both urban and rural communities and even parks

The National Flood Insurance Act of 1968 and the Flood Disaster Prevention Act of 1973 established the National Flood Insurance Program (NFIP) which is administered by the Federal Emergency Management Agency (FEMA; Clearwater Hydrology and Nichols Berman 2002). The NFIP provides insurance coverage to property owners within flood hazard areas that are delineated on published Flood Insurance Rate Maps (FIRMs) for both the 100-year and 500-year flood events (Clearwater Hydrology and Nichols-Berman 2002). In order to quality for the program, candidate municipalities and unincorporated county areas must adopt local floodplain development policies and enforce flood control measures for new construction and redevelopment projects within their jurisdictions (Clearwater Hydrology and Nichols-Berman 2002).

FEMA prepares Flood Insurance Studies and associated FIRM maps to assist communities in local land use planning and flood control decision-making (Clearwater Hydrology and Nichols-Berman 2002). The County of Marin entered into the NFIP in 1982, the date the original FIRM maps were published for the incorporated area (Clearwater Hydrology and Nichols-Berman 2002). Based on the CWP, the Project Area falls within the 100-year flood hazard zone (Clearwater Hydrology and Nichols-Berman 2002). The extent of the 500-year flood hazard zone was not delineated in the Point Reyes area (Clearwater Hydrology and Nichols-Berman 2002).

The Park Service specifically addresses flooding in its 2006 Management Policies. Parks are directed to "minimize potentially hazardous conditions associated with flooding" (NPS 2006; Section 4.6.4). Furthermore, parks should "avoid direct and indirect support of floodplain development and actions that could … increase flood risk" (NPS 2006, Section 4.6.4). When development must occur within a floodplain, non-structural measures should be used to reduce hazards to human life and property, while minimizing impacts to the natural resources

of floodplains (NPS 2006; Section 4.6.4). Development must also be consistent with the standards and criteria of the NFIP (NPS 2006; Section 4.6.4).

Background and Regional Flooding Patterns and History

Two forms of flooding occur in Marin County: 1) tidal flooding and 2) watershed flooding (Clearwater Hydrology and Nichols-Berman 2002). Tidal flooding develops when high tides exceed either the top of bank elevation of tidal sloughs and channels, or the crest of bay levees. Watershed flooding occurs in response to severe runoff-inducing rainfall over the tributary watershed of one of the region's stream channels. Major watershed floods are typically generated by rainstorms of 3-4 days duration that include nested periods of high intensity rainfall. Such rainstorms occur primarily during the wet winter season, which normally extends from November through March. When watershed flooding occurs in conjunction with high bay tides in coastal areas of Marin County, the extent and/or depth of overbank flooding or levee overtopping can increase due to an upward adjustment in the flood water surface profile. The potential for tides to affect flooding patterns in coastal areas could increase in the future due to sea level rise, which would increase base elevation ranges for Mean Sea Level (MSL) and Mean Higher High Water (MHHW) and increase the risk of flooding to homes, roads, and other infrastructure that are at or slight above sea level elevations.

Watershed flooding can result from two different and extreme rainfall patterns (Brown 1988). One pattern is a series of regional storms that saturate soils by persistent rainfall over a period of several weeks. The other pattern is a localized storm of high precipitation intensity during which rainfall lasts for a few hours to a few days and may or may not fall on presaturated ground. Both patterns may cause severe flooding. Localized storms often concentrate on the Pacific coastline and release continuous, very intense rains lasting for several hours to a maximum of four days (Brown 1988). As of the mid-1980s, five of the severest localized storms in the San Francisco Bay region occurred in November 1950, October 1962, January-February 1963, January 1967, and January 1982 (Brown 1988). Some of these extreme precipitation events were influenced to some degree by the El Nino climatic phenomenon (Clearwater Hydrology and Nichols-Berman 2002). Typically, the associated weather is much wetter, and storms and tides are more intense than during non- El Nino periods (Clearwater Hydrology and Nichols-Berman 2002).

As rainfall intensity increases, surface run-off from upland areas flows into nearby drainages and creeks. During a storm, waters will continue to rise until they reach a point at which the stage or height of floodwaters in the channel are at their highest, which is called peak flow. From this point, flood flows typically decrease. This flood flow pattern or flood hydrograph often resembles a flood wave that propagates down the creek channel, ultimately dissipating in some larger body of water (Dunne and Leopold 1978). The height or stage of this flood wave depends, in part, on the amount of reservoir capacity within the system (Dunne and Leopold 1978). In addition to man-made water storage structures, "reservoirs" include the channel itself, the "active" floodplain that is subject to flooding during bankfull or ordinary high water flows, and floodplain terraces that include the flood-prone area (~50-year flood events) and more planning-driven concepts such as the 100-year and 500-year floodplains. In low gradient or topographically "flat" systems, floodplain terraces often consist of large flats or plains adjacent to the riparian corridor or, in tidal marsh systems, marsh plains. Floodplains are discussed more under Water Resources – Hydraulics and Hydrologic Processes.

Because of differences in the length of streams, size of watershed, and run-off rates, the peaks of flood waves can be offset somewhat, with peak flooding in adjacent fluvial or creek systems occurring at different times. Differences in peak flow timing and water pressure can sometimes create a phenomenon called backwater flooding in which rising flood flows from a river or creek actually back up into the channel of another connecting creek or tributary, particularly if there is large "reservoir" capacity through extensive floodplains near the tributary's mouth. During very large storm events, floodwaters from the Russian River in Sonoma County actually flow upstream into one of its largest tributaries, the Laguna de Santa Rosa, which has extensive floodplains that are estimated, at times, to provide more floodwater storage than Lake Sonoma and Lake Mendocino combined (City of Sebastopol 2005).

Development of floodplains and even efforts to "control" floods through flood control channels can sometimes exacerbate the degree and damage from flooding. Watershed flooding is commonly associated with the development of formerly active floodplains and an increase in the peak rates of watershed runoff (Clearwater Hydrology and Nichols-Berman 2002). Peak flow rates increase due to increases in impervious surface coverage and the construction of storm drain systems, which reduce the time of concentration for runoff (Clearwater Hydrology and Nichols-Berman 2002). When peak flow rates increase substantially, and the altered flow regime is not accommodated using channel modifications, stormwater detention or diversion,

and/or stream conservation zones, episodic flooding can ensue (Clearwater Hydrology and Nichols-Berman 2002).

Watershed flooding can precipitate other factors that can dramatically increase the risk and damage from flooding such as complete or partial failures of dams and reservoirs. MMWD currently operates five reservoirs in the Lagunitas Creek watershed. Dam failures are extremely rare due to the stringent design and permitting requirements for dam construction and operation (Clearwater Hydrology and Nichols-Berman 2002). However, in the active tectonic environment of the San Francisco Bay Area, the risk of a dam failure during a major earthquake remains a possibility (Clearwater Hydrology and Nichols-Berman 2002).

Damage-inducing flooding has occurred infrequently in the County, primarily in the lower lying alluvial valleys and former marsh plains in eastern Marin that border the San Francisco Bay (Clearwater Hydrology and Nichols-Berman 2002). Because flooding has only been quantified in modern times, comparing the relative degree of flooding between different major flooding events is difficult, particularly as flooding is often evaluated in terms of subjective factors such as number of people affected, property losses, and reports on areal extent of observed inundation (Brown 1988). The most severe winter in terms of precipitation was probably that of 1861-1862 during which regional storms produced massive flooding throughout the San Francisco Bay region (Waananen et al. 1977; Brown 1988). Frequent, major storm-producing precipitation occurred between 1879 and 1915, a period that was followed by 22 years of less damaging or non-damaging precipitation seasons with one exception (Brown 1988). Between 1937 and 1982, damaging storms recurred on average on an interval of once every 3 years, with the 1955 storm considered to be generally the largest of the 20th century (Brown 1988; FEMA 1997). In 1982, much of Marin County was hit by a severe storm whose intensity was increased by a series of high tides.

Project Area Flooding Patterns and History

As the Project Area is situated in an alluvial valley at the confluence of at least three moderate to large-size creeks and a number of smaller drainages, it is perhaps not surprising that the entire Project Area has been mapped within the FEMA-designated 100-year flood hazard zone (Clearwater Hydrology and Nichols-Berman 2002). The history of the Project Area has been one that has marked by a number of catastrophic floods that have caused extensive to homes, ranches, and roads, as well as substantially changed the physical environment. Within the Project Area, flooding is directly influenced by both tidal and watershed processes, with flooding from creeks often exacerbated by extreme tide conditions.

The largest recorded flood in the Project Area and vicinity was the 1982 storm, which is considered to be a rainfall event with a 100-year recurrence interval. Within the San Francisco Bay region in general, the storm dropped as much as half of the mean annual precipitation within a period of about 32 hours, triggering 18,000 slides, damaging 100 homes, and killing 14 people (Ellen et al. 1988). In Olema and Inverness, 24-hour rainfall totaled 11-20 inches. Flood- and tidal waters completely inundated the Project Area and surrounding low-lying lands, including many of the homes along Levee Road and large sections of the road itself. Damage was intensified by numerous catastrophic landslides along the Inverness Ridge, with the resulting debris flow exacerbating flooding by blocking stream channels and drainage ways and causing localized flooding of Sir Francis Drake Boulevard (Ellen et al. 1988). Huge amounts of sediment were excavated from Bear Valley Creek and other drainages. As described under Hydrologic Resources, the flood also had major effects on hydrologic and geomorphic processes of local creeks, including Bear Valley Creek.

North bank of Giacomini Ranch East Pasture levee during 1982 Storm, a 100-Year Flood Event (Photo: Tom Quinn)

The Giacomini Ranch levees were completely submerged in the high water of this flood. Levees failed in several locations, including along the right bank (East Pasture) between the former summer dam and a few

hundred feet downstream of the Green Bridge; opposite the White House Pool County Park; almost the entire length of the West Pasture bordering the creek; and numerous locations along the East Pasture between White House Pool and the North Levee (KHE 2006a). As with many other floods that severely affected coastal areas, damage was exacerbated by the fact that the flood coincided with a series of higher high tides.

Following the flood, the Giacominis successfully petitioned for the Corps to armor the right bank of Lagunitas Creek with rip rap for several hundred feet upstream of the former summer dam. In addition, the Giacominis replaced the former creek-side levee to its current, set-back location by importing 200- to 300 cubic yards of local landslide material (KHE 2006a). The rebuilt section of levee became higher in elevation than lands on the south side of Lagunitas Creek, which effectively increased flooding potential of homes along Levee Road (KHE 2006a). In response to flood damage from the 1982 event, Marin County formed Flood Control Zone 10, which covers the Inverness Ridge, to collect taxes and clean and restore local creek channels (Clearwater Hydrology and Nichols-Berman 2002).

In 1998, another flooding event occurred, which was estimated as having a 10-year recurrence interval. Again, the entire alluvial valley and floodplains of Lagunitas and Olema Creeks were underwater. Residents along Levee Road and the east side of Sir Francis Drake Boulevard reported substantial flooding, although flooding for many homes on Levee Road was reduced by not only the decreased severity of flooding relative to the 1982 storm, but by the fact that many of the homes had been raised to decrease flood frequency.

This storm was also accompanied by some major hydrologic and geomorphic changes in the Project Area, including an apparent shift in the channel course of Bear Valley Creek from the west to the east side of Olema Marsh, possibly in response to excessive sediment deposition on the west side of the marsh from Inverness Ridge erosion. This sediment deposition resulted in blockage of the western culvert near the White House Pool County Park parking lot and redirection of Bear Valley Creek flow and other Olema Marsh waters to the other remaining culvert in the northeastern corner of Olema Marsh (KHE 2006b). Blockage of the western outlet reduced the available surface area for potential flow conveyance from the marsh from 106 square feet to 42 square feet, which translates into a reduction in conveyance capacity from approximately 630 – 700 cfs to 410 cfs (KHE 2006a). A 5-year flood event produces approximately 490 cfs in Bear Valley Creek (G. Kamman, KHE, *pers. comm*.). The reduction in outflow is compounded by two other factors, as well: the eastern culvert is installed at a higher elevation than the western culvert, and a 315-linear-foot earthen berm that is hardened by heavy vegetation establishment near the eastern outlet acts as a funnel, further limiting drainage (KHE 2006b). These hydrologic impediments appear to be causing a steady increase in standing water levels within Olema Marsh, with water levels possibly increasing as much as 6 feet since 1990 (Evans 1990, KHE 2006b). These increasing water levels exacerbate the potential for flooding of Levee Road and Bear Valley Road, which already flood frequently during storms.

On December 30-31, 2005, intense rainfall and extreme high tides again produced another major flooding event in the Project Area and other portions of the San Francisco Bay region. The magnitude of this flood on Lagunitas Creek at the USGS Point Reyes Station gage has been roughly estimated as an approximately 30-year flood (Greg Kamman, KHE, *pers. comm*.). The Giacomini Ranch flooded completely, with flooding exacerbated by damage to the Giacomini Ranch East Pasture levee a short distance downstream of Green Bridge and near the former summer dam site. Residents along Levee Road noted an appreciable drop in creek water levels when the levees breached (J. Langdon, Levee Road resident, *pers. comm*.). Flooding was again compounded by extreme high tides, which backed up residual floodwaters and caused additional flooding in the Project Area and upstream areas on Lagunitas, Olema, and Bear Valley Creeks. Properties and/or homes on Levee Road and the east side of Sir Francis Drake Boulevard flooded, with the latter apparently due to blockage of stream channels from debris flows off the Inverness Ridge.

While major flooding events remain the most memorable in terms of extent of inundation and damage, hydraulic modeling conducted as part of the proposed projects suggests that the Project Area and vicinity floods frequently, even during lesser storm events. Model simulation results indicate that the southern creek bank of Lagunitas Creek on which approximately 15 to 20 Levee Road homes are constructed generally starts to become overtopped by flood flows during storms with a 3-year recurrence interval (KHE 2006a). Based on hydraulic modeling, properties on the eastern portion of Levee Road would not be completely flooded until flows exceed a 5-year storm event, whereas homes on the western portion of Levee Road, White House Pool park, and Levee Road near White House Pool park would be completely flooded during a 5-year or even smaller storm event (Table 20). These areas are flooded despite the fact that water surface elevations generally drop as flood flows move downstream past the western Levee Road homes towards White House Pool, because, at least during higher flood flows, flood pressure is being partially relieved by overtopping of

the Giacomini Ranch levee (Table 20).

TABLE 20. ESTIMATED FREQUENCY OF FLOODING BY LAGUNITAS CREEK UNDER EXISTING CONDITIONS FOR PROPERTIES AND ROADS ADJACENT TO THE PROJECT AREA

Note: Estimates are based on vertical flood elevations generated by computer hydraulic modeling (KHE 2006a) and elevation information from topographic survey performed by the USGS (2003b) and are for flooding by Lagunitas Creek only.

Location	Vertical Flood Elevation**	Extent of Potential Flooding Based on Hydraulic Model (KHE 2006a) and Topography (USGS 2003b).
Levee Road Homes East		
2-Year Event	~ < 12	No potential for flooding from Lagunitas Creek.
5-Year Event	~ <15.3	Flooding. Creekside edges of properties potentially flooded.
10-Year Event	~ <16.9	Flooding. Properties and Levee Road flooded except for southeastern corner of Levee Road near State Route 1.
50 – 500 Year Events	~19.1 – 21.4	Flooding. Potential for properties and roads to be flooded completely.
Levee Road Homes West		
2-Year Event	~11.4 – 11.6	Flooding. Potential for some flooding in northern portion of properties 500 to 1,000 feet east of Olema Creek.
5-Year Event	~ <15.0	Flooding. Potential for properties to be flooded up to Levee Road and for flooding of Levee Road west of Olema Creek.
10 – 500 Year Events	~16.1 – 20.8	Flooding. Potential for properties and Levee Road to be completely flooded.
Levee Road WHP Park		
2-Year Event	~ 10.1 – 11.0	Flooding. Potential for WHP Park to be flooded extensively with minimal flooding of Levee Road.
5- to 500 Year Events	~ 12.9 – 18.1	Flooding. Potential for almost all of park and Levee Road from Olema Creek to Bear Valley Road to be flooded.
WHP at Sir Francis Drake		
2- to 10- Year Events	~9.8 – 13.1	No potential for flooding from Lagunitas Creek.
50 – 500 Year Events	~14.1 – 15.0	Small potential for flooding from Lagunitas Creek during 500-year flood event.
Sir Francis Drake Homes East		
2- to 5-Year Events	~6.25 to 7	No potential for flooding from Lagunitas Creek.
10-Year Event	<7.8	No potential for flooding from Lagunitas Creek. Pasture just east of Gradjanski property flooded.
50-Year Event	<8.8	Flooding. Very eastern edge of Gradjanski property flooded by Lagunitas Creek. No potential for flooding of home.
100-Year Event	<10.1	Flooding. Larger portion of eastern edge of Gradjanski property and eastern edge of Lucchesi/Kostelic properties flooded by Lagunitas Creek. No potential for flooding of homes.
500-Year Event	~ 11.8 – 13.0	Flooding. Eastern half of private properties flooded by Lagunitas Creek. Flooding close (~ 1 foot) to lowest elevation home. Flooding 3- to 4 feet below elevation of other two homes.

Based on hydraulic modeling estimates, flood flows overtop the portion of the Giacomini Ranch East Pasture levee near the old summer dam during 3.5-year storm events or during storms with slightly higher water levels than a 3-year event (KHE 2006a). Upstream of this and near where the levees were repaired after the 1982 flood event, the minimum flood flows capable of overtopping the East Pasture levee increases substantially, with modeling suggesting that 100-year flood events would be required (KHE 2006a). Downstream of White House Pool, the West Pastures levees overtop during flood events with a 12-year recurrence interval or greater while the East Pasture levee is overtopped by a 7-year flood or greater (KHE 2006a).

Water levels in the West Pasture simulated by hydraulic modeling in the West Pasture indicate that the three primary residences on the east side of Sir Francis Drake Boulevard are not impacted by rising waters from Lagunitas Creek during any of the simulated flood events (5-, 10, 50-, 100-year), except for potentially the 500-year storm event (Table 20; KHE 2006a). The eastern edge of the Gradjanski property -- which is already an existing freshwater marsh – probably floods under 50-year flood events in Lagunitas Creek, while

the eastern edge of the Lucchesi and Kostelic residences would flood only during 100-year flood events (Table 20; KHE 2006a). With the exception of the lowest elevation home, all structures would appear to remain 3- to 4-feet above the 500-year flood water level from Lagunitas Creek: the lowest elevation home would be within 1 foot of the 500-year flood water level. These homes and properties are protected from flooding by Lagunitas Creek not by the levees, which are actually much lower in elevation than the homes, but by the fact that they were constructed on alluvial fans created by some of the numerous Inverness Creek drainages that flow into the West Pasture (KHE 2006a). In addition, based on hydraulic modeling simulations, Lagunitas Creek does not appear to create a backwater effect on upper reaches of either Fish Hatchery Creek or the 1906 Drainage that would increase flood risk (KHE 2006a).

The continued flooding of the homes and properties adjacent to Sir Francis Drake Boulevard in Inverness Park that has been documented even under relatively minor storm events is due to these homes' proximity to the Fish Hatchery Creek and 1906 Drainages that flow off the Inverness Ridge (KHE 2006a). During storms, the Inverness Ridge is prone to landsliding due to its weathered granite bedrock composition (KHE 2006a). In addition to large volumes of sediment, these tributaries frequently produce and carry large woody debris (KHE 2006a). Cumulatively, the sediment and debris commonly clogs the culverts passing beneath Sir Francis Drake Boulevard, causing water, sediment and debris to overtop the road and flow towards the houses (KHE 2006a). Material that passes through the culverts or over the road also falls out of suspension on the downhill side of the roadway due to the rapid change in slope and stream energy (KHE 2006a). This material accumulates and fills drainages, causing further overtopping of creek banks and flooding of surrounding areas (KHE 2006a).

Flood hydrographs or patterns for Lagunitas Creek and its tributaries in the Project Area, Olema and Bear Valley Creeks, show that peak flows appear to be offset, such that the peak of the flood wave from Bear Valley Creek arrives at the confluence before that of Olema Creek and Lagunitas Creek. Based on review of available historical flood flow records, the Olema Creek peak is estimated to lag 2 hours behind the Bear Valley peak, while peak flows on Lagunitas Creek lag 6 hours and 4 hours behind the Bear Valley and Olema Creek peaks, respectively (KHE 2006a). However, backwater flooding at the mouth of Bear Valley Creek primarily occurs during 2-year+ flood events not due to backup of waters from Lagunitas Creek, but due to reduced conveyance capacity through the Levee Road culvert connecting Olema Marsh to Lagunitas Creek (KHE 2006a).

TABLE 21. FLOOD DISCHARGE ESTIMATES FOR VARIOUS RETURN INTERVALS

	FEMA (1997) 107.3 mi^2	USGS 81.6 mi^2	KHE[1] 81.6 mi^2	FEMA/NPS 14.6 mi^2	FEMA[3] 15.2 mi^2	KHE 15.2 mi^2
Year/Flood Return Period	Lagunitas Creek at Olema Ck. (107.3 mi^2) (cfs)	Lagunitas Creek at Pt. Reyes (81.6 mi^2) (cfs)	Lagunitas Creek at Pt. Reyes (81.6 mi^2) (cfs)	Olema Creek At Bear Valley Rd. (14.6 mi^2) (cfs)	Olema Creek At Lagunitas Creek (15.2 mi^2) (cfs)	Olema Creek At Lagunitas Creek (15.2 mi^2) (cfs)
Reported Discharge						
1982	n/a	22,100	n/a	n/a	n/a	4,117
1998	n/a	12,200	n/a	2503[2]	2,599	n/a
2005	n/a	17,700	n/a	n/a	n/a	4,117
Predicted Discharge						
2-yr	n/a	n/a	3515	n/a	n/a	1,193
5-yr	n/a	n/a	8,051	n/a	n/a	2,152
10-yr	14,700	n/a	11,597	3,590	3,728	2,815
50-yr	25,000	n/a	19,830	5,150	5,348	4,624
100-yr	28,050	n/a	23,268	5,720	5,939	n/a
500-yr	34,840	n/a	30,799	6,810	7,071	n/a

Notes: 1) Flow estimates from flood frequency analysis (KHE 2006a).
2) From B. Ketcham, Seashore, *pers. comm*. 2003.
3) FEMA 1997 estimates increased by ratio of drainage areas (15.2 mi^2/14.6 mi^2).

Table Source: KHE 2006a

Flood estimates for the 2- through 500-year floods for the Project Area and vicinity are presented in Table 21 (KHE 2006a). A couple of methods were employed to derive these estimates, including: 1) a standard flood frequency analysis of the USGS flow data at their Point Reyes Station gauge (USGS 1982) and 2) applying an area adjustment factor to FEMA unit runoff estimates (FEMA 1997). For comparison, peak flow estimates for the recent 1982, 1998, and 2005 floods are also presented on Table 21. A flood frequency curve generated from the data indicates that the 1998, 1982, and 2005 events approximate floods having a 10-, 100-, and 30-year recurrence interval, respectively.

Disease and Public Health

Background and Regulatory and Policy Setting

Public diseases can be transmitted through a variety of ways, including person-to-person, as well as animal-to-person, contact. Some diseases are transmitted through direct contact such as biting of an insect such as a tick or a mosquito. Others are transmitted indirectly such as transmission of the Hantavirus through respiration or breathing in of air containing virus-laden particulate from fecal matter generated by mice or exposure to air contaminated by birds carrying the avian flu. Some of the most problematic vectors of disease are those that are extremely common, difficult to avoid, and/or difficult to detect such as ticks, mosquitoes, and mice. Each of these vectors shows affinity for particular types of habitats or conditions, although ticks, which are primarily an "upland" problem, can be occasionally found in upland ecotone or high marsh areas bordering marshes that are flooded more infrequently.

Because of mosquitoes' affinity for water, wetlands are typically considered breeding grounds for these insects, although any land that has stagnant or standing water such as old tires, septic systems, abandoned pools, clogged roof gutters, and rice fields or other agricultural operations poses a risk for supporting mosquitoes. Mosquitoes are dipteran insects with aquatic immature stages and an aerial adult stage (Kwasny et al. 2004). Depending upon seasonal and environmental factors, it generally takes three to 12 days for a mosquito to complete its life cycle from developed egg to early adult stage (Kwasny et al. 2004). Mosquitoes are sometimes separated into two groups: floodwater mosquitoes and standing water mosquitoes (Kwasny et al. 2004). Floodwater mosquitoes have eggs that can withstand dry summer conditions in soil, leaf litter, or at the bases of plants until seasonal summer or fall flooding triggers eggs to hatch, pupate, and emerge as adults (Kwasny et al. 2004). This type of mosquito commonly occurs in managed seasonal wetlands such as those in San Francisco Bay and the Central Valley (Kwasny et al. 2004). Standing water mosquitoes lay their eggs in water or on emergent vegetation in water (Kwasny et al. 2004).

Both floodwater and standing water mosquitoes require water for some portion of their life cycle. Typically, mosquitoes need stagnant, still, or "standing" water that is not subject to high flow velocities or dynamic circulation patterns such as strong wind fetch or daily tidal flushing to breed and complete their growth cycle. Wave action across larger bodies of water physically retards mosquito production by inhibiting egg laying and decreasing larval survival (Jones & Stokes Associates 1995). In addition to water residence time, success of mosquitoes' breeding efforts is affected by water quality such that higher temperatures and higher organic content tend to produce greater number of mosquitoes (Collins and Resh 1989). Also, the pattern of flooding may affect mosquito numbers, with gradual increases or decreases in water levels more conducive to breeding than stable or rapidly fluctuating water levels (Jones & Stokes Associates 1995). Many mosquito species attach their eggs to emergent vegetation, which increases the attractiveness of stagnant waters with some emergent vegetation cover such as drainage ditches in diked areas. Emergent vegetation also decreases the ability of natural predators to prey upon mosquitoes.

Mosquitoes affect public health not only by causing localized allergic reactions on skin when mosquitoes bite people, but through transmitting diseases to humans and other birds and mammals. One of the first diseases linked to mosquitoes was malaria, an ancient disease that originated in Africa and that has killed millions during the past couple of centuries (AMCA 2005). Malaria incidences decreased in the mid 20th century when use of pesticides began to control populations of the genus responsible for transmission of the disease, Anopheles (AMCA 2005). Other diseases associated with mosquitoes are dog heartworm, encephalitis, yellow fever, and, most recently, West Nile Virus.

West Nile Virus is an "arbovirus" or arthropod-borne virus that is primarily transmitted by mosquitoes. Its reservoir host is birds, which means that birds can carry the virus and transmit to mosquitoes that bite them unlike people, horses, and most other mammals that act only as incidental or "dead-end" hosts (CDC 2004).

Unlike malaria and dengue fever, which are carried by only one type or genus of mosquito, several genera – a total of 44 species -- can carry West Nile. These mosquitoes bite birds carrying the virus and then transmit it to humans and other animals such as horses. As with many diseases, the virus causes either no symptoms or a mild illness with flu-like symptoms in most individuals, but, in relatively rare cases, particularly with immuno-compromised individuals and the elderly, West Nile can progress to encephalitis, inflammation of the brain, or neurodegenerative disease. The virus was first detected in the United States in 1999 in New York City (DHS 2006a). Since then, it has spread to 44 states, including California, where it was first identified in 2002 (DHS 2006). In 2005, West Nile Virus activity in birds was found in 54 of California's 58 counties (DHS 2006a). As of the end of 2005, 927 human infections from 40 counties had been reported to date, and there were 18 fatalities in California, all of which were in the Central Valley or southern California (DHS 2006a). In Marin County, there have been no reported human cases, although 14 dead birds have tested positive for the virus (DHS 2006a).

Mosquitoes, as well as birds, can also be tested for the virus. DHS presented detailed data for Alameda and Contra Costa counties in east San Francisco Bay. Within these counties, five species of *Culex* mosquitoes tested positive for West Nile in 2005, two of which appeared to have the highest rates of being infected: southern house mosquito (*Culex quinquefasciatus*) and the Western encephalitis mosquito (*Culex tarsalis*), the latter of which is also the carrier for Western Equine Encephalitis. None of the mosquitoes tested to date in Marin County have tested positive for West Nile, but the county has seven mosquito species present that have tested positive elsewhere in California or the United States, including mosquitoes in the genera *Culex*, *Ochlerotatus*, and *Anopheles* (District, unpub. data). The two species that appear to pose the highest threats based on rates of infection are the northern house mosquito (*Culex pipiens*) and potentially the Western encephalitis mosquito (Marin and Sonoma County Mosquito and Vector Control District 2005). Marin has grouped the northern house mosquito with the southern house mosquito (District, unpub. data), probably because they represent subspecies that occur in different climatic regions, but which can hybridize where they occur together.

The rates of infection within particular mosquito species does not directly correspond to rates of disease transmission, because certain mosquitoes have higher affinities for biting humans than others or do not migrate far from larval habitat. *Culex pipiens* is the most common pest species in urban and suburban setting and, therefore, according to the District, represents the most immediate threat to humans in towns and cities of Marin and Sonoma Counties. This species typically bites birds, but certain urban "strains" appear to prefer mammals, including humans (Savage and Miller 1995). *Culex tarsalis* (the "encephalitis mosquito") may be another important local vector. *Culex tarsalis* primarily bites birds, but will bite humans, livestock, and other mammals if the opportunity presents itself (Kwasny et al. 2004). This switching of host species, combined with the ability of this species to travel long distances, makes it a potent vector of arboviruses, and laboratory data suggests that this species may become the primary vector of West Nile in California (Kwasny et al. 2004).

California law requires that, if a problem source of mosquito production exists in waters or lands that have been artificially altered from natural conditions, the party responsible for those conditions is liable for the cost of abatement (California Heath and Safety Code 2000 *et seq*.). Enforcement of this law is the responsibility of local mosquito abatement districts, which are the governmental organizations responsible for controlling specific disease vectors within their jurisdiction. As their name implies, mosquito abatement districts are primarily responsible for controlling mosquitoes as pest species and disease vectors.

Because of concerns regarding West Nile, the western portion of Marin County was annexed into the District in 2005. Through annexation, which required 50 percent approval from West Marin residents, the district expanded its jurisdiction to add 42,000 parcels, 7,000 of which were in Marin County. The annexation drew strong protests from some members of the West Marin community over fears that the District would use chemical pesticides for mosquito control. Specifically, concerns were expressed about use of methoprenes and pyrethins, both of which have been linked in the literature to toxicity in aquatic organisms, including salmon and frogs. Community representatives have been working with the District to test non-toxic approaches to mosquito control that include education and limited use of larvicides that kill mosquitoes during the larvae stage of development. These larvicides contain a naturally occurring bacterium (*Bacillus thuringiensis israelensis*) that is common in soils. A one-year Memorandum of Understanding (MOU) with community groups signed by the District in 2006 limits pesticide use to these larvicides except during public health emergencies (District, unpub. data).

Jurisdiction of mosquito abatement districts extends over private, county, and state lands, but not federal

lands. Federal agencies are responsible for vector control on federal lands. Based on Park Service Management Policies (2006), native organisms such as mosquitoes that are often by perceived by the public as "pests" are viewed as natural elements of the ecosystem and are allowed to function unimpeded, except under certain conditions. One of these conditions under which native organisms are controlled or managed includes when they pose a human health hazard as determined by agencies such as the U.S. Public Health Service (Centers for Disease Control or the Park Service public health programs; NPS 2006, Section 4.4.5.1). The Park Service uses an Integrated Pest Management Program to reduce the risk to the public, park resources, and the environment from pests and pest-related management strategies (NPS 2006, Section 4.4.5.2). Normally, source reduction--eliminating or altering the water so that the mosquitoes cannot breed or complete their life cycle--is the first choice for control (NPS, IPM Manual). If source reduction is impossible or incomplete, the next tactic to consider should be biological control of the larvae with predators, bacterial insecticides, or growth regulators, which would be administered by Park Service staff (NPS, IPM Manual). While the District does not have jurisdiction over the GGNRA and Seashore lands, the parks allowed the District to trap mosquitoes on Park Service lands for identification purposes in 2005.

Mosquito Species and Habitats in the Project Area and Vicinity

Three days of mosquito trapping in June 2005 in the Project Area and other parts of the Seashore found eight species of mosquitoes, and six of these either also or exclusively occurred on the Giacomini Ranch (District, unpub. data). Mosquitoes on the Giacomini Ranch included the Western encephalitis mosquito, tule mosquito (*Culex erythrothorax*), banded foul water mosquito (*Culex stigmatosoma), Culiseta particeps, Culiseta inornata, and Ochlerotatus dorsalis* (District, unpub. data). Based on this limited sample size, the most common species appeared to be the Western encephalitis mosquito, tule mosquito, *Culiseta particeps, and Culiseta inornata*. At least one occurrence of the northern house mosquito was documented in the Olema Valley, but not on the Giacomini Ranch (District, unpub. data). However, results of the sampling could be skewed by the season chosen for sampling (early summer), with certain species potentially not active, or not as active, during this time of year. Park Service staff observations point to mid- to late summer, particularly August, as the peak periods of mosquito abundance.

Of the mosquito species identified on the Giacomini Ranch, three of these have tested positive in California for West Nile: the Western encephalitis mosquito, tule mosquito, and banded foul water mosquito (District, unpub. data). As noted earlier, the Western encephalitis and northern house mosquitoes have been identified by the District as posing the highest risk of West Nile Virus transmission. The Western encephalitis mosquito is a standing water species that lay its eggs in water, and adults can emerge continuously throughout the summer and fall in areas that have been flooded for an extended period of time, usually for more than 2- to 3 weeks. These seasonally to semipermanently flooded areas include rice fields, poorly drained pastures, semi-permanent and permanently flooded wetlands, sewer treatment plants, and dairy farms (Kwasny et al. 2004). The tule mosquito is another standing water mosquito that deposits its eggs among thick vegetation on the edges or margins of lakes and inland ponds and is one of the few mosquitoes that feeds actively during the day (Kwasny et al. 2004). The banded foul water mosquito is so named because of its association with polluted waters: it typically lives for two to three weeks, but females can live up to several months in cooler climates (Napa County Mosquito Abatement District 2004).

On the Giacomini Ranch, District trapping efforts focused on those areas that are seasonally wet for long periods of year (District, unpub. data). As described under Vegetation Resources, the Giacomini Ranch has remained largely wetland despite being diked more than 60 years ago. Flooding from creeks, run-off, groundwater, and, to a certain degree, tides, creates areas with a wide range in the amount of inundation or saturation, lasting from just a few days to throughout the year. Most of these areas are extensively vegetated, with the exception of irrigation drainage ditches and ditched sloughs that have been dredged to remove vegetation. While levees were obviously constructed to exclude flooding from Lagunitas Creek and Tomasini Creek into the pastures, based on hydrologic modeling, they also act to impound waters within the pastures, particularly in the northern portion of the pastures, thereby prolonging the duration of inundation and saturation (KHE, unpub. data). Construction of extensive ditch systems to drain pastures and/or convey irrigation waters also creates stagnant standing water areas that often become vegetated, if not consistently dredged. While currently allowing muted tidal flow due to modifications or malfunctioning, one-way tidegates installed on Fish Hatchery and Tomasini Creeks do not allow waters within these creeks to fully drain during low tides, which creates stagnant or backwater conditions. The overall numbers and seasonal patterns in abundance of mosquitoes have also probably been affected by seasonal irrigation within the East Pasture. Most of the southern portion of the East Pasture is flood irrigated for several months during the summer, often create standing water for several weeks, while fields in the northern portion are typically spray-irrigated.

Near the dairy facility, the Giacominis also maintain several waste ponds, where mosquitoes have apparently been documented in the past.

While no quantitative sampling has been performed, based on Park Service staff observations, mosquito numbers typically appear to be much lower in the undiked marsh than in the northern portion of the West Pasture, although mosquitoes are still present. Because many of the species typically rest during the day, only biting when disturbed or when hosts are present nearby, this suggests that most of the mosquitoes encountered in the undiked marsh are residents, although some may fly over from nearby diked areas..

Fish surveys on the Giacomini Ranch have documented non-native mosquitofish in both the East and West Pasture creeks, drainage ditches, and ditched sloughs (NPS, unpub. data). The Giacominis most likely introduced these species at some point to control mosquito populations. This fish species has been observed only in very low numbers in the immediate vicinity outside the Ranch (NPS, unpub. data). Mosquitofish are considered to be relatively tolerant of the harsh aquatic conditions that exist in some of the Project Area's waters. Many of the drainage ditches and ditched sloughs have very low to no oxygen, even during the day, and high levels of nutrients and pathogen indicators such as fecal coliform (see Water Resources – Water Quality). These hypoxic and even anoxic conditions create poor habitat for other types of native mosquito predators such as native fish and other insects that might help control mosquito populations.

Limited mosquito trapping has been conducted at or near Olema Marsh (District, unpub. data). The most recent sampling in October 2005 found five species of mosquitoes, with the tule mosquito (*Culex erythrothorax*) by far the most prevalent (District, unpub. data). Other species observed included the banded foul water mosquito (*Culex stigmatosoma*), northern house mosquito (*Culex pipiens), Culiseta particeps, and Culiseta inornata* – many of the same species that occur at the Giacomini Ranch (District, unpub. data). Again, at least three of these species – northern house mosquito, tule mosquito, and banded foul water mosquito – are ones that have tested positive for West Nile Virus in California. The water drainage problems in Olema Marsh that have resulted in longer water residence times and stagnant water conditions increase the potential for mosquito breeding within this large freshwater marsh habitat.

Public Services

Municipal Water Supply

Regional and Project Area Setting

Marin County is served by five water districts. These water districts obtain water supplies from local surface water reservoirs, groundwater, and through agreements for imported water with out-of-county agencies such as the Sonoma County Water Agency. The districts are responsible for providing water to residents and seeking new sources of water when projections indicate a potential long-term deficit in supply. The Project Area is located within the North Marin Water District (NMWD) West Marin Service Territory. NMWD also services Novato in eastern Marin County, however, there is no direct connection of water supply between the two service territories. Freshwater flow on Lagunitas Creek, which flows through the Project Area, is largely controlled, however, by five dams operated by the Marin Municipal Water District (MMWD), which services most of the rest of eastern Marin County. Water supply for the community of Inverness, northwest of the Project Area, is provided by a smaller district, the Inverness Public Utilities District.

Within the West Marin area, NMWD services the towns of Point Reyes Station, Olema, Bear Valley, Inverness Park, and Paradise Ranch Estates. NMWD has 775 active accounts in the West Marin service area, which equates to about 1,769 people using NMWD's estimate of 2.28 people per account (D. McIntyre, NMWD, *pers. comm*.). Currently, the West Marin service area water demand totals approximately 316 acre-feet per year (afy). The projected future demand is 480 afy. NMWD is currently working on a long-range water system plan to identify required facility replacement and improvements needed to properly serve existing and future customers in the West Marin service areas.

NMWD currently obtains its water supply for the West Marin service area from two wells located adjacent to Lagunitas Creek on the U.S. Coast Guard (USCG) property in Point Reyes Station (Figure 37). These wells were installed in 1970. Prior to installation of the wells, NMWD had conducted a study of potential groundwater sources for a potential development project on the east shore of Tomales Bay and concluded that

Figure 37.

the only aquifers capable of yielding significant amounts of water were in alluvial deposits along stream channels (NMWD 1967).

The Coast Guard wells are located approximately 50-feet from the edge of Lagunitas Creek with perforations starting 5-feet below the surface of the creek (SWRCB 1995). The wells are 60-feet deep and extend to bedrock, which is located about 50 feet below the surface of the stream (SWRCB 1995). Recent investigations into stratigraphy of this general area associated with Point Reyes Affordable Housing Project show that soils consist of alluvial deposits (fluvial or creek material), terrace deposits (marine material), and bedrock, which is shale, sandstone, and claystone and believed to be part of the Millerton Formation (Questa Engineering Corp. 2000). The alluvial deposits generally consist of gravelly loams at the surface with interbedded layers of gravelly sands and clays of varying thickness and density (Questa Engineering Corp. 2000). The wells are located in alluvial deposits of unconsolidated sand, silt, and gravel at the lower end of Lagunitas Creek, with the depth of alluvium restricted by the depth to bedrock (SWRCB 1995). A NMWD description of soils encountered during construction of the well indicates the upper 15-feet of alluvial deposits at the Coast Guard wells consist of brown sandy loam (KHE 2006a). Blue sandy clay occurred between 15- and 30-feet below ground surface (bgs), followed by blue sandy clay with some gravel from 30- to 35-feet bgs (KHE 2006a). Five feet of "washed" gravel was encountered from 40- to 50-feet bgs, followed by 10-feet (50- to 60-feet bgs) of brown cemented gravel and clay (KHE 2006a). Bedrock occurred below 60-feet (KHE 2006a).

Capacity of the Coast Guard wells is approximately 807 to 968 afy, which equals approximately 500 to 600 gallons per minute (gpm). The water is pumped from the wells to the Point Reyes Water Treatment Plant, where it is treated before being piped to end users. Treatment typically involves removal of iron and manganese using potassium permanganate and green sand filtration, followed by disinfection with chlorine. Once treated, the water can be stored before it is distributed. The Point Reyes area has three water storage tanks with a total storage capacity of 500,000 gallons. From this facility, water is distributed to Olema, Bear Valley, and Inverness Park in the West Marin Service area: distribution pipelines are discussed further below.

NMWD has two other active wells that it has developed –the Downey Well and the Gallagher Well. The Downey and Gallagher wells are located at varying distances upstream of the Coast Guard wells on Lagunitas Creek (Figure 37). The Downey Well is no longer used for municipal water supply. NMWD, however, is currently contracted with the Giacominis to provide 1.23 cfs from this well during the summer to the Giacomini Ranch for irrigation purposes, although water deliveries typically average closer to 1 cfs (C. DeGabriele, NMWD, *pers. comm*.). This contract is set to expire in July 2008 (C. DeGabriele, NMWD, *pers. comm*.). The Gallagher Ranch well is used for emergency purposes and is not currently connected to the West Marin distribution system, although NMWD is contemplating further development of this well in the future to meet existing demand and offset seasonal quality problems with the Coast Guard wells.

Regulatory and Policy Setting

Federal and state regulations and policies protect both the supply and quality of drinking water for the public. The Safe Drinking Water Act (SDWA) was originally passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply. The law was amended in 1986 and 1996 and requires many actions to protect drinking water and its sources, which include rivers, lakes, reservoirs, springs, and ground water wells. SDWA authorizes the USEPA to set national health-based primary standards for drinking water to protect against both naturally-occurring and man-made contaminants that may be found in drinking water. Within California, the authority for implementation of the SDWA has been delegated to the California Department of Health Services (DHS). The California Safe Drinking Water Act (CA SDWA) was passed to build on and strengthen the federal SDWA. The CA SDWA authorizes DHS to protect the public from contaminants in drinking water by establishing maximum contaminants levels (MCLs) that are at least as stringent as those developed by the U.S. EPA, as required by the federal SDWA. Some of the more recently established primary standards set by DHS include limits on disinfection by-products such as chlorites, which was established in June 2006: USEPA established standards for this pollutant for systems serving more than 10,000 people in 2004. In addition to primary standards, DHS has also set secondary drinking water standards and MCLs for analytes or contaminants of lesser concern that affect the taste, odor, or appearance of drinking water such as chlorides.

Protection of drinking water supplies also occurs through the Porter-Cologne Act. Water quality control plans designate beneficial uses of water for specific water bodies, establish water quality objectives to protect those uses, and provide a program to implement the objectives: one of those beneficial uses is municipal and domestic water supply. For Lagunitas Creek, SWRCB has designated municipal and domestic water supply as

a beneficial use, as well as contact and non-contact recreation, agricultural supply, cold freshwater habitat, fish migration, preservation of rare and endangered species, recreation, fish, spawning, and wildlife habitat. A more complete description of this law can be found under Water Resources – Water Quality. Marin County also regulates activities that substantially degrade or deplete groundwater resources, interfere with groundwater recharge, or substantially degrade surface or groundwater quality through CEQA review.

Municipal Water Supply Issues – Water Distribution

NMWD supplies water to its customers using a network of pipelines, which are either buried belowground or suspended below bridges. There are no water collection, treatment, or storage facilities within the Project Area, but some of distribution pipeline systems are present. Approximately 185,000 gallons of water is piped via an 8-inch asbestos cement, steel, PVC, or iron pipeline system to Levee Road, Inverness Park, and Bear Valley service areas through a pipeline that runs from Point Reyes Station on the north side of State Route 1 and Levee Road to the Sir Francis Drake Boulevard/Bear Valley Road intersection. The pipeline is suspended underneath the Green Bridge and the Olema Creek Bridge on Levee Road, but is buried below ground at both the current eastern outlet and former western outlet of Bear Valley Creek near Olema Marsh (NMWD, unpub. data). The pipeline is buried directly adjacent to the road at the current eastern outlet of Bear Valley Creek, but, at the former western outlet (and current outlet for the Silver Hills drainage), the pipeline route has been diverted slightly such that the pipe is located approximately 100 feet from Levee Road. The current depth of the underground pipeline along Levee Road is unknown, particularly in creek areas where there is potential for changes in surface grade elevations due to sedimentation or erosion, but most buried pipelines are installed so that the top of the pipe is approximately 3 feet below existing grade (C. Chandrasekera, NMWD, *pers. comm*.). From the intersection with Bear Valley Road, a 6-inch pipeline runs to Inverness Park along the western side of Sir Francis Drake Boulevard in Inverness Park (NMWD, unpub. data). Another pipeline runs on the western side of Bear Valley Road to Fox Drive with connections to other pipelines servicing the Silver Hills community and the Bear Valley storage tanks (NMWD, unpub. data). The Bear Valley Road pipeline does not cross Bear Valley Creek.

Municipal Water Supply Issues – Salinity Intrusion

In 1976, NMWD started having problems with salinity intrusion into the Coast Guard wells. Water districts are required by law to provide safe drinking water for customers. The 1995 Basin Plan (RWQCB 1995a) specifies that "controllable water quality factors shall not increase the total dissolved solids or salinity of waters of the state so as to adversely affect beneficial uses, particularly fish migration and estuarine habitat." In addition, California DHS sets chloride levels in potable water as a secondary drinking water standard (NMWD 1997) and recently established disinfection by-products such as chlorites as a primary drinking water standard in 2006. Chlorides can combine with the sodium hypochlorite used for disinfection to create disinfection by-products (C. DeGabriele, NMWD, pers. comm.).

Chloride is a conservative ion, meaning that it does not change forms or bind readily to soils, and is therefore considered a good indicator of water salinity. Chlorides occur in waters derived from both marine and terrestrial sources such as surface waters (fluvial or creek, run-off, etc.) and groundwater, with mineral content of terrestrial sources determined by weathering of rocks native to the area. Primarily for aesthetic reasons, DHS has set the recommended maximum contaminant level (MCL) for chloride at 250 mg/L (NMWD 1997). The upper MCL is 500 mg/L (NMWD 1997). A chloride concentration of 250 mg/L is considered the taste threshold for most people, however, often people can taste levels as low as 100 mg/L (NMWD 1997). Elevated salinities can also create problems with primary drinking water standards through creation of disinfection by-products. The MCL for chlorites is 1.0 mg/L. In addition to these concerns, elevated chlorides can negatively affect people with sodium issues and are often accompanied by increases in manganese that result in discoloration of treated water effluent (NMWD 1997). NMWD has established 100 mg/L as its threshold (NMWD 1997).

Salinity intrusion is a common concern for water districts located in coastal watersheds that rely on groundwater for supplies. Typically, this type of salinity intrusion problem results from overpumping of "fresh" aquifers for municipal and agricultural water supplies, which allows intrusion of underlying marine-dominated saline "groundwater" from bays or oceans to move landward. Based on groundwater gradient data collected to date, there is no evidence that this phenomenon is occurring in the Lagunitas Creek watershed (Questa Engineering Corp. 2001). Despite considerable study, the exact cause of salinity intrusion in the Coast Guard Wells is still uncertain, but mechanisms governing salinity intrusion are likely to be complex and involve a combination of many factors. Starting in the early 1990s, when the Park Service began discussions with the

Giacominis regarding purchase of the Giacomini Ranch, a number of studies have been conducted to evaluate salinity intrusion dynamics at the Coast Guard wells, including studies by Philip Williams and Associates (1996a; 1996b), NMWD and Soldati Engineering (NMWD 1997), and Kamman Hydrology & Engineering, Inc. (KHE 2006a) as part of baseline studies for the proposed project.

Salinity intrusion into the Coast Guard wells first occurred in 1976-1977 coinciding with an extreme two-year drought event (NMWD 1997). In the 1970s, the Giacomini family was still installing the gravel summer dam each summer downstream on Lagunitas Creek for the purposes of drawing irrigation water to increase pasture forage (See Water Resources for more detailed description). The summer dam was located approximately 2,500 feet downstream of the Green Bridge and 5,700 feet downstream of the Coast Guard wells (NMWD 1997). In addition to providing irrigation waters for Giacomini, the summer dam had the additional benefit of being "an effective barrier to prevent saltwater from flowing upstream in the groundwater basin during high tide cycles and contaminating the District's Coast Guard wells" (NMWD 1997). The dam created a pond that was about 7-feet deep and extended about 1.75-miles upstream, inundating approximately 17-acres (SWRCB 1995). Giacomini typically installed the dam in May or June, with removal occurring in November or December, often by large creek flows associated with rainfall events (NMWD 1997).

In 1976, when the gravel dam was removed on January 18, 1976, chloride levels within the wells rose from 29 mg/L to 106 mg/L in 10 days, peaking at 230 mg/L on February 10, and did not dip below 100 mg/L until March 1977 (NMWD 1997). Creek flow had been below 4 cfs for several months and, during the month of January, consistently fell below 3 cfs, dropping as low 1.6 cfs during this period (USGS Point Reyes gage). The day following removal of the dam, predicted tides at Inverness peaked at 6. 1 feet MLLW, with salinity intrusion occurring approximately 8 days after the last high tide exceeding 5.5 feet MLLW. The following winter, the dam was removed on January 4, 1977, and chlorides within the well rose to 198 mg/L, approximately 10 days after the end of the last higher high tide series. From 1976 through 1997, salinity intrusion events as determined by chloride levels exceeding 100 mg/L occurred in six separate events: January-February 1976, January - May 1977, December 1977, December 1980-January 1981, January-February 1981, and December 1986 (NMWD 1997). Based on monthly and weekly data collected by NMWD, well chloride concentrations remained far below 100 mg/L between 1987 and 1997 (NMWD, unpub. data *in* KHE 2006a).

Based on qualitative analysis of the data, NMWD was not able to find a strong correlation between high tides and salinity intrusion events, perhaps because of the "noise" generated by so many other factors such as pumping rates, dam operation, etc. However, through an analysis of patterns in the data, NMWD concluded that, during this period, salinity intrusion events appeared to occur when several factors coincided, specifically 1) the dam was down, 2) Lagunitas Creek flows were lower than 5 cfs for several weeks, and 3) tides as predicted for Inverness exceeded 6.4 ft MLLW (NMWD 1997). Other findings included that infrequent high chloride levels recorded in the creek typically occurred one to two weeks before elevated chlorides were detected in the well and that, once salinity intrusion occurred, chloride levels would remain elevated (>100 mg/L) from three weeks to as long as 16 weeks (NMWD 1997). Earlier, PWA concluded that the Coast Guard wells could operate without saltwater affecting the wells for flows above 6 cfs, although the occasional spring tide would push the salinity front upstream above the wells at high tide (PWA 1996b). PWA also noted the "considerable time lag" of one week between occurrence of high chlorides in the creek and high chlorides in the well (PWA 1996b).

Between 1970 and 1997, when the summer dam was installed annually, salinity intrusion appeared to only occur in the winter or season of higher high tides -- typically December through February with tides exceeding 6.0 feet MLLW -- when the dam was down, but streamflows were low (<5-6 cfs), either because the rainy season had not started yet or because of drought (1976-1977). The one salinity intrusion that occurred when the dam was installed took place during the drought when the dam was put in after the winter high tide series, thereby probably trapping saline waters that could be diluted by the minimal streamflow present (NMWD 1997).

In the 1990s, several events occurred that caused NMWD to become concerned about the long-term future of the Coast Guard wells in terms of providing potable water to West Marin customers. The State Water Resources Control Board (SWRCB) was reevaluating the advisability of continuing to issue permits to the Giacominis for annual installation of the gravel summer dam at its historic location upstream of White House Pool because of concerns regarding impacts to beneficial uses within Lagunitas Creek such as water quality and support of wildlife, particularly to coho salmon and steelhead. In 1995, the SWRCB issued a decision to not issue the Giacominis a permit for installation of the gravel summer dam at that location, effective in 1997, although it did not prohibit location of a dam upstream of Highway 1 bridge during a specified period. The

SWRCB also mandated minimum in-stream flow requirements of 8 cfs during average- and wet-year summers and 6 cfs during dry-year summers as measured at the Samuel P. Taylor USGS gage, with instream flow requirements rising to 20 cfs required in November.

Concurrently, the Park Service began actively discussing with the Giacomini family purchase of 550 acres of the Giacomini Ranch for wetlands restoration. Specifically, NMWD was worried that wetland restoration through removal of levees would move the saltwater-freshwater interface upstream closer to the wells (NMWD 1997). While the feasibility study conducted in 1993 only fleetingly referred to the salinity intrusion issue (PWA et al. 1993), the Park Service subsequently contracted with PWA to evaluate in greater detail the potential for the restoration project to increase salinity intrusion into the Coast Guard wells. A number of technical memoranda were prepared in April and May 1996 (PWA 1996a, 1996b).

Concerned about the loss of the gravel dam and the potential for the ranch to be restored to tidal wetlands, NMWD contracted with Soldati Engineering to analyze all of the water quality and other data collected to date to assess the potential for future salinity intrusion events and identify ways to provide adequate, good quality water to the West Marin area given the coming changes. The NMWD study (1997) recommended several potential mitigation measures, including further development of the Gallagher Well and construction of a connecting pipeline. In addition, NMWD started performing off-tide pumping. Under this practice, NMWD stops pumping for a six hour period (three hours before to three hours after) peak tides, when the predicted tide at Inverness is greater than 5.9 feet. Based on NMWD data, with implementation of the off-tide pumping practices, there have been a few periods since 1997 in which the salinity intrusion threshold of 100 mg/L either came very close to being exceeded (>90 mg/L; August 2001, October 2002 June 2003) or was exceeded (>100 mg/L; November – January 2003; July – September 2004; NMWD, unpub. data). There were no salinity intrusion events in 2005.

As part of the Point Reyes Affordable Housing Project, Questa Engineering Corp. performed a hydrogeologic investigation for the area located west of the USCG property in the town of Point Reyes Station on Mesa Road (Questa Engineering Corp. 2000). Because of concerns related to the impact of proposed leach fields on the Coast Guard wells and municipal water supply, Questa (2000) performed a detailed groundwater investigation and analysis. Questa (2000) determined that the housing project largely occurred outside the Zone of Contribution or recharge area to the Coast Guard wells. Groundwater gradients generally followed topographic gradient with waters flowing from the coastal marine terrace uplands into the adjacent Lagunitas Creek aquifer in which the Coast Guard wells are constructed (Questa Engineering Corp. 2000). However, while groundwater generally followed topographic gradients, to the east and southeast of the housing project, "there is a distinct turning of the groundwater contours towards the east that reflects the draw-down influence of the NMWD water wells" (Questa Engineering Corp. 2000). Questa (2000) concluded that the area where this shift in groundwater gradient direction occurred represented the apparent Zone of Contribution or recharge area for the Coast Guard wells, which appears to be oriented along the axis of Lagunitas Creek (Questa Engineering Corp. 2001). Questa noted in its report that, while the Coast Guard wells are "recharged largely by the streamflow/underflow of Lagunitas Creek," lateral inflow from the adjacent hills appears to play a role, as well, although probably "to a lesser degree."

As part of its investigation, Questa collected water samples from monitoring wells for analysis in December 1999, January 2000, and March 2000. Despite the fact that it was winter, chloride concentrations in groundwater sampled during this period still ranged from 48 to 138 mg/L, compared to 18 to 35 mg/L for well and creek water samples collected by NMWD during all of 1999 (Questa Engineering Corp. 2000). Water quality testing results indicate that elevated late-season chloride concentrations in groundwater are reduced significantly through the winter wet season, likely due to increased surface water recharge (KHE 2006a). In its response to comments on the draft EIR, Questa postulated that "tidal effects in Lagunitas Creek in the vicinity of the NMWD wells are more likely to have a stabilizing influence on groundwater levels during drought conditions" by maintaining the existing groundwater gradient and, thereby, the existing groundwater travel time from the eastern boundary of the housing project to the wells, estimated to be on the order of 2 to 3 years (Questa Engineering Corp. 2001).

As part of hydrologic analyses and modeling contracted for under the proposed project, KHE evaluated prior research into salinity intrusion events, as well as data collected by both NMWD and the Seashore. NMWD data included discrete water quality data (weekly and quarterly samples that include chloride and other ions), pumping rates, stream flow, predicted tides at Inverness, well completion reports, and miscellaneous correspondence (KHE 2006a). The Seashore and KHE also collected additional topographic information upstream of the Green Bridge to improve hydrodynamic model calibration, discrete water samples and salinity sampling during high tides, and continuous water level and salinity data for portions of September and

October 2005. NMWD also collected additional discrete sample data during a high tide series in October 2005. Representatives from KHE and the Seashore met with NMWD representatives several times to coordinate monitoring efforts and discuss available data and preliminary findings. One of the factors that improved data analysis capabilities relative to the 1997 efforts was the availability of continuous water quality data (continuous quasi-conductivity data), which is collected at the treatment plant by NMWD. This data provided a finer level of detail on fluctuations in salinity at the treatment plant in relation to stream discharge, pumping, and tides. Both monitoring and modeling investigations focused on the reach or section of Lagunitas Creek adjacent to the NMWD Coast Guard wells, which previous studies had pointed to as the area where infiltration was probably occurring.

Continuous and discrete monitoring data collected by KHE and the Seashore during the low-flow period in September-October 2005 indicate that tidally-driven water level changes occur in Lagunitas Creek adjacent to the Coast Guard wells when predicted tides at Inverness exceed approximately 3.7 feet MLLW (KHE 2006a). However, tides did not increase water salinity from base levels of approximately 0.1 ppt until water levels in the creek reached approximately 5.1 feet and predicted tides at Inverness had risen to approximately 4.8 to 5.0 feet MLLW (KHE 2006a). The maximum salinity observed in this period occurred when predicted tides reached 5.73 feet at Inverness and was 1.5 ppt, with 1 ppt of seawater containing approximately 560 mg/L of chloride (KHE 2006a). Salinities quickly returned to baseline concentrations once tide levels dropped, suggesting that creek flows – which averaged 9.0 cfs during the monitoring period – quickly flushed salts out of this portion of the creek (KHE 2006a). In addition, no strong stratification occurred within this "pool," meaning that there was no meaningful difference in salinity between surface and bottom waters (KHE 2006a).

Because salinity intrusion has been believed historically to be related to surface flows or shallow subsurface flow governed by surface flows, the KHE model did not include groundwater. Data analysis and hydrodynamic modeling of surface water flows by KHE (2006a) focused primarily on conditions in the reach of Lagunitas Creek adjacent to the Coast Guard wells since 1997, after the old summer dam was discontinued. As flows during the monitoring period exceeded average and dry-year minimum flow requirements, KHE used the monitoring data to calibrate the hydrodynamic model and investigated maximum summertime salinities under both average-year (8 cfs) and dry-year (6 cfs) flows (KHE 2006a). Simulation results suggested that the highest salinities under average-year flows would be approximately 1.6 ppt and would exceed 1.5 ppt only 1 percent of the time. Under average-year summer flow and high tide conditions, simulated average salt concentrations would reach 700 mg/L in a 330-foot reach or section of Lagunitas Creek during a tide series where water levels exceed 5.5 feet MLLW and peak at over 6 feet MLLW (KHE 2006a). With a 2 cfs drop in streamflow to 6 cfs, maximum salinities would increase to approximately 3.2 ppt and would exceed 3.0 ppt less than 1 percent of the time (KHE 2006a). Under dry-year summer flow and higher high tide conditions, simulated average salt concentrations would climb to 1,692 mg/L in the 330-foot section of Lagunitas Creek adjacent to the Coast Guard wells (KHE 2006a). Because the model is incorporating extreme boundary conditions (freshwater to saltwater), the model sometimes overestimated and sometimes underestimated salinities relative to observed salinities, but differences between simulated and observed on the higher high tides modeled never differed more than by 0.3 ppt, which is well within generally accepted industry standards for hydraulic modeling (KHE 2006a).

Based on review and analysis of monitoring data and modeling results, KHE (2006) concluded that the process of chloride delivery to the wells is more complicated than simply intrusion of saltwater during high tides and low-flow events, and other mechanisms may be contributing or even account for delivery and sources of salt to the wells. Important observations, trends, and conclusions from the KHE study (2006a) and other studies are:

- Analysis of the long-term monitoring data from NMWD and data collected by KHE and the Park Service suggest that patterns in salinity observed since 1997 represent two superimposed – and possibly interconnected – trends.

- A large-scale, quasi-seasonal trend sometimes resembling a left-skewed bell curve in which salinity generally (but not always) increases abruptly in summer each year after streamflows drop below 9–10 cfs – often around July -- and continues to either steadily or incrementally increase through the summer to the fall or early winter when it peaks and then gradually tapers off through late winter and spring. The decrease in salinities appears to steadily taper off regardless of increases in stream discharge associated with reservoir releases or fall storm events. In some years, the bell curve pattern is not as strong, and/or salinities do not peak until as late as November.

- Superimposed on top of this large-scale, quasi-seasonal trend are a number of temporary (< 1 week in duration) spikes or increases in salinity that may contribute to the incremental increase in chlorides observed in the quasi-seasonal trend. These spikes as measured by the continuous quasi-conductivity or "Virtual Salinity" data collected by NMWD at its treatment plant show the following relationships:

    1) Occur only in periods of low flows less than 9–10 cfs;
    2) Typically occur in periods of maximum well-pumping rates (summer-time pumping rates);
    3) Occur only when spring tides exceed 5.5 - to 5.7 feet MLLW (even though higher salinity waters reach the vicinity of the Coast Guard wells when predicted tides at Inverness are as low as 4.8 to 5.0 feet MLLW).
    4) Consistently occur approximately 5- 10 days after a 5.5 to 5.7 feet MLLW spring or high tide event, typically during a neap or low tide event;
    5) Manifest as a single peak regardless of the number of days of high tide events the previous week;
    6) May potentially be connected with the large-scale, quasi-seasonal trend such that base-level chloride concentrations may rise in an incremental or stair-step fashion after each "spike" event;

- Boring logs for the Coast Guard wells indicate a 15-foot thick clay layer occupies the intervening area between the creek bed and the deeper water-bearing gravels in which the wells are screened (KHE 2006a). If this clay layer is laterally continuous, it would retard significant exchange of water and salts between creek and well intake (KHE 2006a). Questa (2000) provided some support for this finding, as it found that, in some areas, including within the estimated recharge area to the Coast Guard wells, the groundwater table appears to be confined or under pressure, presumably from an aquitard or stratum within the soils that confines water below.

- The similarity in seasonal chloride concentrations between the coastal marine terrace aquifer (Questa Engineering Corp. 2000) and Coast Guard wells (NMWD, unpub. data), coupled with the documented creekward gradient of terrace groundwater and observed shifting of the groundwater gradient near the wells due to drawdown by the wells (Questa Engineering Corp. 2000), suggest that the terrace aquifer may be at least one contributing source of chloride to the Coast Guard wells.

Based on the available information, KHE (2006a) has developed some preliminary conclusions regarding the possible scenario for salinity intrusion into the NMWD groundwater wells (KHE 2006a). Ultimately, salinity intrusion appears to be controlled by a combination of factors, including tidal height, streamflow discharge, pumping rates, and possible influence from the adjacent terrace groundwater aquifer. Based on virtual salinity or conductivity data, predicted tides at Inverness of approximately 5.5 to 5.7 feet MLLW appear to the threshold at which salinity "spikes' begin to occur, with tides exceeding 5.5 to 5.7 feet MLLW producing an almost linear response in virtual salinity levels such that the sharpness of the salinity "spike" appears strongly correlated with tidal height. Salinity intrusion events during which NMWD experience chlorides exceeding 100 mg/L appear to correlate with exceeding 5.9 to 6.0 feet MLLW (NMWD 1997, NMWD, unpub. data). The assumption in previous studies has been that the point of infiltration occurs at the Coast Guard wells. However, a number of factors, including the impervious stratigraphy where the Coast Guard wells are drilled; the discrepancy between when tidal influence occurs at the Coast Guard well (~4.8 to 5.0 feet) and the threshold at which virtual salinity begins to rise (~5.5 to 5.7 feet); and the long lag time between high tides and actual intrusion into the wells (~5 to 7 days), point to the point of infiltration being upstream of the section or reach of Lagunitas Creek adjacent to the Coast Guard wells. The triggers of salinity intrusion are described based on tidal water level elevation. It should be noted that potential effects of sea level rise would result in general increases in tidal elevations, subjecting the areas within the description area to greater tidal influence.

The exact point or points upstream of the Coast Guard wells where saltwater infiltrates the alluvial aquifer is unknown, but it is possible that at least one of the locations at which infiltration currently occurs is at the Downey Well. The Downey Well, drilled in December 1977 in the streambed gravel bar, is shallow, with bedrock occurring only 25 feet below ground surface. The well was taken out of service in 1982, because of continual maintenance problems and problems with the quality of well from the well (e.g., highly turbid; NMWD 1997). Since construction, Lagunitas Creek has migrated and "captured" the well, such that the well is now in the center of the creek (NMWD 1997). The well was operated infrequently between 1993 and 1997 for additional irrigation waters for Giacomini, but since 1997 and discontinuation of the gravel summer dam, it

has been used every summer to provide the Giacominis with irrigation water (NMWD 1997). As elevated chloride concentrations first occurred prior to drilling of the Downey Well, it is possible that there are other infiltration points, as well, where localized stratigraphy of the streambed allows or allowed infiltration of tidally influenced waters into the alluvial aquifer. Based on the fact that salinity intrusion prior to 1997 was associated with tides exceeding 6.4 feet MLLW (NMWD 1997), this infiltration point would probably also be upstream of the Coast Guard wells.

Hydraulic modeling information suggests that the Downey Wells should become exposed to tidal influence when predicted tides at Inverness reach 5.7 feet MLLW, which corresponds approximately to the tidal range (5.5 feet – 5.7 feet MLLW) at which spikes in virtual salinity or conductivity first become apparent at the Coast Guard wells (G. Kamman, KHE, *pers. comm*.). Pumping of the well during the summer may exacerbate salinity intrusion by increasing capture of tidally influenced waters into the alluvial aquifer. The role of pumping may account for the difference in lag time between high tides and salinity between summer and winter: during the early winter, when pumping rates are down, lag times appear to lengthen from 5 to 7 days to 10 days. From this potential infiltration point, located approximately 3,400 feet upstream of the Coast Guard wells tidally influenced waters would have to flow horizontally through the interbedded layers of alluvial gravels and fines to reach the Coast Guard wells and treatment plant. The exact amount of time that it would take waters from the Downey Well to reach the Coast Guard Wells would depend on horizontal conductivity rates of the alluvial aquifer soils, but 5- to 10 days appears reasonable based on the stratigraphy that is presumed to exist between these well locations (KHE 2006a).

During periods when stream discharge is below 10 cfs and pumping rates are elevated, spring tides move some distance upstream on Lagunitas Creek from the Coast Guard wells before they infiltrate into the alluvial aquifer. Once tidally influenced waters reach the Coast Guard wells, elevated summer-time pumping rates may increase horizontal hydraulic conductivity rates and promote capture of these waters by the Coast Guard wells. The contribution of pumping can be seen from the fact that, during periods when pumping rates drop during the summer and tides exceed 6.0 feet MLLW, the sharpness of the salinity spikes is reduced. The temporary tidally influenced "spikes" in salinity typically dissipate in less than a week. However, even after dissipating, they may potentially contribute to the incremental or stair-step pattern in salinity increases that appears to occur seasonally in chloride concentrations, at least during most years.

As freshwater flows increase and the frequency of spring tides decrease in the fall, chloride concentrations in the alluvial aquifer still tend to taper off very gradually, which may result in part from the fact that decreased pumping rates for both the Downey and Coast Guard Wells during the fall are reducing infiltration capacity and/or conductivity rates and thereby increasing the amount of time needed to "recharge" the alluvial aquifer with fresh water from the stream. Through the winter and spring, salts in the alluvial aquifer are steadily diluted with freshwater from increased stream discharge, except perhaps in periods or years where rainfall is very low.

By late spring of average and wet years, salinities have dropped to "baseline" conditions, which are probably determined by chloride concentrations in the adjacent terrace groundwater aquifer. Even in winter, chloride concentrations in groundwater sampled near the wells still ranged from 48 to 138 mg/L (Questa Engineering Corp. 2000). During dry years, the significant reduction in streamflow, particularly during past years when the SWRCB had not mandated minimum instream flow rates, may have increased the influence of this terrace groundwater aquifer on alluvial aquifer and may have exacerbated the problems with extremely low streamflow during the spring or high tide series that caused several salinity intrusion events during the 1976-1978 period. Even during average or wet years, the terrace groundwater aquifer may contribute to the incremental increase in chloride levels over the summer and fall. However, it is safe to assume that generally, the system involves both surface water-recharge of alluvial aquifers, perhaps at defined infiltration points or locations upstream of the Coast Guard wells, as well as some degree of lateral inflow from the terrace groundwater aquifer.

Wastewater Treatment and Disposal

Regional and Project Area Setting

The urban area of Marin County is unique in the way that it deals with its sewage disposal (Marin County Grand Jury 2003). In other urban areas, either cities/towns provide sewage collection and treatment (San Francisco), or a large agency provides these services for several cities and towns (East Bay Municipal Utility

District (Marin County Grand Jury 2003). In the urban area of Marin, more than 19 different sewer districts or agencies carry out this function (Marin County Grand Jury 2003). None of these agencies can require a property owner outside its boundaries to join the district and connect to a sewer line. For this reason, many homes in unincorporated areas of the county such as West Marin or even some within town limits are on individual sewage disposal systems that are located on-site, including septic tank and leach field systems, holding tanks, and seepage pits.

The number of on-site sewage disposal systems (OSDS) within the county is unknown. The County of Marin Environmental Health Services (EHS) has an inventory on microfiche (approximately 3,500), an inventory of parcels based upon permits issued (approximately 3,128), and an inventory developed using the Geographic Information System (GIS) (approximately 6,941 that meet the dollar threshold to be included; Marin County Grand Jury 2003). Although the combined lists have considerable overlap, EHS makes no claim that all individual septic systems within Marin County have been identified in the three inventories (Marin County Grand Jury 2003). It is possible that many of the oldest septic systems have not been included in these inventories (Marin County Grand Jury 2003).

Within the Tomales Bay watershed, the unincorporated areas are served almost entirely by various types of on-site sewage disposal systems. According to Marin County Community Development Department data, approximately 1,300 parcels within 100 feet of Tomales Bay and its tributaries have on-site disposal systems (RWQCB 2005). DHS conducted some additional studies in 2001and found that, of the known 2,260 parcels in the study area, approximately 1,600 parcels are assumed to have on-site disposal systems (DHS 2001 *in* RWQCB 2005).

Some exceptions to individual on-site treatment are the U.S. Coast Guard (USCG) housing complex, which operates a gravity-fed collection system feeding into three holding tanks with a total capacity of 13,000 gallons for approximately 150 homes (EDAW 2001). This waste is hauled out several times a week to the USCG's Two Rock facility for treatment (EDAW 2001). In addition, the community of Tomales opened a sewage collection and service system in 1977. The system is designed to handle waste from the existing residences and commercial establishments, the school facilities, and approximately 50 new residential units. Any development beyond that would require the expansion of the treatment plant facilities. In the mid-1970s, the USCG had proposed to collaborate with downtown Point Reyes Station in developing a community sewer and wastewater treatment facility, which would have utilized the Giacomini Ranch for spray irrigation, but the town did not approve funding for its share of the project (EDAW 2001).

One of the major issues that has been debated in recent years in relation to on-site disposal systems is the question of how well most of these existing systems are functioning and what role they are playing in Tomales Bay's water quality problems. In its 2001 study, DHS found that, of the parcels surveyed, many of the residences are unsuitable for an on-site disposal system (DHS 2001 in RWQCB 2005). The majority of the parcels lack sufficient available land to install an on-site disposal system that meets the required sanitary setbacks and construction standards, and site conditions reduce the potential for proper functioning of these systems.

Following these surveys, DHS gathered more information on on-site disposal system functionality through shoreline surveys, survey questionnaires, and file reviews (DHS 2001). The study concluded that, along the Tomales Bay shoreline, 134 systems have extremely limited area available to properly operate an on-site disposal system with a leach field (DHS 2001). Another 533 septic parcels are located within 100 feet of surface water, with 743 parcels between 100 and 500 feet from surface water (DHS 2001). There are at least 15 flood-prone parcels in the vicinity of Lagunitas Creek and Highway 1, and septic systems on these properties will likely fail during flood events (DHS 2001). All of the estimated 1,600 parcels with on-site disposal systems have poor soils for septic absorption fields as determined by USDA (DHS 2001). In a recent representative study conducted on the town of Marshall, 24 percent were considered to be failing, and another 16 percent were considered marginal (CSW/Stuber-Stroeh, Inc. 2002 *in* RWQCB 2005).

The County of Marin is currently planning to construct wastewater facilities on the east shore of Tomales Bay to serve up to 38 developed lots in the Marshall area, with possible future service of an additional 20 developed lots to the south (Leonard Charles and Associates 2007). The County may also propose to establish a new County Service Agency (CSA) to provide for operation and maintenance of community wastewater systems and to facilitate the local on-site wastewater management program (Leonard Charles and Associates 2007).

Regulatory and Policy Setting

The State of California regulates on-site disposal systems through the State Water Resources Control Board (SWRCB) and its districts, such as the San Francisco Regional Water Quality Control Board (RWQCB). California Water Code §13291(b) establishes minimum requirements for the permitting, monitoring, and operation of on-site disposal systems for preventing conditions of pollution and nuisance, although Regional Water Boards and local agencies implementing regulations retain the option of establishing requirements for on-site disposal systems that are more protective of water quality than the requirements contained in the code. These regulations apply to all new and existing on-site disposal systems, although they are addressed differently.

In Marin County, the RWQCB has ceded its authority over regulation of on-site treatment systems to the County. In 1971, the County of Marin enacted legislation (amended in 1978, 1984, and1987) that requires that construction of individual wastewater treatment systems be permitted by the County of Marin Environmental Health Services. It also directs the Public Health Officer to inspect all individual septic systems every two years and to approve their continued use (County Code 18.06; Individual Sewage Disposal Systems). In addition, when one or more bedrooms are added to a residential property, the Marin County Code requires an inspection of the septic system and, when necessary, requires that the septic system be upgraded. The Code prohibits construction, use, or maintenance of any component of an individual wastewater treatment system that is injurious to the public health and welfare or that is operated "in such a manner as to overflow onto public or private land or affect any river, stream, creek, spring, lake, pond, reservoir, swamp, ocean, bay, water supply, or water system."

On-Site Sewage Disposal Systems in the Project Area and Vicinity

Almost all of the parcels in Point Reyes Station and Inverness Park that adjoin the Project Area probably currently rely on on-site sewage disposal systems. Approximately 65 percent of the Project Area's eastern perimeter in Point Reyes Station is adjacent to parcels with on-site sewage disposal systems. Because these are individually owned and operated systems, information about the type and age of system and the exact location of these systems is not available. However, most of these systems are probably similar to those commonly used in the rest of Point Reyes Station, such as septic, cesspools, mound systems, and other methods that discharge into the ground. As most of the parcels in Point Reyes Station are on an elevated mesa that is anywhere from 30- to 50- feet higher than the pastures, most septic systems would be expected to be from 18- to 40- feet above the general grade of the pasturelands in the Giacomini Ranch. Within the Dairy ranch facility, the house and some of the outlying buildings probably incorporate some type of on-site sewage disposal.

The southern perimeter of the Project Area is the least developed and, therefore, would be expected to have the fewest number of septic systems. Approximately 40 percent of the southern perimeter falls adjacent to parcels that probably have on-site sewage disposal systems.

The entire (100 percent) of the western perimeter of the Project Area is bordered by parcels that likely have on-site disposal systems. Most of these homes are constructed on the slopes of the Inverness Ridge and are, therefore, at least 5 feet or more above the general grade of the surrounding pasturelands. At least four to five parcels with residential development are directly contiguous with the West Pasture. While detailed schematics are not available, the layout of the parcels would suggest that leachfield development primarily occurred at the rear of the houses.

These systems were constructed at the apex of alluvial fans, which are comprised of depositions of angular, coarse-grained sand to fine-grained granitic gravel material emanating from the mouths of creeks draining off the Inverness Ridge as flows abruptly reach the much lower gradient elevations of the West Pasture (KHE 2006a). Two (2) of the four (4) properties adjoining the West Pasture with on-site wastewater disposal systems are located within 100 feet of a stream, and a third is located within 100- to 500 feet of a stream. These parcels are subject to regular flooding by these creeks under even small- to medium stormflow events and also lie in the 100-year floodplain for Lagunitas Creek.

In addition to numerous creeks, the Inverness Ridge also discharges a considerable amount of groundwater that emerges in many areas at the base of the Inverness Ridge and either sheetflows across the pasture or travels sub-surface in a shallow water table (KHE 2006a). Based on monitoring of water tables conducted as part of the proposed project, it would appear that the groundwater table falls approximately 3 – to 9 feet

above the groundwater table during most of the season, although, depending on the parcel, leach fields may be subject during rainfall events to regular surface flooding from Inverness Ridge creeks and an increase in emergent surface and sub-surface groundwater flow into the West Pasture.

Traffic and Transportation

The sharp juxtaposition between parkland and rural communities has significantly increased the potential for transportation problems along West Marin's largely narrow, two-lane road system, particularly considering its proximity to the highly urbanized San Francisco Bay watershed. In general, Marin County is progressive in terms of encouraging alternative transportation, but even alternative transportation sometimes comes with economic or environmental "costs" that makes implementation a delicate balancing act between competing social and ecological issues. This is nowhere more evident than in West Marin, where community members have sought for decades ways of improving safe and energy-efficient alternative transportation for both residents and visitors, but have had efforts stymied by the fact that most potential routes would cause impacts to the very natural resources that have drawn most of these people to live or visit here. These issues are complicated further by the fact that seemingly similar objectives such as increasing bicycle and/or pedestrian access are motivated by different and often conflicting goals such as transportation versus nature experiences that may ultimately lead to different types of solutions. Within this document, the issue of pedestrian and bicycle "transportation" is addressed under Traffic and Transportation, while trails and other types of public access for both visitors and local residents are addressed under Visitor and Resident Experience. Resolution of these complex environmental and social issues will require a delicate balance to be struck between competing concerns, values, and resources.

Regulatory and Policy Setting

Within Marin County, policies on transportation largely focus on reducing congestion, while encouraging alternative modes for transportation, including use of mass transit and bicycle and pedestrian access.

In August 2005, President Bush signed the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) into law. SAFETEA-LU is a comprehensive bill that funds various surface transportation programs at a total of $286 billion over five years and includes many provisions relating to the Park Service, including reauthorization of the Park Roads and Parkways Program (PRPP) and a new alternative transportation program for parks and other public lands. On a state level, Propositions 111 and 116 passed by voters in 1990 triggered state legislation requiring urban counties to establish a Congestion Management Agency (CMA) to create, update, and administer a Congestion Management Plan (CMP) for the county. The purpose is to establish Levels of Service (LOS) for designated freeways, state highways, and local arterials and to maintain those standards by increasing capacity or managing travel demand on those roads. The CMA annually monitors service levels on freeways, state highways, and routes of regional significance as part of the annual update. State Route 1 from SFD to PRS is part of the designated roadway network. Under CEQA, the County also evaluates changes in traffic conditions, with projects creating changes dropping the Level of Service (see description below) below Level D considered a "significant" impact.

Within the Coastal Zone, which incorporates the Project Area, the LCP (Marin County Comprehensive Planning Department 1981) specifically identifies Sir Francis Drake Boulevard as providing a scenic driving experience for coastal visitors and an important access road for local residents. The LCP (Marin County Comprehensive Planning Department 1981) notes that, "in order to protect its scenic rural character, the road shall be maintained as a two-lane roadway." The LCP (Marin County Comprehensive Planning Department 1981) concluded that "Sir Francis Drake has adequate capacity to handle increased recreational and local traffic, although traffic patterns do occasionally create hazardous conditions for pedestrians and bicyclists in the areas of Inverness and Inverness Park." In addition, the LCP (Marin County Comprehensive Planning Department 1981) identified the need to expand public trails and bike paths both on federal and non-federal lands, but also stresses the need to ensure that they are compatible with the protection of natural resources and "the unique qualities of Marin's coast." Specifically, the concept of a bike/pedestrian trail network that would connect the villages and provide access to public parks was supported (Marin County Comprehensive Planning Department 1981). This issue is discussed further under Visitor and Resident Experience.

The Point Reyes Station Community Plan (Marin County Community Development Agency 2001) focused on the lack of off-street parking as a concern, given the steady increase in numbers of visitors and area residents. All new structures and uses are required to provide off-street parking scaled to the level of use

(Marin County Community Development Agency 2001). The Community Plan (2000) also supports efforts to reduce congestion through alternative transportation, including efforts to identify appropriate locations for paths that could be used for both bicycle commuting and recreation, including investigations into the feasibility of using the abandoned railroad right-of-way.

Transportation Patterns and Traffic Issues in the Project Area and Vicinity

In general, existing and projected future transportation issues are defined, at least for roads and intersections, using Level of Service (LOS) criteria. Separate criteria are established for roads, signalized intersections, and stop sign-controlled intersections. LOS for intersections is typically based on the amount of delay measured in seconds between when a vehicle reaches an intersection, including a queue, and when it passes through the intersection. LOS for roadways uses a Volume-to-Capacity ratio based on conditions of free flow and the amount of restriction on maintaining speed limits or safe speeds for roadway conditions within designated areas. Criteria applicable to the Project Area are shown in Tables 22 and 23.

TABLE 22. STOP SIGN-CONTROLLED INTERSECTION LOS DESIGNATIONS

LOS	Vehicle Delay (seconds)	Description
A	<10	Little or no delay.
B	>10 – 20	Short traffic delay.
C	>20 – 35	Average traffic delay.
D	>35 – 55	Long traffic delay.
E	>55 – 80	Very long traffic delays.
F	>80	Excessive traffic delays.

Source: Highway Capacity Manual Third Edition

TABLE 23. ROADWAY LOS DESIGNATIONS

LOS	Volume to Capacity (V/C) Ratio		Description
	Freeways	Arterials	
A	0.00 – 0.35	0.00 – 0.60	Conditions of free flow. Speed is controlled by driver's desires, speed limits or physical roadway conditions, not other vehicles.
B	0.36 – 0.54	0.61 – 0.70	Conditions of stable flow. Operating speeds beginning to be restricted, but little or no restrictions on maneuverability.
C	0.55 – 0.77	0.71 – 0.80	Conditions of stable flow. Speeds and maneuverability somewhat restricted. Occasional back-ups behind left-turning vehicles at intersections.
D	0.78 – 0.93	0.81 – 0.90	Conditions approach unstable flow. Tolerable speeds can be maintained but temporary restrictions may cause extensive delays. Speeds may decline to as low as 40 percent of free flow speeds. Little freedom to maneuver, comfort and convenience low.
E	0.94 – 1.00	0.91 – 1.00	Unstable flow with stoppages of momentary duration. Average travel speeds decline to one-third the free flow speeds or lower, and traffic volumes approach capacity. Maneuverability severely limited.
F	>1.00	>1.00	Forced flow conditions. Stoppages for long periods, and low operating speeds (stop-and-go). Traffic volumes essentially at capacity over the entire hour

Source: 2003 Performance Measures Monitoring Report Highway Capacity Manual Third Edition

The Project Area only has two road segments within its boundary – a portion of a regional roadway, Sir Francis Drake Boulevard or Levee Road, and a portion of Bear Valley Road. Otherwise, most of the roads occur at the perimeter or in the vicinity of the Project Area and include a variety of state, regional, and local roadways. Existing conditions for these roads, as well as for parking, mass transit, and other transportation modes, is discussed in more detail below.

While LOS is often provided only for current conditions, projections can be made into the future based on anticipated increases in population or visitation to an area. The Seashore contracted with BRW and Lee Engineering (1998) to provide an evaluation of existing and projected future conditions on Park Service, state, and county roads. To assess future conditions, BRW and Lee Engineering (1998) analyzed trends in the San Francisco Bay region population growth and trends in visitation and conclude that visitation would increase 1 percent annually from 1998-2010. Based on this conclusion, traffic count data for local, regional, and state roadways were factored by a growth rate of 1.0 percent per year to evaluate impacts of increases of this magnitude on LOS within the general Point Reyes area (BRW and Lee Engineering 1998).

However, since 1998, park visitation has not increased 1 percent annually. Visitation reached a peak of 2,579,949 in 1992 (NPS, unpub. data). In 1998, visitation totaled 2,477,409 (NPS, unpub. data). In 2004, visitation actually had dropped to 1,960,055, a drop of 21 percent (NPS, unpub. data). Visitation rose slightly in 2005 to 1,988,585 (NPS, unpub. data). However, BRW and Lee Engineering had projected that visitation would total 2,750,000 in 2005 based on a 1 percent annual increase, a difference of 28 percent or 761,415 annual visitors relative to actual numbers of visitors in 2005. By 2010, annual visitation was projected to climb to 2,890,000 (BRW and Lee Engineering 1998). If visitation increased annually from 2005 by 1 percent, it would reach 2,090,023, approximately 28 percent lower or 799,977 fewer visitors than originally projected

State Highways. State Route 1 is the only major regional highway located in the vicinity of the Project Area. State Route 1 is one of the most scenic roadways in the state, offering panoramic and often breath-taking views of California's frequently rugged and remote coastline. The scenic beauty of this roadway makes it a favorite of television commercial producers. The winding and heavily traveled highway hugs the outer coastline of California from southern California to the Lost Coast just north of Fort Bragg. Within Marin County, State Route 1 separates from Highway 101, the main highway in eastern Marin County, just north of the Golden Gate Bridge, heading westward from Mill Valley to the outer coast, where it again begins its winding route up the coast. In the vicinity of the Project Area, State Route 1 goes through the small town of Olema before it enters Point Reyes Station, where it temporarily turns into A Street (see Local Roadways below). Once north of Point Reyes Station, State Route 1 begins to curve westward to follow the eastern boundary of Tomales Bay towards Marshall and Bodega Bay.

Between Olema and Point Reyes Station, it is a two-lane, north-south trending roadway with average annual daily traffic volume of 6, 100 vehicles south and 2,300 vehicles north of Pt Reyes Petaluma Road (DKS Associates 2001 *in* EDAW 2001). The CMA regularly evaluates LOS on the portion of State Route 1 between Sir Francis Drake Boulevard in Olema and Point Reyes Station (DKS Associates 2001 *in* EDAW 2001). A 2000 CMA survey characterized this portion of State Route 1 as Level B LOS in both directions, northbound and southbound, during the afternoon peak hour (DKS Associates *in* EDAW 2001; Tables 21A and 21B). North of Point Reyes Station, LOS drops to Level C for both morning and afternoon peak hours. The design capacity of State Route 1 and some of the other roadways in the area is approximately 34,000 vehicles per day: as of 1996, vehicle trips on State Route 1 amounted to approximately 20 percent of capacity, ranging from 6,100 to 6,800 vehicles per day (Marin County Community Development Agency 2001). No change in LOS is anticipated between 1998 and 2010, even given a projected – and possibly not realistic – increase in Point Reyes area visitation of 1 percent per year (BRW and Lee Engineering 1998).

Regional Roadways. Sir Francis Drake Boulevard, including Levee Road, which is technically the southernmost portion of Sir Francis Drake, is the only regional roadway located in the vicinity of the Project Area. As was noted earlier, it was specifically referred to in the LCP (Marin County Comprehensive Planning Department 1981) as providing both a scenic driving experience, as well as being an important access road for residents living on the Point Reyes Peninsula.

Sir Francis Drake Boulevard, which originates in eastern Marin County, runs primarily as a two-lane road once east of the town of Fairfax through the towns of Woodacre, Forest Knolls, Lagunitas, and Tocaloma before stopping at State Route 1 in the town of Olema. From Olema, the road picks up again at Levee Road near the Green Bridge in Point Reyes Station. Traffic traveling south on Levee Road is controlled using a stop sign, but there is no stop sign for vehicles on State Route 1. Levee Road moves through a small residential area as it curves westward and crosses the northern end of Olema Marsh. The road then curves northward to follow the western edge of Tomales Bay as it becomes the main and only road for residents of Inverness Park, Inverness, other private developments on the Inverness Ridge, ranches within the Point Reyes headlands, and visitors to the Seashore and State and County Parks such as Tomales Bay State Park and Chicken Ranch Beach. Seashore visitors use this road to access Drake's Estero, Tomales Point, Abbott's Lagoon, the Lighthouse, Chimney Rock, and many other beaches along the Point Reyes Headlands.

A LOS Analysis was performed on the portions of Sir Francis Drake Boulevard just east of the town of Olema and west of the intersection with Pierce Point Road rated this portion of the regional roadway generally as Level D during both morning and peak hours (BRW and Lee Engineering 1998). However, the portion near Pierce Point Road had slightly better traffic conditions during morning peak hours (Level C; BRW and Lee Engineering 1998). LOS was not anticipated to change greatly between 1998 and 2010 in either location, even given the projected – and possibly not realistic – increase in Point Reyes area visitation of 1 percent per year (BRW and Lee Engineering 1998).

Collectors and Local Roadways. A Street corresponds to the in-town portion of State Route 1 within the town of Point Reyes Station and is the main downtown street in Point Reyes. Within town, State Route 1 is a two-lane road with a posted speed limit of 25 mph. Mesa Road is a local roadway that runs along the eastern portion of Point Reyes Station and the main roadway serving the Point Reyes Mesa residential development. It has several curves and corners. A portion runs along the Giacomini Ranch property in the vicinity of Tomasini Creek, which flows underneath Mesa Road, and the small dirt road that leads to the Giacomini Hunt Lodge. From Mesa Road, several smaller roads – some of which are considered private – provide access for residents who live on the Point Reyes Mesa directly adjacent to the northern portion of the Giacomini Ranch East Pasture. Mesa Road eventually curves eastward and ends at State Route 1 on the northeastern boundary of Point Reyes Station. A stop sign at the intersection with State Route 1 controls crossing of the state highway, which does not have a signal or stop sign.

In the town of Point Reyes Station, B and C Streets parallel A Street to the west and are less heavily traveled than A, serving primarily residences and commercial businesses and public services such as the Sheriff's substation and Fire Station. C Street runs along the eastern perimeter of the Giacomini Ranch Dairy Facility. B Street has a stop sign at its T-intersection with State Route 1, but there is no stop sign for cross-traffic on State Route 1. There are three other stop-sign controlled intersections on B Street. There are no stop signs on C Street.

At the eastern end of town, another local arterial road, Point Reyes-Petaluma Road, serves as an important connection between Point Reyes and towns such as Nicasio, Novato, and Petaluma.

A more direct connection between the portion of Sir Francis Drake Boulevard that ends in Olema and the portion near Inverness Park is Bear Valley Road, which starts in Olema and runs north-south until it dead-ends into Sir Francis Drake Boulevard. The intersection has a stop sign for vehicles traveling north on Bear Valley Road, but there is no stop sign for cross-traffic on Sir Francis Drake Boulevard. Most of this road runs through undeveloped areas such as pasture, with the exception of the Park's administrative headquarters and Bear Valley Visitor Center and a relatively small residential development at the northern end of the road near the intersection with Sir Francis Drake Boulevard. Visitors to the park use Bear Valley Road to access the Bear Valley Visitor's Center, Bear Valley Trail and associated trails and remote camping areas, as well as Limantour Road, a Seashore-maintained road that crosses over the Inverness Ridge to Limantour Beach. This road also provides access to a youth hostel and to several Seashore-owned residences in the vicinity of the youth hostel and the Limantour Beach area. Limantour Road has a stop sign at its intersection with Bear Valley Road, but there is no stop sign for cross-traffic on Bear Valley Road.

Within the town of Inverness Park, several small roads connect residences with homes constructed on the slopes of the Inverness Ridge, including Drakes View Drive and others.

At the northern end of Sir Francis Drake Boulevard, Pierce Point Road connects visitors, park employees, and rancher residents with the Tomales Point area, including Abbott's Lagoon, McClure Beach, Tomales Bay State Park. Some of the quarries proposed for restoration with use of excavated sediment from the Project Area would be accessed from Pierce Point Road.

LOS information for A Street is discussed under State Highways. Point Reyes-Petaluma Road was rated as Level C during both morning and afternoon peak hours (BRW and Lee Engineering 1998). The LOS analysis for Bear Valley Road characterized it as Level D under both morning and afternoon peak hours and under existing and projected future growth conditions (BRW and Lee Engineering 1998). Pierce Point Road had a lower LOS south of Tomales Bay State Park (LOS C) than north of the park, where LOS increased to Level B, at least in the morning (BRW and Lee Engineering 1998). Another local arterial road, Point Reyes-Petaluma Road, was rated as Level C during both morning and afternoon peak hours (BRW and Lee Engineering 1998).

Intersections. None of the intersections within the vicinity of the Project Area are signalized. There are approximately 12 intersections within the vicinity of the Project Area that are stop sign-controlled. The

majority (10) are T-intersection stop signs or single stop-sign intersections in which cross-traffic is allowed to flow freely. Two intersections in the town of Point Reyes Station are either four-way stop sign-controlled or two-way stop sign-controlled at a four-way intersection with cross-traffic allowed to flow freely. Again, as explained earlier, at intersections, LOS is defined as the average total delay in seconds per vehicle from the time a vehicle stops at the end of the queue until the vehicle departs from the stop line, including the time from the back to the front of the queue. Some typical LOS for intersections without signals in the vicinity of the Project Area are given below ((DKS Associates 2001; EDAW Inc. 2001)).

- *State Route 1 and Sir Francis Drake Boulevard/Levee Road*: Morning Peak Hour (Level A); Afternoon Peak Hour (Level B); Weekend Mid-Day Peak Hour (Level B).
- *State Route 1 and Mesa Road near Green Bridge*: Morning Peak Hour (Level B); Afternoon Peak Hour (Level B); Weekend Mid-Day Peak Hour (Level B).
- *State Route 1 and Mesa Road near Greenbridge Gas*: Morning Peak Hour (Level A); Afternoon Peak Hour (Level A); Weekend Mid-Day Peak Hour (Level A).

Emergency Vehicle Access. The Marin County Fire Department is located at 201 B Street. Average response time for the fire department is 5 minutes (DKS Associates 2001 *in* EDAW 2001). Emergency vehicles currently have access to the Project Area from C Street and the Dairy Mesa facility and Sir Francis Drake Boulevard near the town of Inverness Park. Emergency vehicles currently experience little or no delay in accessing the Project Area during the morning, evening, and weekend peak hours, because of immediate proximity and/or high levels of service at the relevant intersections. Emergency access to the interior of the Project Area is somewhat limited. Compacted earthen roads would allow some degree of access, unless roads are flooded or extremely wet to most of the East Pasture. However, there are no existing ranch roads in the West Pasture, although a dirt track does allow 4 wheel-drive (4-WD) vehicles to enter the West Pasture near the Gradjanski residence and cross Fish Hatchery Creek at a creek crossing. In addition, there is a gate at the southern end of the West Pasture that allows 4-WD access at the southern end. Access at the northern end is largely foot access via the north levee.

Parking. BRW and Lee Engineering (1998) did not analyze parking capacity in the Project Area and immediate vicinity. However, parking capacity was qualitatively assessed for existing and future parking needs in other areas of the Seashore by rating parking capacity from very high to very low (BRW and Lee Engineering 1998). Parking lots with very high capacity were those in which occupancy does not exceed 90 percent of capacity during weekdays and weekends regardless of season, while areas with very low parking capacity are more than 90 percent full during most weekdays and weekends regardless of season (BRW and Lee Engineering 1998).

On-street parking in downtown Point Reyes Station has historically been a subject of community concern. On-street parking represents a large share of the downtown parking facilities. Approximately 40 percent of the homes on the west side of Point Reyes Station do not have driveways, carports, or garages, necessitating on-street parking. As visitation to Point Reyes Station increases, competition for on-street parking spaces will increase and cause additional impacts to residents and merchants in town. The Point Reyes Station Community Plan (Marin County Community Development Agency 2001) identified localized parking congestion in the downtown area as a major concern. Furthermore, on-street parking has also been identified as an impediment to improving the traffic capacity of downtown streets. According to the LCP (Marin County Comprehensive Planning Department 1981), "parking restrictions and limits on recreational vehicle travel could also substantially improve capacity. On some streets, cars park "nose-in," which increases capacity relative to parallel parking, but decreases overall traffic capacity.

Public use of informal social paths or trails on the Giacomini Ranch levees have resulted apparently in periodic parking problems periodically both in the vicinity of Third and C Streets in Point Reyes Station and along Sir Francis Drake Boulevard. There are no designated formal or informal parking areas for the Giacomini Ranch East Pasture and Green Bridge County Park trail network. Most people park alongside homes on 3rd and C Street in Point Reyes Station or walk to the trail from other parts of town. Because there are no designated formal or informal parking areas, street parking is often at a premium on most weekends in the town of Point Reyes Station, with people parking along C Street or Third Street. This increases parking and traffic congestion, noise, and trash for residents on Third Street. Parking along C Street typically occurs along the side fences of residences, business, or public service operations, as no homes actually front C Street. Parking on Third Street occurs in front of homes. While use of this trail is not heavy relative to formal Park Service trails such as Bear Valley Trail and appears to be mainly used by local residents, nearby homeowners state that the trail is attracting increasing numbers of people from other communities looking for opportunities to walk their dogs. Because of overflow problems from Point Reyes Station, it is likely that the worst problems

occur on weekends when visitors need to park further from downtown because of the limited number of parking areas near A Street. They end up vying for parking with the limited number of people using the informal social path during that time. Because parking occupancy probably exceeds 90 percent on most weekends, particularly during the high season, parking capacity for this particular area might be rated between low and medium.

Two formal parking lots serve existing trails in the Project Area and vicinity. There is a parking lot at the trailhead for Tomales Bay Trail with approximately 14 parking spaces that generally has, based on the BRW and Lee Engineering criteria, very high parking capacity and another parking lot at White House Pool County Park with approximately 43 parking spaces that might be rated as having medium to high capacity.

Parking for the informal social path on the Giacomini Ranch north levee consists of one or more roadside pull-outs that can comfortably fit approximately 23 vehicles. Because this path is not as heavily used, parking and pull-outs into traffic along Sir Francis Drake Boulevard are typically not problematic, and parking capacity might be rated as very high. However, between December and February, many birdwatchers flock to "Waldo's Dike" to observe California black rails in the undiked marsh north of Giacomini Ranch and use the levee for access. Parking during peak visitation periods such as weekends can become chaotic, with pull-outs full and vehicles parking haphazardly along Sir Francis Drake Boulevard where there is no road shoulder. With vehicles often in the actual roadway, this parking pattern impacts road safety and decreases vehicle conveyance and LOS. Use by birdwatchers, some of whom come from all over the state to view rails, is limited to extreme high tide events, which, during December, January, and February, occurs usually for four days each month. The worst parking problems comes when one or more of those days coincide with the weekend, and, because of these problems, parking capacity would probably receive an overall rating of medium capacity, in which occupancy does not exceed 90 percent except during weekdays and weekends in holiday and high season periods.

Public Transportation. Golden Gate Transit provides daily bus service within Marin, Sonoma, San Francisco, and Contra Costa counties. During the week (Monday through Friday, the West Marin Stagecoach provides service between San Anselmo, Point Reyes Station, Inverness Park, and Inverness. The West Marin Stagecoach started in 2002 as a two-year demonstration service created by Marin County that focused on increasing access for seniors, youths, and others to medical, civic, educational, work, and shopping sites throughout Marin. At least initially, the Stage was funded by the Marin County Transit District, the County of Marin, and the Federal Transit Administration. Money from the sales-tax hike (Measure A) passed last November 2004 apparently ensured the future of the West Marin Stagecoach.

During the week, the Stage's 12-passenger buses have four east- and west-bound runs each day, with the last eastbound run leaving at approximately 5 p.m. from Point Reyes. There are at least three formal stops in the vicinity of the Project Area at the Dance Palace in Point Reyes Station, downtown Point Reyes Station, and Inverness Park. Published travel time from Point Reyes Station to San Anselmo is approximately 54 minutes. The Stage also has the capability of carrying two bikes on outside bike racks. Golden Gate Transit used to provide one route on the weekends that served Point Reyes Station (Route 65), but it no longer runs.

Alternative Transportation. Pedestrian activity is generally light within the vicinity of the Project Area. As noted earlier, use of the informal social paths and other trails in the vicinity is discussed more fully under Visitor Experience. Pedestrian traffic in the western portion of Point Reyes Station is very light and limited to residents, users of the informal social path, and, on weekends, visitors parking on the outskirts of town. Residents occasionally walk or casually bicycle on the shoulder of Sir Francis Drake Boulevard and Levee Road, but use is limited, probably due to concerns about safety due to the narrowness of the shoulder in some areas. Many of those walking or casually bicycling are linking to the White House Pool County Park at the intersection of Levee, Sir Francis Drake, and Bear Valley Roads, which has a weather-dependent dirt trail that runs along the south side of Lagunitas Creek (see Visitor Experience). In addition to casual bicyclists, long-distance road cyclists also frequent the Point Reyes Station and Inverness Park areas, particularly on weekends. While casual bicyclists will often ride on the dirt shoulder, road cyclists typically hug the paved edge of the roadways, which are all two-lane and narrow to moderately wide. None of the highways or roadways discussed has formal bike lanes.

For several decades, residents of southern Tomales Bay have discussed the possibility and effects of creating a pedestrian and bicycle trail that would link the western portion of Tomales Bay near Inverness to Point Reyes Station and potentially even further north along State Route 1. The first formal attempt to address this issue was the West Marin Pathways Study, completed in 1988 by Brian Wittenkeller and Associates for West Marin Paths, a local non-profit group, and Marin County. This document incorporated a detailed conceptual

plan and cost estimate for a bicycle and pedestrian pathway system around the south end of Tomales Bay, including several alignments adjacent to or crossing over into the Giacomini Ranch. The concept plan was very comprehensive and ambitious (LandPeople 2005). It included recommendations for bike lanes and/or paved multi-use paths along much of the route, including many routes that were on the then-private Giacomini property (LandPeople 2005). It did not include a detailed evaluation of environmental, construction, and maintenance constraints, and requirements (LandPeople 2005). The West Marin Pathways Study was never adopted, although two small components were reportedly constructed by either the County or others – a cantilevered pedestrian causeway at White House Pool and a bridge across the eastern Bear Valley Creek outlet in White House Pool County Park. According to local residents who participated in the process, this was because of the high (for the time) estimated implementation cost and concern over environmental and adjacent landowner impacts. The estimated cost for the pathway improvements was approximately $2.75 million for design, construction, and construction contingencies, plus $1.5 million for land acquisition (LandPeople 2005).

A more recent pertinent document that was adopted by the County is the June 2001 *Marin County Unincorporated Area Bicycle and Pedestrian Master Plan*, prepared by Alta Transportation Consulting for the Marin County Department of Public Works (LandPeople 2005). This document contains analysis; goals, objectives and policies; a proposed system and improvements plan; and specific projects (LandPeople 2005). Among the projects is a recommended series of improvements in the Point Reyes and Inverness Area, including a potential bike/pedestrian path from the Point Reyes Station to Inverness (LandPeople 2005). The Plan refers to the 1988 West Marin Pathways Study. The Plan also recommends the use of railroad right-of-way, where feasible, to complete the recommended routes (LandPeople 2005). The Plan does not go into detail on the precise location or configuration of these bicycle routes, but does include bikeway standards that imply the routes would be either paved Class I separated multi-use path at least 8' wide, or paved bike lanes 4 to 5' wide on the road shoulder (LandPeople 2005). The draft Marin CWP also shows a proposed trail along Levee Road and Sir Francis Drake Boulevard the entire distance to Inverness, but the map does not specify the type of trail (LandPeople 2005).

Visitor and Resident Experience – Public Access Resources

National parks are valued for the recreational and aesthetic resources they provide to the public, both visitors and adjacent residents. Park visitors expect national parks to provide beauty, a sense of quiet, and opportunities for hiking, bird-watching, and other recreational pursuits. Perhaps, some of the most valued natural resources within parks in terms of sheer visitor numbers are "wetland" ones such as rivers, lakes, oceans, waterfalls, and even geysers. While earlier sections have focused on utilitarian ecological and social functions of wetlands such as water quality improvement or floodwater retention, wetlands undeniably provide other important social services, one of which is recreation. Wetlands offer opportunities for hiking, birdwatching, fishing, kayaking and canoeing, boating, and swimming. In addition, wetlands can provide breathtaking vistas or viewsheds. These recreational benefits are one of the reasons that the public has come to increasingly value wetlands.

As discussed under Traffic and Transportation, increasing emphasis on alternative transportation means such as walking and bicycling has added another dimension to public access traditionally encountered in parks, which focuses on providing visitors with a natural experience. For exercise or to improve the environment, an increasing number of people are looking to use trails and paths for transportation purposes. While, overall, the objective appears to be the same, bicycle and/or pedestrian public access, differences in the goals of these user groups – transportation versus nature experience – can result in very different solutions that may not be mutually satisfactory. For the purposes of this document, bicycle and pedestrian issues related primarily to transportation are covered under Traffic and Transportation, while this section focuses primarily on public access for natural and recreational purposes.

Regional and Park Setting

As a region, the San Francisco Bay area has actively sought opportunities for providing public access to both its residents and visitors. Agencies such as the Bay Conservation and Development Commission have taken a very proactive role in increasing access along the edge of San Francisco Bay, project by project. Perhaps, the most ambitious regional effort is the San Francisco Bay Trail, a planned recreational corridor that, when

completed, encircle the San Francisco Bay region with a continuous 400-mile network of bicycling and hiking trails, of which 240 miles have been completed.

With more than 50 percent of its lands in public ownership or conservation easement, Marin County is one of the leaders in the San Francisco Bay region in terms of providing access to both residents and visitors. Some of the largest tracts of undeveloped land within the county are its national parks, including the Seashore and north district of GGNRA. While many parks primarily serve visitors who come from outside the park's region, the majority of the 2.5 million visitors who come to the Seashore each year live in the San Francisco Bay area. In 2002, more than 700,000 visitors visited the three Seashore visitor centers, and more than 70,000 visitors had extended contacts with park interpretative staff through ranger-led programs. The main visitor is at Bear Valley near the park's administrative headquarters, which serves 350,000 people annually. The nearby trail, the Bear Valley Trail, is the most heavily used trail, with 70 percent of visitor centers users believed to use the trail (J. Dell'Osso, Seashore*, pers. comm*.).

Some of the largest tracts of undeveloped land within the county are its national parks, including the Seashore and north district of GGNRA

The Seashore provides backcountry campgrounds, numerous beaches, and 147 miles of hiking trails. Activities include hiking, water sports, horseback riding, fishing, camping, wildlife viewing, and other interpretive opportunities. Hiking is primarily a day-use activity. There are approximately 50 trails throughout the Seashore, and they are found in a range of habitat types, ranging from wooded mountains to sandy beaches. Overnight stays are possible in four backcountry campgrounds, the Stewart Horse Camp, the Point Reyes Hostel, a private campground, and local hotels and inns. Visitors bring horses daily to ride on designated trails, and hundreds rent horses every week from commercial stables.

Though Stinson Beach and Bolinas attract more surfers, North Beach is known as a challenging surfing area. Nature study and wildlife viewing are important activities at Point Reyes. Visitors make special trips to the Seashore to see migrating whales, shorebirds, breeding elephant seals, tule elk, and spring wildflowers. Information received from visitor surveys conducted by Sonoma State University (NPS 1997; 1998b) found that most park visitors spend 2-6 hours at the Seashore in a variety of activities dependent upon the season, ranging from whale watching and kayaking to hiking and bird watching.

The attractiveness of the Point Reyes area to visitors and residents is enhanced by the fact that the western portion of Marin County remains largely undeveloped, even those portions not owned by the Park Service. The pastoral setting of the largely agricultural community draws many visitors, who enjoy both viewing the working farms and purchasing some of the locally produced products in stores within local towns. The beauty of the area has also led to an active artist community that caters to visitors. Tomales Bay itself – portions of which fall within the Seashore and GGNRA boundaries – attracts people interested in the thriving oyster industry and abundant water-based recreational opportunities such as boating, kayaking, and swimming. The "open space" opportunities offered by the Seashore and GGNRA have been greatly enhanced through creation of numerous other open space areas and parks in western Marin County by local and state agencies, including Marin Municipal Water District lands, County Open Space lands, Mt. Tamalpais State Park, Tomales Bay State Park, and several small County Parks at White House Pool, Green Bridge, and Chicken Ranch Beach.

Regulatory and Policy Setting

The Park Service 2006 Management Policies emphasizes that "providing opportunities for appropriate public enjoyment is an important part of the Service's mission" (NPS 2006, Section 8.1). In fact, public education and enjoyment could be considered an integral component of the wetland restoration process. "When practicable, the Service will not simply protect, but will seek to enhance, natural wetland values by using them for educational, recreational, scientific, and similar purposes that do not disrupt wetland functions" (NPS 2006, Section 4.6.5). In 2003, the Seashore published a report that evaluates in detail the condition and maintenance and upgrade needs of existing trails (Seashore 2003). The Trail Inventory and Condition Assessment with Recommendations report (2003) also discusses the need and potential for new trails, including the potential for trails in or adjacent to the newly purchased Giacomini Ranch (Seashore 2003). It notes that one of the tasks will be to determine "appropriate levels of public access for interpretive and educational uses … Because the bulk of the property will be devoted to marsh restoration, it appears unlikely

that major through-trail routes will be feasible (with the possible exception of a portion of the Tomales Bay west shore trail as described in the Marin Countywide Trails Plan)" (Seashore 2003).

Marin County also actively supports enhancement of public access and recreation. Within the Coastal Zone, the LCP (Marin County Comprehensive Planning Department 1981) encourages enhancement of public recreational opportunities and the development of visitor-serving facilities in its coastal zone, as long as it "preserves the unique qualities of Marin's coast and … is consistent with the protection of natural resources and agriculture." Generally, low-intensity recreational uses such as hiking, camping, and fishing are favored over high-intensity uses (Marin County Comprehensive Planning Department 1981). The LCP (Marin County Comprehensive Planning Department 1981) also directs federal parks to provide additional coastal access trails and bike paths "where feasible and where consistent with the protection of the parks' natural resources." Specifically, the LCP (Marin County Comprehensive Planning Department 1981) expressed support for the East/West Greenway along the railroad-right-of-way and the concept of bike and pedestrian trail network in the West Marin area, with potentially the most likely area being State Route 1 and Sir Francis Drake Boulevard. The Community Plan (2000) also supports efforts to identify appropriate locations for paths that could be used for both bicycle commuting and recreation, including investigations into the feasibility of using the abandoned railroad right-of-way.

However, while facilitating public use, enjoyment, and appreciation of bayfront lands, projects should "avoid or minimize disturbance to wetlands, necessary buffer areas, and associated important wildlife habitat" (Marin County Comprehensive Planning Department 1981). Both the LCP (Marin County Comprehensive Planning Department 1981) and the Point Reyes Station Community Plan (Marin County Community Development Agency 2001) have established policies against development of the Point Reyes Mesa bluff area above the railroad-right-of-way in the Giacomini Ranch East Pasture through setbacks.

In 2001, the County of Marin issued the *Marin County Unincorporated Area Bicycle and Pedestrian Master Plan.* This document contains analysis; goals, objectives and policies; a proposed system and improvements plan; and specific projects (LandPeople 2005). Among the projects is a recommended series of improvements in the Point Reyes and Inverness Area, including a potential bike/pedestrian path from the Point Reyes Station to Inverness (LandPeople 2005). The Plan also recommends the use of railroad right-of-way, where feasible, to complete the recommended routes (LandPeople 2005). The draft Marin CWP also shows a proposed trail along Levee Road and Sir Francis Drake Boulevard the entire distance to Inverness, but the map does not specify the type of trail (LandPeople 2005).

Both the Architectural Barriers Act of 1968 (PL90-480) and the Americans with Disabilities Act (ADA) of 1990 (PL 101-336) help to ensure that buildings and other facilities meet set standards to make them accessible to all visitors, including those with disabilities. The Park Service complies with ADA standards and follows the stricter of either the Americans with Disabilities Act Accessibility Guidelines (ADAAG; 36 CFR part 1191) developed in 1991 or the Uniform Federal Accessibility Standards (UFAS) established in 1984. Standards for outdoor recreational facilities are often guided by recommendations from a report issued in September 1999 by a Regulatory Negotiation Committee convened by the Architectural and Transportation Barriers Compliance Board (Access Board) to help guide development of guidelines for facilities such as trails, boating and fishing facilities, parks, and sports facilities. Based on these guidance documents, the Park Service requires that walks or paths that connect to accessible features need to be made accessible and that key features in the park need to be made accessible. However, paths need to be kept consistent with preserving the natural and cultural resources of the park, if the same experience can be provided on some portion of the alignment or a different trail. California has also developed handicap access standards through California Building Code, Title 24 regulations, although the Title 24 standards are intended for urban facilities and not necessarily rural and park-type trails.

Public Access Opportunities within the Project Area and Vicinity

Background

For comparison purposes, semi-quantitative ranking systems were developed as part of this document for characterizing visitation and the number of public access structures, facilities, and uses.

The number of structures, facilities, and uses within a 0.5-mile radius of trailheads or destination areas (e.g., Drake's Beach) is ranked as low, moderate, and high based on a relative comparison with the number of

structures, facilities, and uses present in other areas of the Seashore and north district of the GGNRA. Structure, facilities, and uses include not only constructed buildings and facilities (e.g., visitor centers, bathrooms, bridges, stairs), but amenities such as telephones and water fountains and attractions or permitted uses such as birdwatching, fishing, horseback riding, backpacking trailhead, and connections to other trails, etc.. The Seashore's Roads and Trails Division was consulted on the number of facilities, structures, and uses for other trailheads or destination points in the Seashore and north district of the GGNRA. Because this system is intended to be only a semi-quantitative tool for assessing effects of the proposed project, each facility, structure, and attraction or use was simply counted as one, regardless of the size of facility or relative degree of "draw" that certain facilities structures, and attractions or uses might have. Facility, structure, and use ranking consisted of low (between 1 and 5 structures, facilities, and uses), medium (between 6 and 10), and high (> 10). The Bear Valley Visitor Center area ranked as having the highest number of structures, faculties, and uses with approximately 25.

Although formal data on use of these structures and facilities do not exist, for the purposes of this document, use of facilities, structures, and uses semi-quantitatively estimated as very low (average of < 50 people per day), low (average of ≥ 50 and <125 visitors per day), medium (average of ≥125 and <450 people per day), and high (average of ≥450 people per day). These criteria were developed based on a relative comparison of daily numbers of people using other structures, facilities, and uses in the Seashore and north district of the GGNRA. Information used to develop criteria on public access, structures, and facilities and/or visitation came from analysis of aerial imagery, consultation with the Seashore's Roads and Trails division, published information, and data from the Interpretative and Law Enforcement Divisions. Data from the Interpretative Division includes estimated number of visitors based on road traffic counts and multipliers for average number of people per car.

Public Access Resources

Existing Trails, Users, and Maintenance

Because the Giacomini Ranch has been privately owned until recently, the only formal trails within the Project Area are those on lands owned by the Seashore and GGNRA and lands managed by the County of Marin Parks and Open Space District (Figure 38). However, several informal trails have been developed along portions of the Giacomini Ranch's levees. The Project Area and immediate vicinity currently incorporates approximately five (5) formal or informal trails or trail segments. A description of these formal and informal trails is provided below.

The number of structures, facilities, and uses of formal and informal trails in the Project Area ranged from low (between 1 and 5) to medium (between 6 and 10), with White House Pool County Park and the Giacomini Ranch West Pasture characterized as medium. All of the existing trails in the Project Area would be characterized as having very low visitation (average of <50 people per day) relative to trails such as Bear Valley, including Tomales Bay Trail, Olema Marsh Trail, Giacomini Ranch West Pasture, Giacomini Ranch East Pasture, White House Pool County Park, and Green Bridge County Park (E. Hulme, superintendent, Marin County Open Space and Park District, *pers. comm*.).

To the north of the Giacomini Ranch, Tomales Bay Trail, which is on GGNRA lands that are leased by the Martinelli family for beef cattle grazing, starts at a moderate-sized parking lot on State Route 1 on the eastern side of Tomales Bay and winds approximately 1.37 miles on a fire road trail through grassy hills to a vista point that overlooks the southern portion of the Bay (Figure 38). This designated hiking and biking spur trail ends at the base of Railroad Point, just north of where Tomasini Creek flows out into Tomales Bay. Visitor amenities are minimal along this trail and restricted to maintenance of the fire road and signage at the start of the trail, so public access structures, facilities, and uses would be characterized as low. The trail is not ADA accessible, and dogs are not allowed. Use of this trail would be estimated as very low compared to heavily used trails such as Bear Valley, although there are no formal use estimates.

South of Giacomini Ranch, the County has leased two areas from the state of California Wildlife Conservation Board that are maintained as parks. The largest of these is the County's White House Pool park located at the intersection of Sir Francis Drake Boulevard and Bear Valley Road (Figure 38). An approximately 0.5-mile unpaved dirt path starts on the northern side of Levee Road near the northeastern corner of Olema Marsh and winds through dense riparian habitat and open ruderal grassland areas adjacent to Lagunitas Creek before it ends at White House Pool. Two small wooden bridges cross the former and current outlets for Bear Valley Creek. A large paved parking lot (discussed below) occurs at the western end of the park and provides some

Figure 38

access for water-based recreation such as kayaking. With the exception of the parking lot, visitor amenities are relatively simple and restricted to a portable toilet and small benches that have been placed along the creek. However, because of the accessibility to people with bikes, horses, boats, and dogs, the number of structures, facilities and uses of this trail ultimately ranked as high. Use of this trail is very low relative to the Bear Valley Trail with annual visitation of this and the Green Bridge County Park trails estimated at 7,000 people (E. Hulme, superintendent, Marin County Open Space and Park District, *pers. comm*.) and includes primarily people walking dogs, bicyclists, and birdwatchers. The County does limited maintenance on the trail and viewing areas along the trail annually, as well as regularly servicing the portable restroom in the parking lot. The trail is not ADA accessible.

The eastern end of the White House Pool County Park trail is directly opposite the Olema Marsh trail, which runs approximately 0.39 mile along the eastern edge of Olema Marsh through grassland directly adjacent to the shutter ridge created by the San Andreas Fault (Figure 38). Use of this trail would be characterized as very low compared to heavily used trails such as Bear Valley, despite the fact that it offers a moderate or medium number of attractions and features (facility, structure, and uses between 6 and 10). Most visitors come to this area for birdwatching and access it from the southern end, which includes an access road and a small unpaved parking lot. This trail has the potential to link the White House Pool County Park trail with the Limantour Trail that parallels Bear Valley Creek and thereby potentially connect with the Bear Valley Trail near the Bear Valley Visitor's Center. Use of this trail linkage would currently require crossing of several busy roads that do not have pedestrian crosswalks. The trail is not ADA accessible.

Between the Green Bridge and Giacomini Ranch dairy facility is a small, approximately 10-acre parcel dominated by seasonal wetland/grassland and riparian scrub-shrub (Figure 38). Several dirt paths totaling approximately 0.5 miles criss-cross the park, with the main entrance and exit points being the Giacomini Ranch driveway at 3rd and C Streets in Point Reyes Station and the southeastern side of the Green Bridge. Amenities are extremely minimal in this park, with structures, facilities, and uses ranked as low (between 1 and 5). The trail is not ADA accessible. While visitor use of this trail system would be characterized as very low compared to Bear Valley Trail, a fair number of people use this system, largely because it connects to one of the informal paths that has been created on the Giacomini Ranch's southern levee, and the trail allows dogs on leash, as do most other County parks. The County does limited maintenance on the trail annually.

For many years, the public has accessed the Giacomini property along an approximately 0.32-mile informal dirt path on the elevated creek bank and levee (Figure 38). This spur trail ends at approximately the location of the Giacomini's old summer dam and largely has views of Lagunitas Creek, some patches of riparian habitat, the Giacomini Ranch's East Pasture, and the White House Pool County Park. Use of this trail would be characterized as very low compared to heavily used trails such as Bear Valley, although there are no formal use estimates. Most of the users are members of the local community who walk their dogs, bird watch, or even do some painting, most of whom access the trail from 3rd and C Street in Point Reyes Station. While the Park Service restricts dog walking to certain areas of the Seashore and the GGNRA and requires dogs to be on a 6-foot leash at all times (36CFR 2.15 (a) 2), leash laws have not been enforced within the Giacomini Ranch, because this area is not under formal Park Service management currently. Because of this path's informal nature, there are no visitor amenities, and there is no connection with the White House Pool County Park. Facilities, structures, and uses would be characterized as low (between 1 and 5). It is unclear whether the Giacominis maintain this area or whether it is maintained through use, but there is no formal maintenance. The trail is not ADA accessible.

The other informal trail in the Project Area is at the northwestern corner of the Giacomini Ranch along the top of the levee at the northern end of the West Pasture (northwestern levee; Figure 38). It can be accessed from a small pull-out area on the east shoulder of Sir Francis Drake Boulevard north of Drake's View Drive. This approximately 0.28-mile dirt spur trail leads from Sir Francis Drake Boulevard to the northeastern corner of the West Pasture at Lagunitas Creek. This trail does not receive as much use as the informal path near Point Reyes Station, however, there are occasional hikers and dog walkers, as well as hunters who access State Lands Commission areas north of the Giacomini Ranch via this levee. Other than parking, amenities are minimal, but structures, facilities, and uses ranked as medium (between 6 and 10), because of the viewing, birdwatching, and other features available. The trail is not ADA accessible. The trail generally receives few or very low number of visitors. Highest visitation for this trail occurs in the winter, when literally hundreds of birders from San Francisco Bay and other areas crowd onto the levees to view California black rails that move from the adjacent undiked marsh during extreme high tides in December, January, and February into higher elevations areas such as the levees. During the weekends, more than 50 vehicles are often parked haphazardly some distance along the narrow shoulder of Sir Francis Drake Boulevard. Because of the potential disturbance to these special status

species, in 2005, the Seashore requested that birdwatchers restrict trail use to the western end of the trail to decrease proximity to rails seeking high-tide refuge.

Parking

Parking issues are addressed under Transportation, but, because parking affects visitor and resident experience in terms of ease accessing trails, information from the Transportation section is summarized here. Two formal parking lots serve trails in the Project Area and vicinity. There is a parking lot with 14 parking spaces at the trailhead for Tomales Bay Trail that generally has high capacity (i.e., occupancy does not exceed 90 percent of capacity during weekday and weekend regardless of season) and another parking lot with approximately 43 parking spaces at White House Pool County Park that has medium capacity (i.e., occupancy does not exceed 90 percent of capacity during weekdays and most weekends except for some holiday and high season period weekends). Approximately 23 informal parking areas exist for the Giacomini Ranch West Pasture in pullout areas along the side of Sir Francis Drake Boulevard, although parking often overflows onto the street during the winter high tide periods. There are no designated formal or informal parking areas for the Giacomini Ranch East Pasture and Green Bridge County Park trail network, with most people parking alongside homes on 3rd and C Street in Point Reyes Station or walking to the trail from other parts of town. Parking can be difficult on busy weekends and weekdays.

Safety Issues

One of the foremost concerns that pedestrians and cyclists have about public access is safety (Alta Transportation Consulting 2001). While many bicyclists believe that the vast majority of bicycle crashes involve collisions with automobiles, in actuality, studies of hospital data have shown that most actually result from falls or collisions with stationary objects, other cyclists, or pedestrians (Alta Transportation Consulting 2001).

Relative to adjacent counties such as Sonoma and the state as a whole, Marin County has a low fatality rate for pedestrian accidents. Between 1995-2005, the pedestrian fatality rate for Marin County averaged approximately 0.79 fatalities per 100,000 population, compared to 1.6 fatalities per 100,000 population in Sonoma County and 2.2 for California as a whole (National Highway and Transportation Safety Analysis NHTSA 2007). In reviewing data from April 1996 to April 1999 for preparation of the Marin County Unincorporated Bicycle and Pedestrian Master Plan (February 2001), Alta Transportation Consulting found that approximately 100 serious accidents occurred per year during that study period (Alta Transportation Consulting 2001). Sir Francis Drake Boulevard ranked highly, with a total of 26 crashes (Alta Transportation Consulting 2001). Unincorporated areas of Marin County tied with Novato for having the second highest rate of pedestrian crash accidents behind San Rafael at 27 percent (Alta Transportation Consulting 2001).

NHTSA did not report rates of fatal bicycle accidents for individual California counties, but California as a whole had a rate of 3.06 per million people (NHTSA 2004b). Marin County statistics for serious bicycle accidents were somewhat similar for pedestrian accidents. Alta Transportation Consulting found that approximately 170 bicycle-motor vehicle crashes per year were reported between 1996 and 1999 in Marin County. Compared to other communities in California, the number of incidents per 1,000 people in Marin County (0.69 incidents per 1,000 persons) is similar to that of the national average of 0.67 incidents per 1,000 persons (Alta Transportation Consulting 2001).

Of those, approximately 39 occurred in unincorporated regions of the county (Alta Transportation Consulting 2001). Roads that had multiple crashes during this period included Sir Francis Drake Boulevard (21 crashes; section not specified) and State Route 1 in unincorporated County (14 crashes; Alta Transportation Consulting): these rates were among some of the highest reported for particular roads, although both of these roads are extremely long and span almost the entire county, stretching from east to west and north to south, respectively. A comparison with data provided by the California Highway Patrol (CHP) showed that, between 1990-2005, 11 bicycle and 1 pedestrian accident occurred on Point Reyes-Petaluma Road between the Marin-Sonoma County line and State Route 1 and 15 bicycle and 3 pedestrian accidents occurred on Sir Francis Drake Boulevard between White's Hill in Fairfax and State Route 1 (Officer Ingles, CHP, *pers. comm*.). The unincorporated area of Marin accounted for approximately 18 percent of Marin County bicycle accidents between 1996 and 1999, the second highest behind San Rafael at 40 percent and Novato at 15 percent (Alta Transportation Consulting 2001).

Visitor and Resident Experience – Visual Resources and Viewsheds

Background and Regulatory and Policy Setting

The Park Service Organic Act of 1916 states that the Park Service "…shall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations…by such means and measures as conform to the fundamental purpose of the said parks, monuments, and reservations, which purpose is to conserve the **scenery** and the natural and historic objects and the wildlife therein…" Park Service Management Policies (2006) describe the "park resources and values" that are subject to the Park Service no-impairment standard (NPS 2006; Section 1.4.6). Included among these are a park's "scenery, scenic features, natural visibility, both in daytime and at night, and natural landscapes." Park Service management policies characterize scenic views as highly valued characteristics of the natural resources, processes, systems, and values found in national parks. Scenery is not limited to features, but relates to light and shadows, as well. Parks are directed to "…preserve, to the greatest extent possible, the natural lightscapes of parks, which are natural resources and values that exist in the absence of human-caused light" (NPS 2006, Section 4.10).

Viewsheds are often experienced from automobiles, which has resulted in designation of scenic highways in California. The entire segment of State Route 1 in Marin County is an eligible state scenic highway under the CalTrans Scenic Highway Program. The *Guidelines for the Official Designation of Scenic Highways* (CalTrans 1996) states that the scenic corridors (defined as the area of land generally adjacent to and visible from the highway) of officially designated state scenic highways are subject to protection, including regulation of land use, site planning, advertising, earthmoving, landscaping, and design and appearance of structures and equipment. Within the Coastal Zone, which incorporates the Project Area, the LCP (Marin County Comprehensive Planning Department 1981) specifically identifies Sir Francis Drake Boulevard as providing a scenic driving experience for coastal visitors and an important access road for local residents. The LCP (Marin County Comprehensive Planning Department 1981) notes that, "in order to protect its scenic rural character, the road shall be maintained as a two-lane roadway."

Viewsheds are often experienced from automobiles, which has resulted in designation of scenic highways in California

The LCP for Zone II (Marin County Comprehensive Planning Department 1981) refers to visual resource protection policies in the Coastal Act that address the importance of protection of views to scenic resources from public roads, beaches, trails, and vista points. The *Marin Countywide Plan* (draft Countywide Plan 2005) mandates that visual and aesthetic resources, especially scenic vistas, shall be protected by review of planned projects and removal of inconsistent existing elements. The County has developed two policies to protect visual and aesthetic resources. The Viewshed Protection policy protects visual access to the bay front and scenic vistas of water and distinct shorelines through its land use and development review procedures. The View Corridor and Enhancement Policy urges that existing built elements, such as overhead utilities, which detract from the shoreline and marsh landscape, should be eliminated or blended into the environment.

Visual Resources and Viewsheds in the Project Area and Immediate Vicinity

Background

The analysis of viewshed or visual resources was guided by two widely-accepted protocols used for evaluating visual impacts of proposed projects: the Federal Highway Administration (FHWA) technical document *Visual Impact Assessment for Highway Projects* (Federal Highway Administration 1983) and the US Forest Service (USFS) *Landscape Aesthetics: A Handbook for Scenery Management* (USDA 1995). These protocols, together with guidance from Park Service Management Policies (2001) on protecting dark night sky resources, form the

basis of an objective methodology used to establish the visual characteristics and quality of landscapes and to assess impacts on scenic vistas and scenic resources.

The analysis was based on the premise that people value most highly the more scenic landscapes, that natural or natural-appearing landscapes are generally the most valued, and that people also value cultural enclaves of structures (fences, historic structures) as sub-dominant visual themes nested within larger natural-appearing landscapes (USDA 1995). While this is generally true, in Marin County, pastoral landscapes, as well as natural landscapes, are valued, as well, with the county and the public making efforts to retain an agricultural way of life in west Marin and the scenic values this way of life provides. Pastoral landscapes include predominantly agricultural lands with grazing by livestock, however, other forms of agricultural also have scenic value to people such as vineyards. In addition to composition and structures, other valued characteristics of landscape include diversity of form, line, color, and texture; long sweeping vistas; and natural lightscapes (FHWA 1983, NPS 2001).

Eight viewpoints and view corridors were chosen to represent the visual resources of the Project Area for this analysis (Figure 39). These views were chosen subjectively as those locations from which most visitors would visually experience the Project Area. They were also chosen to represent the range of views of the Project Area which are available from within the site and from the surrounding community. For each of these views, the present landscape character was described according to principles defined in FHWA (1983) and USDA (1995) and incorporated natural lightscape characteristics, as required by Park Service Management Policies. Baseline conditions were then compared to projected changes to the views under all project alternatives. In the analysis, potential changes to the following landscape elements were evaluated:

- *Integrity:*

  Scenic integrity is defined in *Landscape Aesthetics: A Handbook for Scenery Management* (USDA 1995) as:

- *The degree of direct human-caused deviation in the landscape by management such as earth moving, road construction, or resource extraction:* This element is evaluated by measuring the degree of alteration in line, form, color, and texture from the natural or natural-appearing landscape character, or from the established landscape character accepted over time by the general public. This is done by measuring changes in scale, intensity, and pattern against the attributes of that landscape character.

  Views with high scenic integrity also have a sense of wholeness or intactness, with no discordant elements.

- *Diversity:*

  Diversity in landscape is characterized by variety in form, line, color, and texture components visible in a landscape view. Diversity is also characterized by high variety in these components within the foreground view (up to 0.25 miles from the observer), mid-ground view (between 0.25 and 1 mile from the observer), and background view (more than 1 mile from the observer) of the view; and also variety between these views. In general, mid-ground views are subjected to the most visual scrutiny by observers.

- *Prospect:*

  Scenic values increase as the terrain allows longer views. Prospect describes the length of view from the viewpoint or view corridor.

- *Natural Lightscapes:*

  Scenic values are highest in landscapes dominated by natural lighting regimes. After sundown these landscapes are lit predominantly by star- and moonlight. In scenes with natural lightscapes light pollution from nearby communities and distant metropolises is minimized.

Figure 39

Visual Resources in Project Area – General Description

In addition to active recreational opportunities such hiking, biking, walking dogs, horseback riding, and kayaking, visitors and residents of local communities can experience the beauty of national parks and undeveloped areas through viewsheds or opportunities to view aesthetically pleasing vistas within the watershed, whether that be the waters of Tomales Bay, grazing cows in a field, or a herd of tule elk on Tomales Point.

The major visual resource landforms in the Project Area and immediate vicinity are the rift zone valley along the San Andreas Fault (valley bottom), the Point Reyes Mesa coastal marine terrace bordering the Giacomini Ranch to the east (terrace), the granitic-dominated Inverness Ridge on the west (ridge), and the grassy shutter ridge hills that separate Bear Valley Creek from Olema Creek (hills). For the purposes of evaluating existing viewshed resources, visual quality was assessed at nine viewpoints in the Project Area and immediate vicinity. Viewsheds in the Project Area include both low-elevation viewpoints along roads and trails, as well as higher elevation ones on the Point Reyes Mesa and Inverness Ridge, which include many rural residential developments. Because of the steepness of the Inverness Ridge and even Point Reyes Mesa, background visual resources, which include features more than 3 miles from the viewpoint, are often not visible, except in certain directions (e.g., north along the rift zone valley) or from elevated viewpoints on the Inverness Ridge or Point Reyes Mesa.

Viewshed resources are experienced somewhat differently by visitors and residents even at the same viewpoint depending whether they are stationary or moving. As the LCP noted, Sir Francis Drake, which closely follows the edge of Tomales Bay, offers numerous viewsheds or viewpoints, although the experience probably differs slightly depending on whether visitors and residents are driving, bicycling, walking, or standing still. Motorists can catch glimpses of the southern and northern portions of Olema Marsh on Bear Valley Road and Levee Road, respectively, and of the western portion of the Giacomini Ranch along portions of Sir Francis Drake Boulevard. Viewing opportunities along Sir Francis Drake Boulevard primarily consist of pastures and, when present, grazing cattle: the levee obscures views of Lagunitas Creek. Groundwater and small creeks along the base of the Inverness Ridge have promoted growth of stands of riparian scrub-shrub and forest (see Vegetation Resources) that obscure portions of the pasture from vehicular, pedestrian, and cyclist passers-by on Sir Francis Drake Boulevard. The viewshed of some of the residents of Inverness Park is also minimized by the riparian habitat, primarily those along Sir Francis Drake Boulevard. Most of the residents, however, live on the hillside, above the treeline. Viewpoints near Olema Marsh from Bear Valley and Levee Roads, most often seen from a moving car, primarily offer views of marshlands, riparian forest, grassy hills along the shutter ridge, and the forested Inverness Ridge. Most of the residential development on the Inverness Ridge in the Silver Hills is remarkably hidden from view by the tall conifers that dominate much of the ridge.

Some viewpoints can only be accessed on foot. The elevated vista point near the end of Tomales Bay Trail offers spectacular views of southern Tomales Bay, Lagunitas Creek, undiked marshlands, the forested Inverness Ridge, and, depending on the exact viewpoint, some views of the heavily vegetated Point Reyes Mesa bluff. The lower elevation White House Pool County Park trail and the two Giacomini Ranch informal paths offer more constrained views of Lagunitas Creek, pastoral areas with cows, riparian habitat, the forested Inverness Ridge, the heavily vegetated Point Reyes Mesa bluff, and/or undiked marshlands. Visual quality of these areas is negatively affected to some degree by unsightly infrastructure or encroachments associated with agricultural development such as levees, riprap, pipelines, power poles, and deteriorating barns, although the dairy cows and pasturelands themselves, which remain green almost all year long, can be perceived as a benefit to visual quality as they provide highly valued pastoral scenery.

On the eastern side of the Giacomini Ranch, viewshed opportunities are constrained by natural topography and land use and ownership, as most of the East Pasture's perimeter is privately owned or leased by the Giacominis from the Park Service. As with Inverness Park, residents of Point Reyes Station live on an elevated mesa or terrace that maintains a viewshed despite the fact that willows are present and have even expanded in areal extent. The elevation of the terrace in this area allows panoramic views of southern Tomales Bay and the entire Giacomini Ranch, similar to that offered by the Tomales Bay Trail. Several isolated stands of very tall eucalyptus growing on the Point Reyes Mesa slope on private lands probably do block views of Tomales Bay in some areas. Views from the town of Point Reyes Station are reduced to some degree by the presence of the dairy facility buildings, barns, and the row of cypress trees, all of which are quite tall. Views from town primarily consist of pastures, grazing cattle, and the heavily forested Inverness

Ridge. Growth and expansion of willow along the eastern edge of the Green Bridge County Park has apparently negatively affected views for some of the residents near 3rd and C Streets in Point Reyes Station, whose homes are on a lower portion of the mesa than those to the north.

Visual Resources in Project Area – Specific Descriptions from Viewpoints

Sir Francis Drake Boulevard, Inverness Park: Along Sir Francis Drake Boulevard bordering the West Pasture the foreground view is dominated by tall (average = 20 foot) riparian trees such as willow and alder sustained by groundwater that seeps from the toe of the Inverness Ridge and sheetflows across the West Pasture. Between these clumped stands of riparian trees, travelers may observe longer views across the West Pasture. In the mid-ground, these views are dominated by short, grazed annual grasses that are green in the winter and golden-yellow in summer on the flat pasture and that are broken occasionally by sparse stands of open-leaved willow trees growing in linear ditches and old slough channels. Behind the pasture, the rise of the West Pasture levee is visible, and beyond that the rough, green vegetation on the slopes of the Point Reyes Mesa. At the northernmost reach of this view corridor, the longer views are obstructed by the tall (~9 foot), green stalks of cattails in the freshwater marsh bordering Sir Francis Drake Boulevard. At several locations along the roadway, views of the Project Area are interrupted by small homesteads consisting of single-story wood frame houses and out buildings, vehicles and farm equipment, fencing, and small ranch operations. From many vantage points along the road, the bright silver form of the loafing barn is visible in the far distance beyond the Lagunitas Creek levees. At the far southern reach of this view corridor, the scene is dominated by the broad blue/brown band of Lagunitas Creek and its abundant green riparian vegetation, rounding a 90-degree bend at White House Pool. At night, the lightscape from this view corridor is dominated by lighting from the town of Inverness Park, residences bordering the Project Area, and a horizontal band of sparse dim lights from the visually-distant Point Reyes Mesa residences.

Inverness Ridge above Inverness Park: From residential roads on Inverness Ridge above Inverness Park, observers, including residents, can obtain an expansive view of the Project Area. The **foreground** of these views is typically dominated by conifer forest trees lining the roadways. **Mid-ground** views consist of tree tops and roofs of single-family homes. The **background** views, however, are dominated by the East and West Pastures within the Project Area. One of the primary elements of this view is the blue undulating form of Lagunitas Creek winding north through the Project Area, bordered by thin, bright green bands of tall wetland vegetation. The levees bounding the creek are visible at this vantage, distinguished from the lower marsh plain by their brighter gold color in summer, breaking the pastures into geometric forms. Black and white cows graze and rest in the pastures. The vegetation in pastures in late summer is variegated gold and dull green, broken by linear bands of darker green riparian vegetation persisting in ditches and old slough channels. During the winter, when the pastures are more uniformly green, the islands of riparian vegetation are distinguished primarily by their height and apparent roughness. Beyond the pastures, to the east, the roofs and rough, dark green vegetation of the Point Reyes Mesa forms a contrasting horizontal band of color and texture. The view to the south affords vistas of the East Pasture, including grazing cows, green irrigated grasslands, and streaks of brown fencing and silver-colored irrigation piping. Behind the East Pasture observers can see the silvery geometric form of the loafing barn in the East Pasture and the brown, unvegetated fenced cattle lots, and the structures of Point Reyes Station behind them. Looking to the north, observers can note the linear feature of the West Pasture north levee bounding the end of the West Pasture and marking the transition from pasture to the Natural Landscape characterized by green undiked salt marsh and blue Tomales Bay to the north. The forested Inverness Ridge to the west, and grassy rounded hills to the east, slope down to meet the marsh and the bay. At night, the lightscape approximates natural lighting, broken only by the sparse dim line of visually-distant lights from Point Reyes Mesa residences~~,~~ and from cars moving along Sir Francis Drake Boulevard.

West Pasture North Levee: The immediate **foreground** is dominated by the highly-artificial structure of the 20-foot tall weather station and the wire fence surrounding this equipment. Looking south from the eastern tip of the levee, into the Project Area, the foreground of the view is scored by the broad dark blue line of Lagunitas Creek bounded within its levees. The levees themselves are set back from the creek by a 10-foot band of low-texture herbaceous vegetation~~,~~ and rise about 8 feet above the marsh plain. The levees are dominated by a Ruderal Landscape characterized by a texturally-complex annual exotic herbaceous plants, mostly gold-colored by late summer. Behind the levee, looking toward the East and West Pastures, the **mid-ground** view is of short-grazed annual grasses, gold-colored in summer and broken up in places by green patches of taller perennial shrubs along linear features such as ditches and old slough channels. The West Pasture is bordered to the west by the tall green cattails of the freshwater marsh. Behind the freshwater marsh, in the **background** of the view, automobiles on Sir Francis Drake Boulevard are occasionally seen and

heard, and houses on the lower elevations of the dark-green forested Inverness Ridge are visible. Looking toward the East Pasture, a dominant feature of the mid-ground view is the 10-foot tall highly-geometric form of the Tomasini Creek tide gate controlling the outflow of Tomasini Creek water into Lagunitas Creek and the levees that preclude views of the East Pasture. Further down the East Pasture levee, to the south, the small, wooden, pitch-roofed pumphouse for the East Pasture irrigation system is visible, as are the wooden power poles delivering electricity to the pumps. These, combined with the levees, disrupt the integrity and unity of the Pastoral Landscape. In the background, residences on the Point Reyes Mesa, which are about 30- to 50 feet above the level of the marsh plain, are visible between and behind tall green stands of eucalyptus trees. The silvery, geometric form of the loafing barn, in the far southern end of the Project Area is partially visible in the distance. After sundown, this view is highly characteristic of a rural lightscape: sparsely distributed residential lights on the slopes of the Inverness ridge, headlights of cars moving along Sir Francis Drake Boulevard, and the dim visually-distant lights of Point Reyes Station and the Point Reyes Mesa are the only intrusions into the natural darkness.

White House Pool County Park: This view corridor along the single-lane dirt trail paralleling Lagunitas Creek, accessed from the White House Pool County Park parking area, is dominated in the **foreground** by the broad blue channel of the creek and its associated bright-green riparian vegetation. In the **mid-ground** view, the southern portion of the East Pasture levee rises up about three feet above the level of the marsh plain, visually separating the creek from the southern portion of the East Pasture. The levee is dominated by tall, rough, flowering weedy vegetation, intermittently broken by low hedges of dark green blackberry bushes and tall solitary stands of round-profiled gray-green willow trees. A post-and-wire fence runs along the top of the levee, contributing to the pastoral quality of the view. Behind the levee, elevated silver~~y~~ irrigation piping is clearly visible, somewhat disrupting the integrity and unity of the Pastoral Landscape characterized otherwise by green pasturelands dotted sparsely with black and white cows. The expanse of green fields in the East Pasture in the **background** is broken up by levees, ditches, roads, wooden power line supports, and fences running parallel and perpendicular to each other. Looking to the east, viewers can observe the strongly-pitched roof and metallic siding of the large loafing barn and its skirt of unvegetated brown cattle yards. To the northeast, the rough, dark green undifferentiated vegetation of the Point Reyes Mesa is punctuated with glimpses of private residences and stands of tall linear eucalyptus trees. Behind the Point Reyes Mesa, the smooth grassy rounded form of Black Mountain dominates the horizon, sloping northward down to other grassy, rounded ridges and the green-and-golden bluffs of Millerton Point. To the northwest, observers can view the heavily forested Inverness Ridge paralleling the Project Area northward, with occasional outcroppings of single family houses on lower slopes. The northwest prospect includes views of residential development and power lines following Sir Francis Drake Boulevard to the north. After sundown, the lightscape at this location is altered only by the thin band of lights of the residences on the Point Reyes Mesa~~,~~ and the dim collection of lights from the residences on the slopes and toe of the Inverness Ridge.

Point Reyes Station C Street: From C Street looking westward towards the Project Area, the immediate **foreground** of the view is largely dominated by ranching activities associated with the Giacomini Dairy. At the northernmost portion of this view corridor, views of the dairy operations, including the loafing barn and wood-frame houses and out buildings, are obscured by a 25-foot-tall stand of rough-textured, dark green Monterey Cypress trees. At the southern reach of this view corridor, pale wooden fences and rough-churned expanses of the dairy's enclosed cattle yards front C Street. Beyond the cattle yards, the scene encompasses several tall, rounded peaks of stores of materials, including manure and sawdust, and the open, dark interior of the aluminum-sided loafing barn. Looking to the south, viewers can observe rough, dark green, shrubby vegetation on the southern portion of the East Pasture levee and the linear feature of the levee itself confining Lagunitas Creek to its broad blue channel. Beyond the operations yards in the **mid-ground** vista, viewers can observe the green short-grazed irrigated fields or Pastoral Landscape of the East Pasture. These fields are predominantly smooth-textured, but are broken by occasional patches of taller, rough-textured dark green vegetation, with black and white cows dotting the pasture. Wooden power poles elevate linear stretches of wire across the pasture, somewhat disrupting the integrity and unity of the Pastoral Landscape. Beyond the pasture in the **background** view, the rise of the levee stretching north along Lagunitas Creek is visible, backed by coniferous forest and the housing development at the toe and lower slopes of the Inverness Ridge. Occasional traffic on Sir Francis Drake Boulevard is visible. The lightscape at this location is altered from natural conditions~~,~~ and is dominated by the nearby lights of Point Reyes Station~~,~~ and the dim sprinkling of lights from the residences on the Inverness Ridge.

Hunt Lodge East Pasture: The **foreground** in front of the Hunt Lodge is dominated by the rough, dark-green cattails choking the channel of Tomasini Creek running northward parallel to the East Pasture. The long, red, wood-sided Hunt Lodge itself forms a prominent part of the view here, surrounded by boxy green hedges and tall Monterey Pine and eucalyptus trees. Beyond Tomasini Creek, the levee visually and

topographically separates the channel from the flat green plane of the East Pasture grasslands. The levee, which rises about 3- to 5 feet above the pasture, is topped by a Ruderal Landscape characterized by rough, patchy blanket of tall multi-colored weedy vegetation. The East Pasture beyond the levee, in the **mid-ground** of the view, is segmented into geometric forms by broad roads, post-and-wire fences, and silvery elevated irrigation piping. This piping, the Tomasini Creek levee, and infrastructure such as wooden power poles and electrical lines, fences, and the pitched-roof wooden pumphouse somewhat detract from the integrity and unity of visual resources in the Pastoral Landscape that is otherwise dominated by black and white cows in the fields. Beyond the pasture, the horizontal rise of the Lagunitas Creek levee is visible in the background, backdropped by the rough dark-green evergreen vegetation of the Inverness Ridge. In the background of this view, the Natural Landscapes of Inverness Ridge and the rounded grassy hills to the east converge to meet the undiked salt marsh and the bay. To the south, the dark green rough-vegetated slopes of the Point Reyes Mesa rise up above the Project Area, topped with a sparse settlement of residences and tall stands of eucalyptus trees. Beyond the Mesa to the south, the metallic aluminum siding of the loafing barn is highly visible at the south end of the East Pasture, ringed by fences and the barren grounds of cattle yards. The natural lightscape at this site is marred only by the dim residential lights from the Inverness Ridge.

Tomales Bay Trail: The vista from the Tomales Bay Trail encompasses nearly the entire Project Area. The predominant feature of the **mid-ground** view of the Project Area is the long, dark blue sweep of the Lagunitas Creek channel, running from the far southern reach of the site northward towards the bright blue basin of Tomales Bay. Looking to the south, the silvery pitched roof of the loafing barn protrudes a tiny bit into the irrigated green fields of the East Pasture, which are segmented and somewhat disrupted by linear fences, roads, ditches, and power poles. To the east of the pumphouse, the shallow channels of remnant slough features are visible, along with linear artificial-looking ditch features, bounded by the dark green slopes of the Point Reyes Mesa. The artificially constrained path of Tomasini Creek, leveed to run alongside the Point Reyes Mesa until it reaches the tidegate at its mouth to Lagunitas Creek, is also highly visible. Looking to the west beyond Lagunitas Creek, the rise of the roughly-vegetated levee, dominated by a Ruderal Landscape, visually separates the West Pasture from the rest of the Project Area. In the **background** view, the Ridge is the dominant feature of the west vista, paralleling the smooth fields of the Project Area~~,~~ and running north to meet Tomales Bay. From this vantage, occasional traffic is seen and heard on Sir Francis Drake Boulevard, and the houses dotting the hillside are unobtrusive.

Olema Marsh Bear Valley Road: The **foreground** of the view along Bear Valley Road is dominated by tall (~15 foot), dark green riparian forest vegetation, such as willow and alder trees. Between stands, observers can look west into Olema Marsh. Immediately visible from the road are bright green patches of mid-height wetland vegetation (~2 foot tall), such as bulrush and fern, backdropped by taller (~9 foot) cattail and patches of open water. In the **mid-ground** view the land slopes up to the grassy, golden Shutter Ridge, dominated by a somewhat Natural Landscape of ruderal and native grasses and forbs. Wooden power poles are visible in the far distance. To the north, the mid-ground view is dominated by a row of dark green willow trees bounding the marsh, and beyond that, the green Bolinas Ridge and golden, rounded Black Mountain comprise the **background** view.

Socioeconomic Resources

Marin County has a $500 million annual tourist industry. It is estimated that the Seashore contributes over $150 million to the regional economy visitor expenditures on dining, fuel, gifts, groceries, and lodging (NPS 2002). According to a visitor survey conducted by Sonoma State University (NPS 1997), 74 percent of the visitors to the park are traveling to the Seashore as their main destination; 50 percent of park visitors are staying between 2-6 hours in the park, with 30 percent staying overnight; and 40 percent of visitation comes from Marin, Sonoma, and San Francisco Counties, with 16.5 percent coming from outside of California.

The Seashore received 2.35 million visitors in 2000, accounting for 930 travel party days and nights in the area. An average visitor party spends $94 per party per night in the local area ($109 if locals excluded). Total visitor spending was $87 million in 2000 or $80 million excluding local visitors. This spending of visitors from outside the local region generates $69 million in sales by local tourism businesses, yielding $25.6 million in direct income and supporting 1,100 jobs. Each dollar of tourism spending yields another $0.63 in sales through the circulation of spending within the local economy. Including these secondary effects, the total economic impact of the park on the local economy is $113 million in sales, $42 million in wages and salaries, and 1,800 jobs (Michigan State University 2001).

Park Operations and Management Resources

Background

To fulfill its mission, the Park Service receives funding from both the federal appropriations process and other federal revenue sources. The Park Service requests direct Congressional funding and reports on the other federal revenue sources through an annual budget document submitted to Congress entitled "Budget Justifications," or more popularly called, the "Green Book." Like most federal agencies, the Park Service relies on federal appropriations to fund its core activities, although there is increasing use of alternative revenue sources such as fees and even private grants and mitigation monies to fund specific projects. In addition to base funding, certain parks receive monies from fees generated through park admissions, and parks can also apply for one-time funding through certain appropriation programs that cover cyclic maintenance, construction, etc. For example, the park recently received approximately $1.6 million in this one-time funding for cyclic maintenance on historic structures and other natural resources projects. As part of the San Francisco Bay Network, the Seashore benefits from monitoring information gathered as part of the $800,000 Inventory and Monitoring (I&M) Network. The park will also receive about $625,000 in fee revenues for other maintenance projects and operation of the whale shuttle system and campground reservation system. In addition, the park receives approximately $1,000,000 in FirePro and Wildland Interface funding for hazardous fuel reduction and fire prevention activities.

The Seashore is one of the 30 most visited parks in the National Park system. It is estimated that the Seashore contributes over $150 million to the regional economy.

Because of the limited amount of base funding available to support the 389 park units, the Park Service directs its units to consider the effects of proposed projects on base funding, including any increases in operations and maintenance expenses.

Park Operation and Management Resources

For FY2006, the Seashore has about 75 permanent staff, 10 term employees, and 25-30 temporary staff working on a variety of projects and programs, including Natural Resources, Cultural Resources, Science, Maintenance, Roads and Trails, Fire, Law Enforcement, and the Pacific Coast Learning Center. During the peak summer months, the park staff increases to about 150 staff members, including Youth Conservation Corps enrollees who provide assistance in a number of ways to Point Reyes National Seashore. This work force is supplemented by 20,000 hours of Volunteers-in-Parks service, three Student Conservation Assistants, and AmeriCorps.

The Seashore maintains the necessary infrastructure to support an annual park visitation of 2.25 million people, provide offices, support structures and limited housing for the permanent and seasonal park staff. The Seashore also administers approximately 19,000 acres of the north district of GGNRA. More than half of the Seashore -- the 32,373-acre Philip Burton Wilderness Area -- must be managed in conformance with the 1964 Wilderness Act, NPS Management Policies (NPS 2001a, Chapter 6), and the Director's Order and Reference Manual 41 for Wilderness Preservation and Management. 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 et seq., Section 4 (c)).

Permanent park structures outside the Wilderness Area include:

- 3 visitor centers
- 2 environmental education centers
- 30 restroom complexes

- 4 backcountry campgrounds
- 17 water systems
- 147 miles of trails
- Over 100 miles of roads
- Over 100 public and administrative structures, and
- 27 sewage treatment systems

The Seashore also manages and protects park cultural resources including:

- 297 historic structures
- 127 recorded archaeological sites
- 11 identified cultural landscapes
- 498,000 museum objects

Financial resources available to achieve the park's annual goals include a base-operating budget of approximately $5.6 million. In addition, the park receives supplemental support for fire operations, cyclic maintenance, special natural resource projects, and repair and rehabilitation of structures. Apart from the Park Service program, there are numerous commercial leases within the Seashore operating businesses, farms, ranches, and an aquaculture production. Leases include:

- 6 dairies
- 9 beef cattle ranches
- Silage production on approximately 1,000 acres of land,
- Oyster production in Drakes Estero, and
- Water supply to Bolinas Community

Project Operation and Management Resources

Planning and other activities conducted for the proposed project to date have been almost exclusively funded out of non-Park Service monies. The wetland restoration component has received funding from a Caltrans mitigation, SS Cape Mohican oil spill settlement funds and several private and federal grant sources (Gordon and Betty Moore Foundation, National Fish and Wildlife Foundation, North American Wetlands Conservation Act, National Wetlands Conservation Act). The funding from CalTrans and Cape Mohican has covered expenses of from one to two term FTE employees and occasional seasonal hires involved in planning and overseeing the proposed project. Since acquisition of the property, annual expenditures for the project, including personnel, monitoring, some property maintenance, and contracting for baseline studies including hydraulic and hydrodynamic modeling, ranged from $132,026 to $277,833 annually through September 2005. Personnel costs incorporated most of the environmental compliance activities for the proposed project, including scoping, alternative workshops, and preparation of this document, as well as a substantial amount of the vegetation and wetland-related baseline studies. The Seashore is currently applying for funding from at least three more private grant sources. It is anticipated that private funding would entirely pay for any further planning needs (i.e., permitting) and implementation or construction of the proposed project.

The proposed project has received some federal funds and support. Federal monies used for the proposed project came from $1.55 million in Congressional appropriations used to purchase the Giacomini Ranch and two competitive grant programs (Conservation Challenge Initiative and Park Service-USGS). Permanent base-funded Seashore staff has assisted with administration of the project, such as contracting, payroll, benefits administration, personnel, and maintenance associated with immediate operations and maintenance needs. On an annual basis, it is estimated that, on average, permanent, base-funded staff contribute less than 25 FTE days each year to the proposed project.

The Giacomini Ranch currently has no park facilities. Maintenance is not performed by Park staff currently on an annual basis, as most of the maintenance with the exception of the 2003 West Pasture levee repair and sediment removal from the 1906 Drainage downstream of the Lucchesi residence has been conducted by the Giacominis as part of their on-going operation of the ranch under a Reservation of Use agreement until spring 2007. However, immediate operations and maintenance needs such as repair of the Fish Hatchery Creek culvert and tidegate in 2003 and annual sedimentation removal from the 1906 Drainage due to flooding of adjacent private residences have been overseen by park maintenance personnel. Because the Giacominis continue to operate the Giacomini Ranch, existing informal social paths are not currently maintained by the Seashore.

Intentionally Left Blank