

Bolinas Lagoon Management Plan Update 1996

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Bolinas Lagoon Management Plan Update 1996

Approved By:

Bolinas Lagoon Technical Advisory Committee

_____, 1996

Marin County Parks, Open Space, and Cultural Commission

_____, 1996

Board of Directors, Marin County Open Space District

_____, 1996

This plan is dedicated to the memory of

CLYDE WAHRHAFTIG

NELLO PACE

and

FRANCES STEWART

Clyde Wahrhaftig and Nello Pace served with distinction on the Bolinas Lagoon Technical Advisory Committee for many years. Aside from their notable personal achievements in other fields, both made important contributions toward resolving issues related to the ecologically sound management of Bolinas Lagoon.

Frances Stewart, a grand and gracious West Marin elder and political dynamo, was a charter member of the Bolinas Lagoon Technical Advisory Committee. She led early efforts to prevent development of Bolinas Lagoon and achieve its designation as a nature preserve.

EXECUTIVE SUMMARY

Bolinas Lagoon is one of Marin's most significant natural resources. The Lagoon, an estuary located at the southern end of the Point Reyes peninsula, is approximately 1,100 acres with a watershed of 16.7 square miles. The Lagoon tidelands are publicly-owned. Most of the Lagoon is owned by the County of Marin and is managed as the Bolinas Lagoon Open Space Preserve by the Marin County Open Space District (MCOSD). Along with Drake's Estero and Tomales Bay, Bolinas Lagoon provides an important coastal environment for fish, birds, and mammals that is unparalleled along the northern California coast between San Francisco and Humboldt Bays. Open water, mudflat, and marsh provide productive and diverse habitats for marine fishes, waterbirds, and marine mammals. It is also unique in that it is part of a much larger protected natural habitat complex that is part of or adjoins the Gulf of the Farallones National Marine Sanctuary (GFNMS), Pt. Reyes National Seashore, Golden Gate National Recreation Area, Central California Coast Biosphere Reserve, and Mount Tamalpais State Park, and Audubon Canyon Ranch. Few other places in California offer such opportunity for natural resource management to encompass so many species and habitat types.

The purpose of this document is to update the 1981 *Bolinas Lagoon Resource Management Plan*. The updated plan considers information collected since the last plan, the success of the activities and policies enacted during this period, and the application of new federal, state and County regulations affecting Lagoon water quality and habitat protection. In addition to this update of the prior plan, a significant portion of this report concerns (1) the physical and ecological changes that have occurred in the Lagoon as a result of sediment accumulation, (2) projected future changes, and (3) management alternatives and remedial actions to preserve the unique estuarine habitats within the Lagoon. It is important to note that the analyses of past and future physical changes were based on a review of existing information, much of which is incomplete or was originally analyzed using different methods. This information was used to identify general physical trends but additional studies are required to understand the Lagoon's physical processes and to identify specific remedial action strategies.

The foremost resource management issues are the continuing sediment accumulation and the loss of estuarine habitats, both consequences of human impacts. For at least 7000 years, there was a dynamic equilibrium of sedimentation balanced by sea level rise and tectonic subsidence. This system was destabilized by human activities beginning in 1849 with intensive logging, clearing and grazing in the Lagoon's watershed. Based on the most complete information available, it is estimated that the Lagoon is losing tidal prism to sedimentation at about 1.4 million cubic feet per year. Between 1968 and 1988, the Lagoon lost an estimated 25% of its tidal prism and 7% of its estuarine habitat.

Without intervention and until the next tectonic event, the rate of tidal prism loss is expected to continue, resulting in further losses of total estuarine habitat. It is estimated that between 1988 and 2008, subtidal habitat area will decrease by 40% (down nearly 80% compared to 1968);

intertidal flat area is expected to decrease 30%; emergent salt marsh habitat type area will have increased more than 50% (400% increase compared to 1968); and upland habitat will increase by 11% as estuarine and wetland habitats are converted to uplands.

Little empirical information is available on changes in the abundance of taxa other than birds, but it is expected that the Lagoon will lose significant diversity in estuarine invertebrates and fish species. Such changes, as reflected by changes in bird diversity, may have occurred already and monitoring of these populations is highly recommended. While harbor seal populations have increased, at some point the loss of channels and overall access will deter seals from using the Lagoon. Available data on changes in abundance of bird species on the Lagoon indicate that diving birds (e.g., grebes and diving ducks) have decreased since 1972, generally correlated with the loss of subtidal habitat. At the same time, species most dependent on intertidal flats (e.g., shorebirds and dabbling ducks) have increased, consistent with an observed increase in their primary habitat. The abundance trends of both groups at Bolinas Lagoon has tended to be counter to statewide trends or trends elsewhere in the region. Based on predicted physical changes, it is expected that waterfowl and shorebirds (i.e., the groups with the greatest abundance and species diversity that are dependent on the Lagoon's estuarine habitats) will decline as the subtidal channels and intertidal flats shrink. By 2008, the Lagoon will likely be a significantly less valuable migration and overwintering location on the Pacific Flyway, where estuarine habitats have already suffered huge losses and degradation. The loss of the wettest estuarine habitats would be offset to a small degree by increases in salt marsh and riparian habitats. Salt marshes at Bolinas Lagoon support a relatively low diversity of birds, fish, and invertebrates compared to the lower elevation estuarine habitats. The salt marshes do provide habitat for a few special status species, and the riparian habitats at Pine Gulch Creek provide breeding and migratory habitat for passerines (i.e., songbirds).

If present physical and ecological trends continue, there will be a continued loss of estuarine habitat and the diversity and abundance of Lagoon life as subtidal and intertidal habitats are converted to emergent marsh and uplands. These changes are largely the result of past alterations of the watershed by humans. These developments are counter to the overall management goal and objective of the MCOSD, GFNMS, and the Bolinas Lagoon Technical Advisory Committee (BLTAC) which is to maintain and restore the abundance and diversity of Lagoon life, the estuarine habitats that sustain them, and the underlying physical factors that maintain Bolinas Lagoon as a lagoon.

Based on the observed, predicted and prudently assumed physical and ecological trends, remedial actions are required to meet this goal. There are several possible remedial actions that could be employed under current conditions that would restore wetland habitat or slow the rate at which wetland is likely to be converted to upland. Various alternatives that can be used alone or in combination for sediment management are (1) watershed management geared toward reducing sediment inputs, (2) dredging to remove accumulated sediment and to promote sediment removal from the Lagoon via tidal scouring, (3) Pine Gulch Creek restoration, (4) fill removal, and (5)

restoring tidal prism at Seadrift Lagoon. A "No Action" alternative would rely on future geologic activity and sea level rise to conserve/restore ecological resources of the Lagoon. All of the above alternatives have varying degrees of unpredictability.

A survey and analysis of sediment erosion areas and remedial actions to reduce sediment delivery to the Lagoon are recommended. Even though the primary factors contributing to high historic sediment deposition such as logging in the watershed, extensive clearing, and grazing, have, to a large extent, ceased, they may have continuing secondary effects. Also, current land use practices such as farming, residential construction, and tree removal, still contribute an unknown amount of sediment to the Lagoon. Therefore, watershed management is an important component of conserving the unique ecological, economic, and recreational resources of the Lagoon.

The second management tool is dredging to remove accumulated sediments and to promote sediment removal through tidal scouring. The Lagoon is within the Gulf of the Farallones National Marine Sanctuary whose regulations prohibit dredging except when necessary for ecological maintenance. Additional information is needed to determine the location, extent, volume and frequency for several dredging alternatives and the possible impacts from a range of dredging options. Dredging alternatives may range from limited spot dredging to large scale maintenance dredging. Limited dredging would focus on critical areas where sediment removal would open channels and promote increased tidal scouring and removal of sediments. Maintenance dredging would remove a set amount of accumulated sediments to restore the tidal prism; for example, removal of approximately 1.4 million cubic yards of accumulated sediment would restore the Lagoon's tidal prism to 1968 levels. Dredging may result in adverse impacts and threats to particularly sensitive marine resources. The challenge, therefore, is to identify technically feasible, cost-effective, and environmentally acceptable ways to meet the goals and objectives of maintaining a functioning estuarine lagoon and the diversity and abundance of Lagoon life.

Constraints on implementing any remedial action include the sensitivity of the Lagoon's resources, uncertainty about physical variables affecting sedimentation, uncertainty in predicting the effects and efficacy of remedial actions, potentially high costs of dredging, and difficulty in obtaining permits from agencies. Consequently, it is recommended that a Sediment Management Plan (SMP) be developed that would address these constraints. A framework for a SMP is presented that would insure intervention at appropriate levels when needed, base intervention on observed physical and ecological changes, take advantage of natural processes such as watershed restoration and earthquakes, develop a decision-making framework, monitor key variables, and with information obtained from monitoring, modify, update and improve the decision making process.

Numerous agencies have jurisdictional, planning or regulatory oversight of the Lagoon or its watershed. In order to implement management goals, communication and coordination among the various agencies and entities having authority or interests in the Lagoon should be improved. The MCOSD has the primary role in managing the natural resources of the Lagoon. The BLTAC,

which serves as the technical advisor to the MCOSD for all matters potentially affecting the Lagoon, has provided a forum for discussing issues relating to the Lagoon and for coordinating management efforts.

The final section of the report provides direction to the MCOSD regarding day-to-day Lagoon management issues. Thirty-five resource management issues and recommendations are discussed, ranging from educational programs, oil spill protection, kayaking, and harbor seal disturbance, to land and easement acquisition. A significant portion of the MCOSD's management efforts relate to recreational uses of the lagoon. Certain recreational activities such as canoeing, kayaking, motorboating and jetskiing, directly conflict with resource management goals because they disturb resting or breeding harbor seals. Educating the public as to the sensitivity of the Lagoon's wildlife resources is emphasized as the key to reducing conflicts between human activities and wildlife.

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I. INTRODUCTION

Bolinás Lagoon is an Open Space Preserve managed by the Marin County Open Space District (MCOSD). It is a tidal embayment located at the southern end of the Point Reyes peninsula and is one of Marin's most significant natural resources. Along with Drake's Estero and Tomales Bay, Bolinás Lagoon provides a unique coastal environment for fish, birds, and mammals that is unparalleled along the northern California coast between San Francisco and Humboldt Bays. Open water, mudflat, and marsh provide productive and diverse habitats for marine fishes, waterbirds, and marine mammals. It is also unique in that it is part of a much larger protected natural habitat complex that is part of or adjoins the Gulf of the Farallones National Marine Sanctuary (GFNMS), Pt. Reyes National Seashore, Golden Gate National Recreation Area (GGNRA), Central California Coast Biosphere Reserve, and Mount Tamalpais State Park. Few other places in California offer such opportunity for natural resource management to encompass so many species and habitat types.

Development of both Bolinás and Stinson Beach has subjected Bolinás Lagoon to direct and indirect human impacts. Direct impacts include fill placement in the Lagoon for construction of Highway 1, development of the Seadrift housing project and adjoining artificial lagoon, diversion of Easkoot Creek, the channelization of Pine Gulch Creek, the Bolinás groin, and the Seadrift seawall. Indirect impacts include the establishment of non-native plants and invertebrates, water quality degradation, and streamwater diversion. The greatest impact, however, is associated with historic land use practices that have led to sedimentation accumulation within the Lagoon and a loss of wetland habitat. In the past 20 years, the Lagoon's tidal prism has decreased by 25 percent and with it the ability of the Lagoon to flush sediments out with the tide cycle. Estuarine habitats are being converted permanently to upland habitats, and this reduction of the total estuarine area is predicted to continue unless remedial management actions are taken.

The Marin County Board of Supervisors formed the Bolinás Lagoon Technical Advisory Committee (BLTAC) in 1974 to offer advice and comments to the County on issues affecting the Lagoon and its natural resources. Two central documents, the *Bolinás Lagoon Plan* (1972) and the *Bolinás Lagoon Resource Management Plan* (1981), have been prepared that address management of the Lagoon. Management activities that have subsequently been undertaken include: construction of a sedimentation basin on Pine Gulch Creek; elimination of grazing in the Pine Gulch Creek delta; removal of exotic vegetation along some of the Lagoon's edges; and restoration of wetland habitat in the east end by removal of the Seadrift causeway and the old Stinson Beach landfill dump.

The purpose of this document is to update the 1981 *Bolinás Lagoon Resource Management Plan*. The updated plan considers the information collected since the last plan, the success of the activities and policies enacted during this period, and the application of new federal, state and County regulations affecting Lagoon water quality and habitat protection. In addition, a significant portion of this report concerns (1) the physical and ecological changes that have occurred in the

1 Lagoon as a result of sediment accumulation, (2) projected future changes, and (3) management
2 alternatives and remedial actions to preserve the unique estuarine habitats within the Lagoon. It is
3 important to note that the analyses of past and future physical changes were based on a review of
4 existing information, much of which is incomplete or analyzed using different methods; this
5 information was used to identify general physical trends but additional studies are required to
6 understand the Lagoon's physical processes and to identify specific remedial action strategies.

7
8 Section II of this report identifies the management goals and objectives for Bolinas
9 Lagoon developed by the MCOSD and the BLTAC. Sections III, IV, and V examine past, current
10 and future expected physical changes within the Lagoon based on a review of existing information.
11 These are followed by Section VI on ecological relationships and interactions within the Lagoon
12 and how the abundance and diversity of Lagoon life may be affected based on the expected
13 physical changes. Then Section VII develops a framework for designing technical information that
14 will be required for identifying feasible and cost effective remedial actions that can be applied to
15 meet the stated goal and objectives. Section VIII of the report sets forth a list of other issues and
16 recommendations relevant to MCOSD management of the Lagoon as a natural area affected by
17 recreational, educational and land uses within the Lagoon and its watershed.

1 **II. BOLINAS LAGOON MANAGEMENT GOALS**
2

3 The management goals and objectives for Bolinas Lagoon developed by the Marin County
4 Open Space District (MCOSSD) and the Bolinas Lagoon Technical Advisory Committee (BLTAC)
5 are as follows:
6

7 **GOAL I: Preserve and restore the ecological values of Bolinas Lagoon.**
8

9 Objectives:
10

- 11 1) Preserve the abundance and diversity of Lagoon life (especially native
12 aquatic birds, marine mammals, fish, and marine plants and invertebrates).
13
- 14 2) Preserve and enhance, over the long term, an ecological system including
15 aquatic habitats (subtidal, intertidal, marsh, riparian, sand bar, and beach)
16 that best protects the abundance and diversity of Lagoon life.
17
- 18 3) Restore water quality and hydraulic functions that will decrease
19 sedimentation and prevent the loss of rich estuarine habitats.
20

21 **GOAL II: Consistent with GOAL I, maintain and enhance the opportunities**
22 **for education, research, recreation, navigation, and aesthetic enjoyment of**
23 **Bolinas Lagoon.**
24

25 Objectives:
26

- 27 1) Promote education of the public about the ecological values of the Lagoon
28 and its watershed.
29
- 30 2) Support research about the Lagoon's physical and biological systems and
31 human uses.
32
- 33 3) Allow compatible recreational activities.
34
- 35 4) Continue use of a limited area of the Lagoon for small boat mooring.

1 **GOAL III: Promote land use management in the Lagoon's watershed**
2 **consistent with preserving and restoring the ecological values of Bolinas**
3 **Lagoon.**

4
5 Objectives:

- 6
7 1) Promote cooperative efforts to acquire and preserve lands of ecological
8 significance to Bolinas Lagoon.
9
10 2) Encourage and support sound watershed management practices.
11
12 3) Encourage cooperative watershed improvement efforts.

III. JURISDICTIONAL HISTORY

Historically, the tidelands had been under the jurisdictional control of the State of California. In January 1956, responsibility for managing the Lagoon's tidelands was transferred to the Bolinas Harbor District. The Harbor District, a public body, either initiated or was instrumental in securing a wide range of scientific and technical investigations of the Lagoon and parts of its immediate surroundings. In 1966, the Harbor District presented a plan for an extensive marina development for 1,600 boats within the Lagoon. In 1967, Audubon Canyon Ranch and the Nature Conservancy conveyed lands in Bolinas Lagoon, including Kent Island, to the County on the condition that they be kept as a nature preserve. Because Kent Island was identified in the Harbor District's marina development plan as the site for dredged spoils and infrastructure for the marina, the Harbor District could not use the site for these purposes. The local population voted for the dissolution of the Harbor District in 1969 for economic as well as environmental reasons.

In 1969, the Bolinas Lagoon tidelands were transferred to Marin County by the State. The law transferring the tidelands required the County to submit to the State, within three years, a reasonable plan for the use and protection of the Lagoon tidelands. Two studies were used as the basis of this plan. First, the County invited the Conservation Foundation to assist in developing comprehensive planning guidelines for the area and the Foundation initiated research into the ecology, geology, and water quality of the area. The result of the Foundation's work was a set of specific findings and recommendations for the protection, use, development, and management of the tidelands and the watershed (Conservation Foundation 1971). Second, the California Department of Fish and Game (1970) published a report on the Lagoon and its value to the people of the State with specific recommendations for the protection and use of the Lagoon's tidelands.

The conclusions, recommendations, and proposals contained in these were the basis of the Bolinas Lagoon Plan prepared by the Marin County Parks and Recreation Department in 1972; the Plan was reviewed by the State Department of Navigation and Ocean Development and approved by the Board of Supervisors and the State Lands Commission. The State Attorney General also issued an opinion (Appendix A) stating that the County is not required to provide for the entire list of items in the legislation that transferred title of the tidelands to the County (Appendix A) but could instead concentrate almost exclusively on the environmental, educational, aesthetic, and research values of the Lagoon.

Recognizing the need for technical and citizen input related to the Lagoon's management, the County established the BLTAC in 1974. Bolinas Lagoon was designated a Marin County Nature Preserve in 1977 with management responsibility assigned to the County Parks Department. In 1988, the County transferred management responsibility to the Marin County Open Space District, which manages the Lagoon as the Bolinas Lagoon Open Space Preserve.

1 A condition of the tidelands grant was submittal of a progress report five years after
2 certification of an acceptable plan. The requirement was satisfied in June 1978, fulfilling all
3 requirements of the grant to transfer Bolinas Lagoon tidelands to the County. In 1981, the Bolinas
4 Lagoon Resource Management Plan was completed (Madrone Assoc. 1981). In 1981, Bolinas
5 Lagoon was included within the federally designated Gulf of the Farallones National Marine
6 Sanctuary (GFNMS) by the National Oceanic and Atmospheric Administration (NOAA). As stated
7 in the designation document published in the Federal Register:

8
9 *"The purpose of designating the Sanctuary is to protect and preserve the extraordinary*
10 *ecosystem, including marine birds and mammals, and other natural resources [of Bolinas*
11 *Lagoon and the other waters of the Sanctuary] and to ensure the continued availability of*
12 *the area as research and recreational resources."*

13
14 The Sanctuary designation document and regulations are provided in Appendix A. The Sanctuary
15 provides direct jurisdictional and permit authority over the waters and seabed in the Lagoon up to
16 the mean high tide line for certain activities, and thus has widely overlapping authority with the
17 County over the Lagoon's tidelands.

18
19 Numerous other organizations have jurisdiction over certain activities in the Lagoon (e.g.,
20 CDFG) or on those portions of the Lagoon or watershed that are owned or managed by them (e.g.,
21 Golden Gate National Recreation Area). Ownership patterns of the Lagoon are discussed in
22 Section VII and jurisdictional responsibilities in Appendix B.

IV. OVERVIEW OF ESTUARINE LAGOON EVOLUTION

Geologically, lagoons are dynamic and relatively ephemeral features along the coast. A coastal lagoon is formed when a river mouth or similar feature is drowned by rising sea level. Littoral drift creates a sandspit or barrier bar across the mouth of the drowned valley such that a narrow inlet is formed. Whereas sediments may enter a lagoon from numerous sources including rivers, creeks, flood currents, wind, and erosion along the shoreline and watershed, the only agent for removing sediments from a lagoon is the ebb current. Hence, in most situations, the rate of overall sediment accumulation depends on the rates at which the sediment is supplied and removed by the ebb current.

Once sediment enters a lagoon, it is distributed primarily by tidal currents. Tidal current velocity largely controls sediment deposition and erosion. Deposition occurs at zones of low current velocity and wave action. Marsh vegetation, benthic organisms, differential currents during flood and ebb current, wave action and the formation of tidal deltas (produced by decreased velocity of currents moving from the restricted inlet to the open ocean) all affect current velocity and sediment deposition patterns within a lagoon. Common features of lagoons are tidal deltas which often occur in pairs. The delta outside the lagoon is usually larger than the inside one. Frequently, the inner delta becomes a crescent-shaped island and the outer delta a sand bar.

The "life" of an estuarine lagoon depends on the rate of sediment accumulation. Rusnak (1967, cited in Ritter 1973) estimated that sediment accumulation ranges between one and two meters per thousand years (one to two mm/yr) in most lagoon systems. In comparison, sea level rise in the San Francisco area has averaged one to two mm/yr from 5,000 b.p. (before present) to the present (Atwater 1977). On some lagoons, including Bollinas Lagoon, periodic tectonic subsidence of the lagoon floor substantially increases tidal prism (the volume of tidal estuarine water between MHHW and MLLW) and reverses the effects of decades of sediment accumulation. In undisturbed conditions, lagoon systems may persist for considerable periods of time. However, most lagoon systems have been impacted by human land-use practices that substantially increase sediment delivery rates. When sediment accumulation is greater than counterbalancing forces of sea level rise and tectonic subsidence, subtidal areas increase in elevation and are replaced by intertidal flats, emergent marsh, and eventually, upland habitat along the fringes of a lagoon and around delta islands. As tidal prism is lost, the scouring effect of the ebb tide is reduced at the mouth. Eventually, a high wave action event from the ocean may close the entrance until high water in the lagoon seasonally opens the entrance channel. In this phase, sediment accumulation within the lagoon may be rapid, leading eventually to a permanently closed condition and progression toward a seasonally brackish to freshwater marsh and eventually to an upland meadow.

V. PHYSICAL DESCRIPTION OF BOLINAS LAGOON: HISTORIC, CURRENT AND PROJECTED FUTURE CONDITIONS

A. LOCATION

Bolinás Lagoon is situated on the California coast about 12 miles northwest of the Golden Gate and San Francisco Bay (Figure 1). The Lagoon is approximately 1,100 acres and its tidal channels, mudflats and marshes support a rich diversity of marine and estuarine life. Triangular in shape, the Lagoon is about 3.5 miles long on a north-south axis and no more than 1 mile across at its widest axis. It is surrounded by the Bolinas Ridge rising nearly 2,000 feet to the east and by the Point Reyes Peninsula on the west. Urban development is concentrated in the nearby communities of Stinson Beach and Bolinas. Access to Bolinas Lagoon is provided by State Highway 1, the Bolinas/Olema Road, Wharf Road, Seadrift and Dipsea Roads. The most prominent topographic feature east of the Lagoon is Bolinas Ridge, which runs northwest from Bolinas Lagoon to Tomales Bay. Bolinas Mesa is a broad, elevated marine terrace forming the western margin of the Lagoon. Stinson Beach, in part a narrow sandspit, forms the southern boundary of the Lagoon (Figure 2).

The Lagoon watershed is approximately 16.7 square miles and has maximum dimensions of 3 miles in width by 9 miles in length (Ritter 1973). Pine Gulch Creek, draining about half of the basin, is the only perennial and significant tributary to enter the Lagoon from the west. The intermittent, eastern tributaries are short and steep, and have drainage basins of less than one square mile, and small deltas (Ritter 1973). Easkoot Creek now flows into the south end of the Lagoon but historically drained into the ocean. The two major channels in the Lagoon are Bolinas Channel and the main (unnamed) channel that has numerous tributary channels (Figure 2).

B. PHYSICAL CHANGES/NATURAL CONDITIONS

Bolinás Lagoon was formed at least 7,700 years ago when rising sea level invaded the graben that forms the southern end of San Andreas Rift Valley and a sandspit formed across the mouth of the drowned valley separating the Lagoon from Bolinas Bay. From 9,000 b.p. (before present) to 5,000 b.p. sea level rise averaged 20 mm/yr but slowed to about 1 to 2 mm/yr from 5,000 b.p. to the present (Atwater 1978). Sea level rise has caused the barrier beach to move inland and to extend the Lagoon northwards into the San Andreas Rift Valley. During this evolution the Lagoon probably maintained its present triangular shape.

Bergquist (1978) used soil borings to examine Lagoon conditions and depositional history from approximately 8,000 b.p. to the present. Bergquist extracted soil cores from different locations in the Lagoon and examined types and sequences of soil, invertebrates and pollen in each core. The Bergquist results indicate that from 8,000 b.p. to the early 1800's, there was a dynamic equilibrium in the Lagoon's depth and configuration: marsh deposits and Lagoonal deposits occurred in sequences, indicating a shifting balance between sea level rise, sediment accumulations

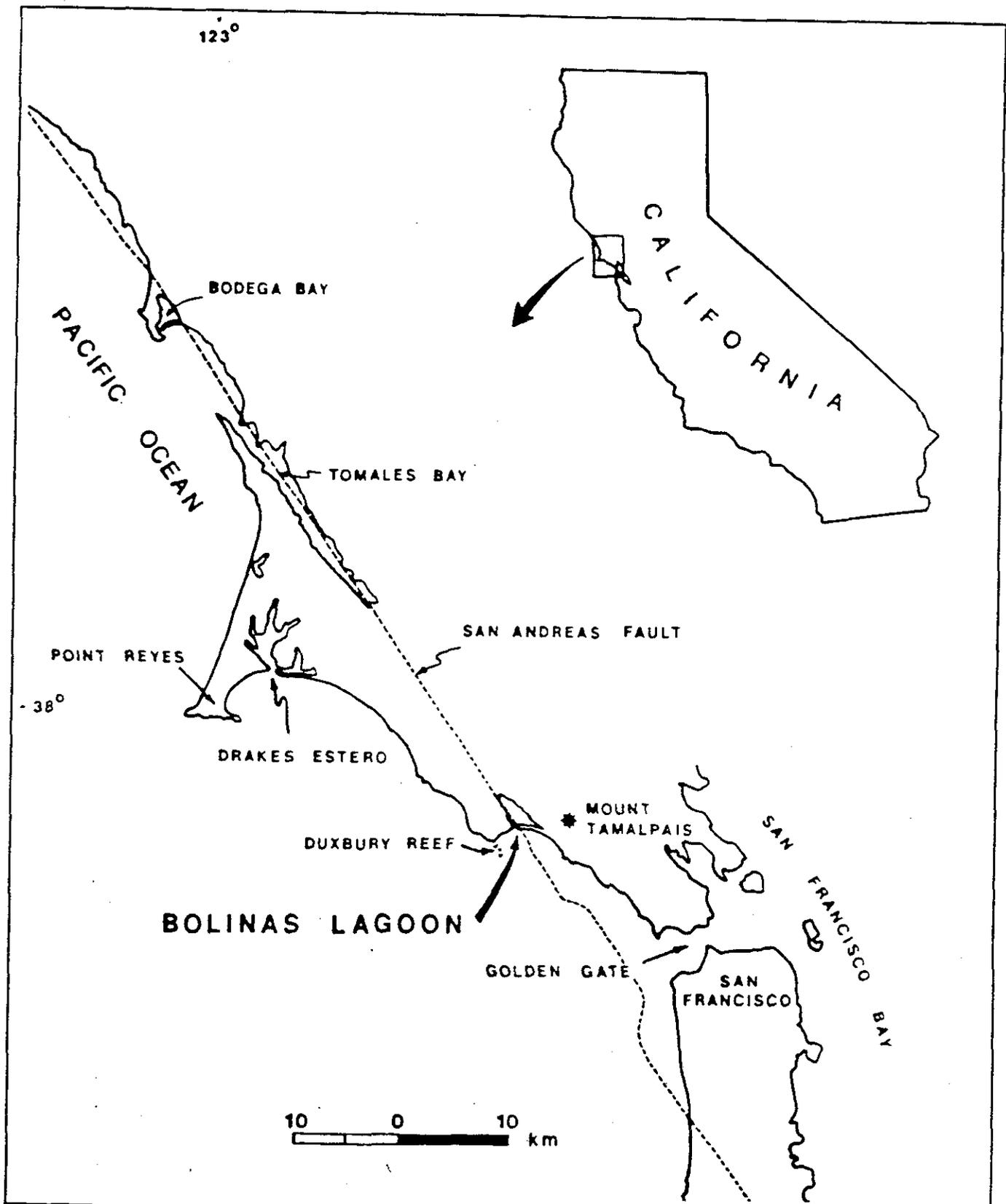
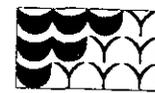


Figure 1. Location of Bolinas Lagoon in relation to other features along the northern California coast. Modified from Bergquist 1978.



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1 and tectonic subsidence. Sediment accumulation during the pre-1850 period averaged 3 mm/yr
 2 whereas tectonic subsidence averaged 1.6 mm/yr and sea level rise 1.5 mm/yr (Table 1).
 3 Bergquist's results indicate that the Lagoon was never a deep-water embayment and that, viewed
 4 over the long-term, it was predominantly intertidal mudflat and shallow subtidal habitat as shown
 5 in the first accurate map (1854) of the Lagoon (Figure 3).

6
 7 Table 1. Historic sediment accumulation in Bolinas Lagoon.

Date	Sedimentation ¹ mm/yr	Tectonic Subsistence ¹ mm/yr	Sea Level Rise ² mm/yr	Net Accumulation mm/yr	Loss of Tidal Prism ³ mcf/yr
Pre-1849	~ 3	~ 1.6	~1.5	~0	~ 0
1849-1906	~ 16	~0	~ 1.5	~ 14	~ 2.0

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¹ Interpreted from ranges of values given by Bergquist, 1978.

² From Atwater, 1978.

³ Assuming accumulation in mudflats and channels - 1,000 acres.

The morphology of the southwestern portion of the Lagoon was created by the deposition of sand carried into the Lagoon on the flood current that formed a tidal delta (Kent Island). This island in turn protected the area in its lee from wave action, allowing mudflat sedimentation to reach elevations suitable for colonization by salt marsh vegetation, thereby creating a marsh plain that extends into the Lagoon.

C. HISTORIC CHANGES IN LAGOON MORPHOLOGY

Ritter (1970), Rountree (1973) and Bergquist (1978) studied the historic evolution of the Lagoon and how human and natural changes have affected its morphology. These studies indicate that (1) watershed disturbance such as logging and grazing in the 19th century greatly accelerated sediment deposition in the Lagoon, (2) the 1906 earthquake caused about 1 foot of subsidence in most of the Lagoon (G.K. Gilbert, in Lawson, 1908, p.82) greatly increasing its tidal prism, and (3) sediment deposition continues to reduce the Lagoon's tidal prism.

Native Americans had little impact on the Lagoon compared to the landscape changes that followed settlement by Europeans. The first European settler arrived about 1834 and in 1849 logging of timber for building in San Francisco began in the Bolinas watershed. To transport the lumber, several "embarcaderos" or wharfs were built in the Lagoon during the next few decades. Typically, lumber was transferred from lighter to larger, heavier ships outside the Lagoon or towed as rafts into San Francisco Bay. In 1854, the depth of water over the bar was surveyed at 1 foot at low water (U.S. Coast Survey Map #T452). This limited the drafts of vessels using the Lagoon to a maximum of about 7 feet (Rountree 1973). Hence, accounts such as that by Munro-Fraser (1880) written 30 years later, are incompatible with the 1854 survey data:



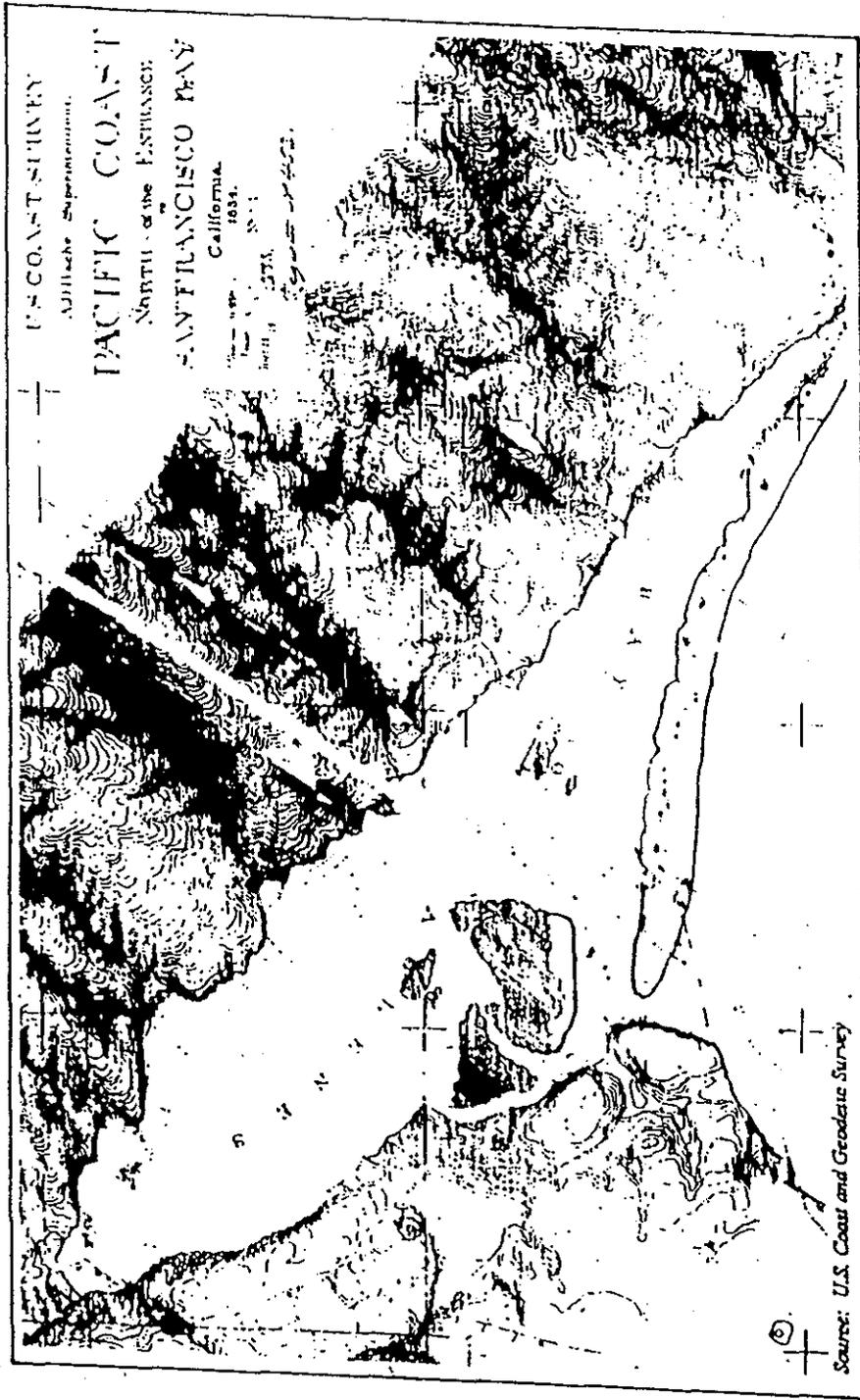


Figure 3. 1854 Topographic Map of Bolinas Lagoon.



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1
2 *"When vessels first began to sail into the port [of Bolinas], a schooner drawing 10 feet of*
3 *water could pass over the bar [outside the inlet] with ease at any stage of the tide, while*
4 *now [c. 1880], the same draught of vessel can barely pass at the highest stage"*

5
6 Between 1852 and 1870, 10 schooners were built near the mouth of McKennan Gulch.
7 Most were 40 to 70 feet and drew 4 to 7.5 feet of water. Siltation forced ship-builders to move
8 operations repeatedly and one embarcadero was unusable as early as 1857 (T. Barfield cited in
9 Ritter 1973).

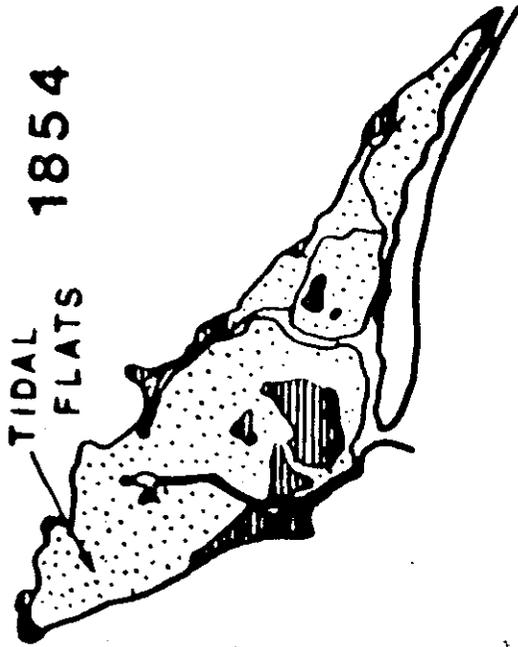
10
11 Dairy products and cattle were important exports from the vicinity. This period of cutting
12 of lumber, cordwood, vegetation clearing and extensive grazing, road building and large intensive
13 fires in the watershed correlates with a period of high sedimentation rates in the Lagoon. For
14 example, Bergquist's (1978) analysis of soil cores indicates high sedimentation rates during the
15 1849-1906 period. Sediment deposition increased from an estimated 3 mm/yr prior to 1849 to 16
16 mm/yr between 1849 and 1906, resulting in an estimated tidal prism loss for the 1849-1906 period
17 are 2 million ft³/yr. During this period, Pine Gulch Creek deposited large quantities of sediment
18 and extended its delta into the Lagoon.

19
20 The maps in Figure 4 show the sequence of changes in the Lagoon based on available
21 surveys as delineated by Rountree from 1854 to 1968. It is possible to make rough estimates of
22 the potential diurnal tidal prism from these surveys based on the areas of tidal marsh, mudflat and
23 channel. For the purposes of this analysis, the upper edge of the marsh is estimated to be
24 approximately Mean Higher High Water (elsewhere the shoreline is mapped at Mean High Water)
25 and the lower edge of the marsh at +2 ft above Mean Sea Level based on contemporary surveys of
26 marsh vegetation. The low tide line is assumed to be at MLLW within the Lagoon.

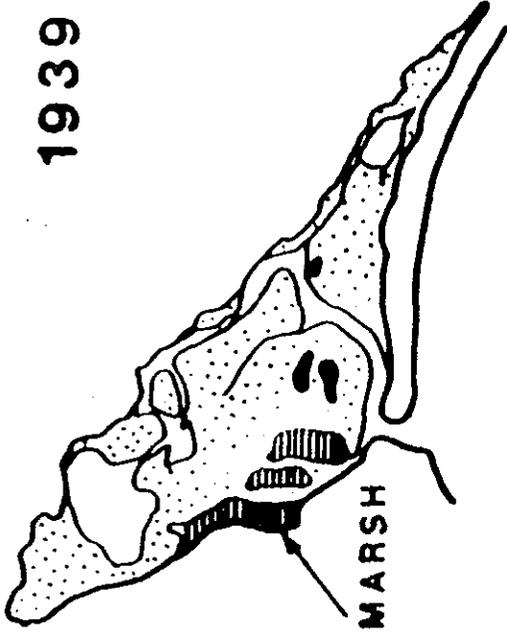
27
28 As noted above, based on analysis of sediment cores (Bergquist 1978), it appears that prior
29 to disturbance of the watershed in the 19th century, the Lagoon tidal prism was fairly stable with
30 net long-term sedimentation balanced by sea level rise and tectonic subsidence. In contrast, data
31 from sediment cores taken in the various parts of the Lagoon show sedimentation rates of 13 to 19
32 mm/yr during the period 1849 to 1906 (Table 1). If this rate was typical for the whole Lagoon and
33 adjusted for sea level rise, the loss of tidal prism would be about 2 million ft³/yr as shown on
34 Figure 5.

35
36 The 1906 earthquake increased the diurnal tidal prism by about 50 million ft³ directly due to
37 subsidence of between 30 and 35 cm over most of the Lagoon. However, the secondary effects of
38 the earthquake would have also increased the tidal prism. Shifting of mudflats into the channels
39 allowed accumulated sediments to be scoured out of the Lagoon by ebb tidal currents as the tidal
40 drainage system reestablished itself. Subsidence also allowed for greater wave erosion causing
41 most of Kent Island and its associated marshes to be converted to mudflats between 1906 and
42 1929. The 1929 topographic map (Figure 6) shows the effects on the Lagoon morphology

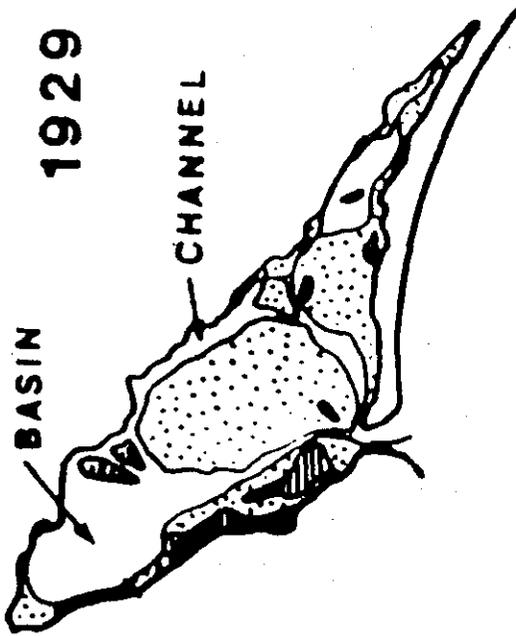
TIDAL FLATS
1854



1939



BASIN
1929



1969

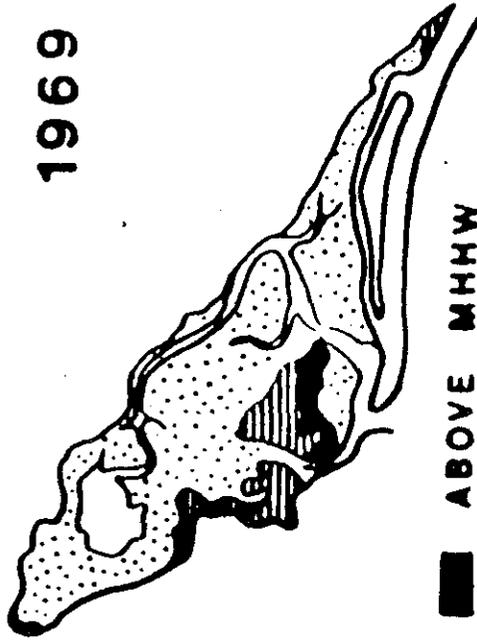
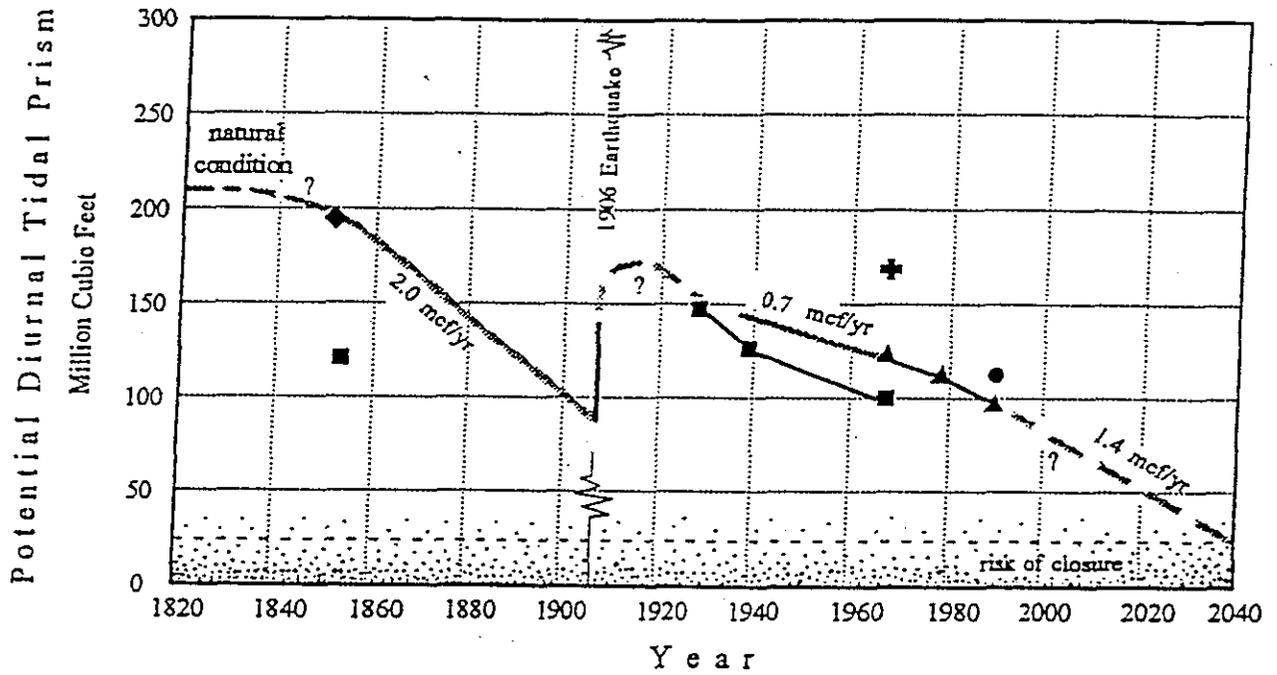


Figure 4. Map sequence by Rowntree (1975) showing evolution of Bolinas Lagoon.

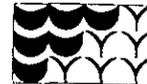


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- KEY:**
- ◆ 1854 estimated from Rowntree (1975), adjusted for Bergquist (1978) sediment core data
 - + Ritter's estimate in Johnson (1973)
 - Estimated from Rowntree's Map (1975)
 - Calculated from Towill map (1988)
 - ▲ Wahrhaftig & Bergquist (1993)

Figure 5. Bolinas Lagoon Change in Tidal Prism.



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1 eastward of the San Andreas fault trace.
2

3 Rate of tidal prism loss for the 1906-1939 period can only be very generally estimated by
4 extrapolating between post-1906 earthquake and 1939 estimated tidal prism values (see Figure 5).
5 Unfortunately, the first detailed bathymetric survey carried out by the Corps of Engineers in 1939
6 cannot be located. However, Ritter (1973) used this map to compute the rate of tidal loss at 0.7
7 million ft³/yr between 1939 and 1968 (Figure 5).
8

9 D. RECENT LAGOON CONFIGURATION (1968-present) 10

11 Recent changes in the Lagoon's configuration are based on studies by Johnson (1973a),
12 Wahrhaftig and Bergquist (1993) and Williams and Kuffe (in press). Johnson (1973a) reported a
13 tidal prism value for the 1968 survey based on areas provided to him by Ritter in 1971 (Ritter
14 1971). These values for tidal prism loss for the 1968-88 period are plotted in Figure 5. It should
15 be emphasized that Wahrhaftig and Bergquist (1993) carried out the only systematic analysis using
16 the same methods on available maps with spot elevations (1968, 1978 and 1988 aerial photographs
17 of the Lagoon) and provide the most accurate estimates of tidal prism loss. These studies indicate
18 that tidal prism loss for the 1968-88 period averaged 1.4 million ft³/year. In addition, Wahrhaftig
19 and Bergquist (1993) calculate that rate of tidal prism loss for the 1978-88 period was 10% higher
20 than for the 1966-78 period. It is estimated that the tidal prism was reduced by 25% from 1968 to
21 1988.
22

23 The maps in Figure 4 show that by 1968, with a few significant exceptions, the pre-1906
24 earthquake morphology of the Lagoon had been reestablished with the flood tide delta island (Kent
25 Island) reforming and a similar configuration of mudflats and tidal channels as had existed in 1854.
26 Exceptions were: (1) the construction of the Dispea Road portion of the Seadrift subdivision and
27 the creation of the artificial lagoon on the barrier spit in the 1950's; (2) Pine Gulch Creek was
28 essentially channelized by berms along its lower reaches preventing sheet-flow and course
29 changes; (3) the delta formed at the mouth of Pine Gulch Creek had advanced far into the Lagoon;
30 (4) Easkoot Creek was diverted into the southern end of the Lagoon whereas it naturally flowed
31 directly into the ocean via a small wetland; (5) the Lagoon margin was filled for construction of
32 Route 1 and Bolinas Road; and (6) the concrete groin at Bolinas.
33

34 It is clear from the encroachment of the Pine Gulch Creek delta that Pine Gulch Creek
35 watershed is a major contributor to sediment deposition in the Lagoon. In addition, the
36 encroachment of the delta appears to have had two important secondary effects. It protected a large
37 area of mudflats from wave action allowing their gradual conversion to salt marsh and it constricted
38 the tidal channel to the west of Kent Island that formerly conveyed a portion of the ebb tide (and
39 with it the scouring effects and sediment transport) from the upper end of the Lagoon. Surveyed
40 cross-sections of this tidal channel in 1993 show continued siltation in the western tidal channel
41 and in the southern arm of the Lagoon between 1988 and 1993 (Williams and Cuffe 1994). This
42 may be seen in Figure 7, which shows a cross-section of the Lagoon between Bolinas and Kent

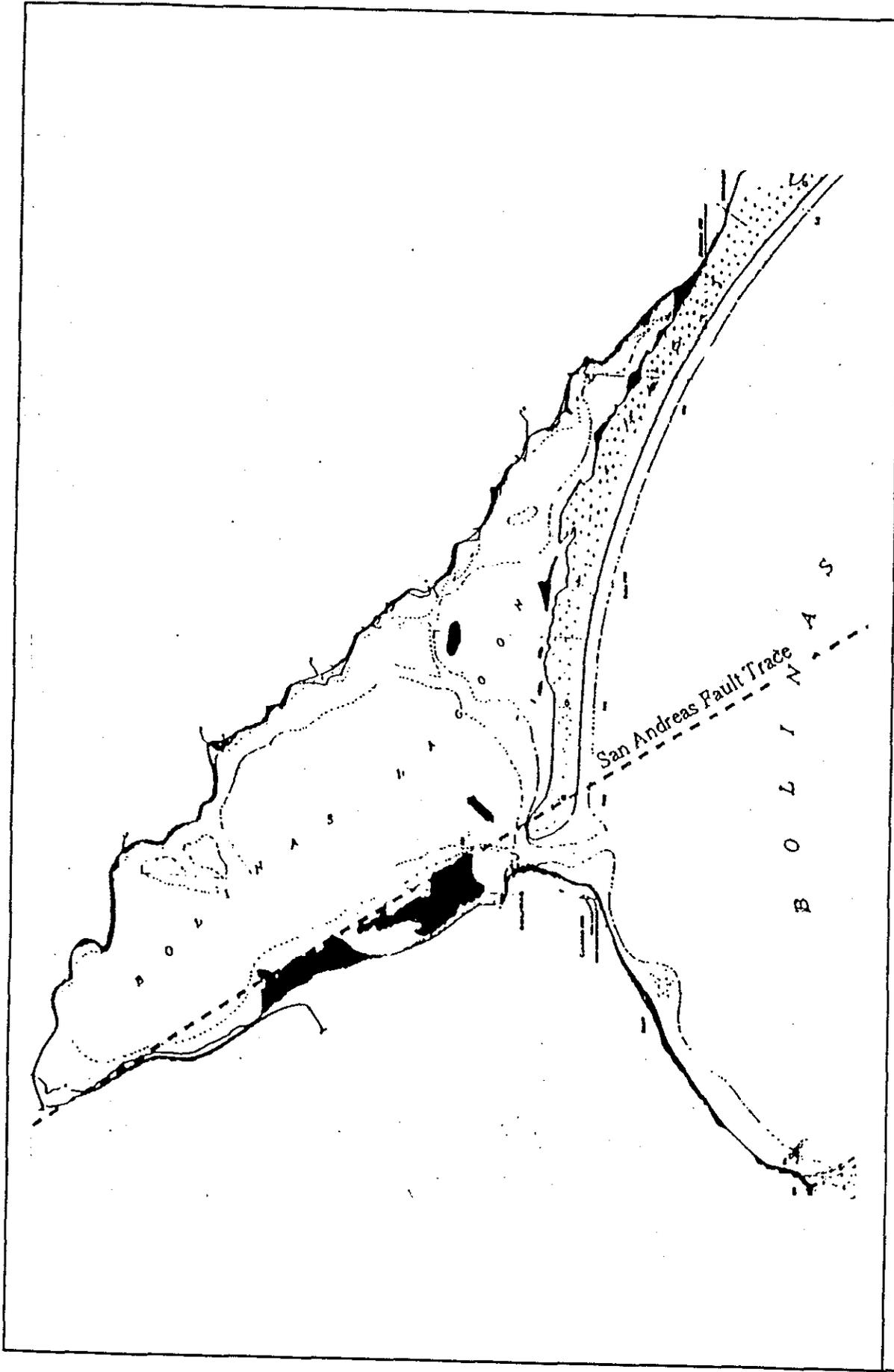


Figure 6. 1929 Topographic Map of Bolinas Lagoon showing San Andreas Fault Trace.



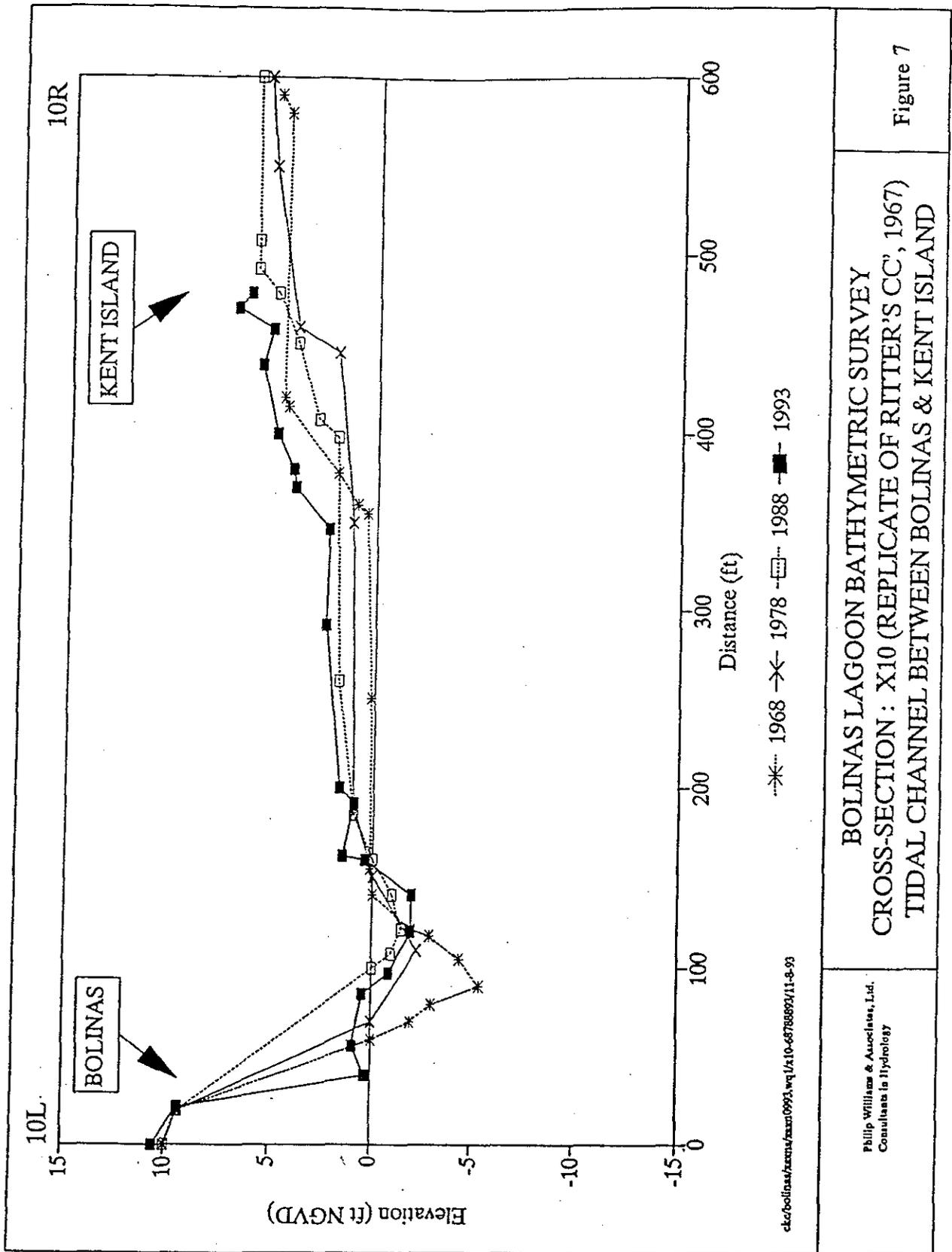
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1 Island: not only has overall elevation increased but the channel has become narrower and
2 shallower. This is the main channel used by boaters going to Bolinas.
3

4 The geometry of the entrance channel and offshore bar is determined largely by the
5 effective tidal prism of the Lagoon (O'Brien 1971, Jarrett 1976, Mehta and Joshi 1988).
6 Consequently, an increase or reduction in tidal prism would be expected to cause an increase or
7 decrease in channel depths, cross-sectional area and corresponding changes in depths of water over
8 the offshore bar. As noted above, historical records indicate that during the 1850's timber was
9 shipped out of the Lagoon to San Francisco. This must have been done during periods of high tide
10 as the 1854 hydrographic survey shows a one-foot depth of water over the offshore bar at MLLW,
11 similar to the depths reported in 1993. These depths are close to values predicted by empirical
12 geometry relationships for the range of tidal prism estimated in Bolinas Lagoon (Appendix C).
13 Similarly, maximum depths within the channel throat were about 13 ft below mean sea level in
14 1855 and about 12 ft below mean sea level in 1993. During the 1968-1988 period, comparison of
15 detailed surveys across the entrance show that the entrance channel area below mean sea level,
16 rather than decreasing as might be expected, actually increased from 1,350 ft² to 1,750 ft² while the
17 tidal prism declined by 25%. However, such an increase is well within the natural variability of
18 the system and a significant decrease in entrance channel area may not be expected until tidal prism
19 loss approaches 50% or more from 1988 levels.
20

21 The net accumulation of sediment within the Lagoon is greatly affected by local wave action
22 and tidal scouring. The predominant winds are from the northwest, and the strongest winds are
23 from the southeast, both of which blow along an 18,000-foot fetch on the main axis of the
24 Lagoon. Sediments deposited in the Lagoon by flood events can be resuspended by wave action
25 and carried out of the Lagoon on ebb currents. The shallower the water the more pronounced is
26 the wave resuspension, and so sedimentation and wave erosion interact to determine mudflat
27 elevations within the Lagoon.
28

29 As is discussed in greater detail in the next section, the reduced tidal prism and increased
30 sedimentation have resulted in significant changes in the actual and relative areas of the three
31 principal estuarine habitats: subtidal, intertidal flats, and emergent marsh (Table 2). Most
32 significant, these changes have also resulted in a net loss of estuarine habitat of about 7% as the
33 highest marsh areas convert to upland habitat. Figure 2 is a composite of aerial photos showing
34 the Lagoon's 1988 morphology. The pattern and extent of channelization, configuration of Kent
35 Island and the Pine Gulch Creek delta, diminution of Pickleweed Island and other physical
36 features can be seen. The 1994 conditions differ in that the causeway and dump in the southern
37 end of the Lagoon were removed in 1993 and the mudflat and tidal marsh habitats are being
38 restored. The removal of the causeway and the fills in the southern end of the Lagoon (December
39 1993) resulted in increased tidal circulation and a direct increase in tidal prism of 248,000 ft³ and
40 an additional increase of 435,600 ft³ resulting from increased tidal circulation (Williams and Oliver
41 1992). For comparison, as noted earlier, loss of tidal prism from 1968 to 1988 is estimated to
42 have averaged 1.4 million ft³ per year.



BOLINAS LAGOON BATHYMETRIC SURVEY
 CROSS-SECTION: X10 (REPLIATE OF RITTER'S CC, 1967)
 TIDAL CHANNEL BETWEEN BOLINAS & KENT ISLAND

Figure 7

Philip William & Associates, Ltd.
 Consultants in Hydrology

1

Year	Total Acreage	Emergent Marsh Acreage	Percent Emergent Marsh	Intertidal Flat Acreage	Percent Intertidal Flat	Subtidal Acreage	Percent Subtidal
1968	1140	80	0.07	510	0.45	550	0.48
1988	1060	160	0.15	700	0.66	200	0.19
2008	940	340	0.36	480	0.51	120	0.13

2
3
4 At present, almost all of the 16.8 square mile watershed of Bolinas Lagoon is in public ownership.
5 The watershed is steep, rising to about 1800 feet, and is susceptible to high erosion rates due to
6 landsliding and debris flows during sustained intense winter rain storms. The potential for erosion
7 is high due to unstable Franciscan mélangé bedrock in the eastern half of the watershed, the highly
8 erodible Monterey Shale on the west, and the watershed's location within the San Andreas Rift
9 Valley (Figure 8). Few data are available on the sources of sediment but Pine Gulch Creek is
10 clearly a significant source based on the expansion of its delta over the last several decades. Ritter
11 (1970) estimated that Pine Gulch Creek deposits approximately 4,000 tons of sediment in the
12 Lagoon on an annual basis (this is roughly equivalent to 4,000 yds³/year or less than 10 percent of
13 the estimated annual tidal prism loss of 1.4 million ft³). However, Ritter estimated the sediment
14 load from a single high-rainfall day at 3,800 tons of sediment, illustrating the variability and
15 rainfall dependent nature of erosion and creek sediment load. Ritter provides no explanation of
16 methods or sampling procedures, so that no independent assessment of these estimates is possible.
17 It is recommended that all sediment sources be identified and, in particular, all major creeks
18 flowing into the Lagoon be assessed for sediment load and potential erosional problems such that
19 remedial actions can be focused on those watersheds with the highest potential to reduce sediment
20 delivery to the Lagoon. In addition, analysis of deposition as a result of sediments carried into the
21 Lagoon by littoral drift and the flood current is recommended as part of a detailed study of the
22 physical and hydrological processes that affect sediment accumulation within the Lagoon (Section
23 VII).

24 25 E. PREDICTED FUTURE CHANGES

26
27 Predicted future changes in the Lagoon's configuration are based on the rates of tidal prism
28 loss that occurred between 1968 and 1988. As described above, Wahrhaftig and Bergquist (1993)
29 carried out the only systematic analysis using the same methods on available maps with spot
30 elevations (1968, 1978 and 1988 aerial photographs of the Lagoon) and provide the most accurate
31 estimates of tidal prism loss. During this period, the tidal prism of Bolinas Lagoon was reduced
32 by approximately 25% (Figure 5, page 15). Extrapolating this annual loss of tidal prism (estimated
33 to be 1.4 million ft³/yr) the tidal prism will decline as shown in Figure 5. In predicting future loss

From Ricker, 1973

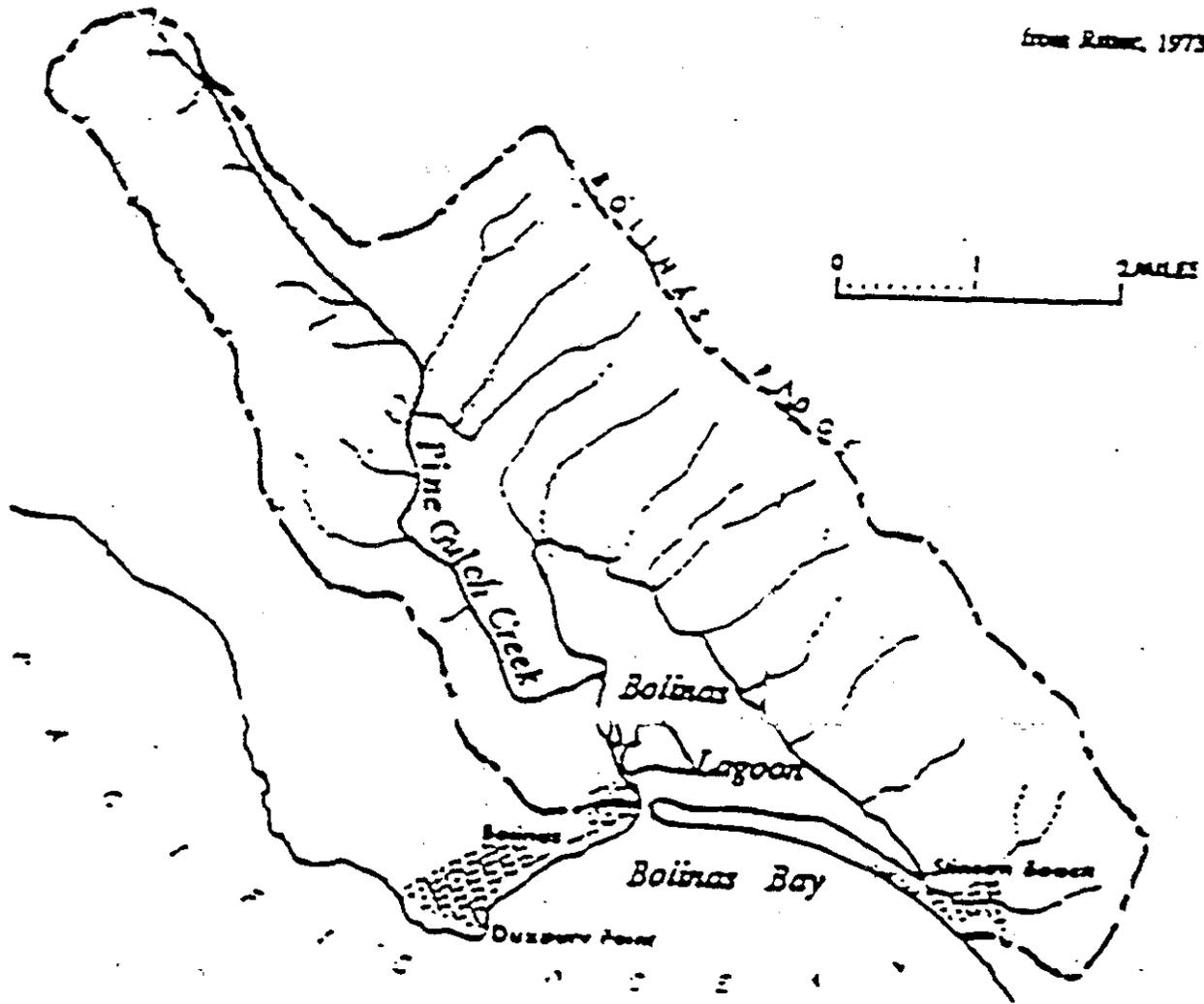
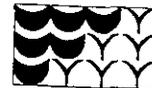


Figure 8. Watershed of Bolinas Lagoon.



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1 of tidal prism from these data, two factors should be considered. First, sediment delivery to the
2 Lagoon is highly dependent on storm events so that periods with numerous extreme storms will
3 deliver large quantities of sediment to the Lagoon. Second, the role of periodic earthquakes in
4 Lagoon floor subsidence and increasing tidal prism has been important in the long-term but,
5 because of their unpredictability, earthquake events have not been factored into these predicted
6 future changes. However, large earthquakes are expected to occur in the time frame (50 years)
7 encompassed by these estimates.

8
9 If tidal prism continues to decrease, as has occurred at a rapid rate in the 1968-88 period,
10 there will be further reduction in channel dimensions and conversion of subtidal habitat to intertidal
11 flat, intertidal flat to emergent marsh, and, most significantly, marsh to upland habitat (Table 2,
12 page 20). These changes in habitat types are discussed in more detail in Section V. In addition, it
13 is estimated that there would be risk of intermittent Lagoon closure in about 50 years (Appendix
14 C). Closure is most likely when littoral transport is high enough to fill significantly more of the
15 entrance channel on the flood tide than can be scoured by the succeeding ebb. Suspension and
16 movement of sand onshore during extreme wave events may have the same effect. Closure,
17 therefore, most likely occurs when there is a coincidence of high wave energy and weak ebb
18 velocity. Weak ebb velocities occur during neap tides when the tidal prism is small and when
19 streamflow (which adds to ebb velocities) is low. In spite of the significant reduction of tidal
20 prism, the mouth of Bolinas Lagoon has never closed in historic times. Because of the absence of
21 more detailed data and analysis, closure estimates are uncertain and vary over a period of from 20
22 to 100 years into the future. As noted above, other processes such as changes in the rate of sea-
23 level rise, earthquakes, and long-term recovery of watershed conditions could change the predicted
24 rate of reduction in tidal prism and loss of estuarine habitat.
25

VI. ECOLOGICAL DESCRIPTION OF BOLINAS LAGOON: HISTORIC, CURRENT AND PROJECTED FUTURE CONDITIONS

A. BOLINAS LAGOON IN A REGIONAL CONTEXT

The latitudinal position of Bolinas Lagoon is approximately 38° N; this position with coastal marine influence provides a temperate climate with little variation between summer and winter temperatures and few days below freezing. The geographical location along the Pacific Flyway makes the Lagoon an ideal staging ground and stopover site for migratory birds and the equitable climate provides wintering habitat for a wide array of waterfowl and shorebirds. Nutrients and fish and other nektonic species enter and leave the Lagoon with each tidal cycle.

The Lagoon's biological diversity is enhanced due to its proximity to San Francisco Bay (the largest estuary on the Pacific Coast) and its location on the outer coast adjacent to the upwelling, nutrient rich waters of the Gulf of the Farallones. In addition, the relative proximity of Bodega Bay (32 miles), Estero de San Antonio and Estero Americano (26 mi.), Limantour and Drake's Esteros (13.5 mi.), and Tomales Bay (12 mi.) place Bolinas Lagoon within a network of coastal estuaries that share biological similarities and which, *in toto*, provide foraging, breeding, nursery, and roosting grounds for a wide variety of estuarine and marine species.

Bolinás Lagoon provides critical habitat for several species that utilize these estuaries on a regular basis. The Lagoon is an important migratory stop or overwintering location for many species of shorebirds and waterfowl that use the Pacific Flyway. The largest concentration of osprey (*Pandion haliaetus*) in California is situated in this Lagoon (Evens 1991). Shorebird flocks (e.g., marbled godwit, American avocet) move between San Francisco Bay and Bolinas Lagoon on a regular basis (Shuford *et al.* 1989). Over 100 pairs of great blue herons, great egrets and snowy egrets nest in Picher Canyon of Audubon Canyon Ranch and forage extensively at Bolinas Lagoon and other nearby estuaries. Nesting egrets move between Bolinas Lagoon, Tomales Bay and Drake's Estero and great blue herons disperse widely among these sites (Shuford *et al.* 1989). Striped bass are known to migrate between Tomales and San Francisco Bays and other anadromous fish species enter and utilize Bolinas Lagoon and the other estuaries.

It should be noted that from a regional perspective, estuarine habitats have been greatly diminished or degraded with significant losses of tidal wetland habitat. For example, in the San Francisco Estuary, approximately 34,580 acres of mudflat and open water were converted to tidal marsh due to sediment accumulation from hydraulic mining activities in the Sierra foothills (Nicholas and Wright 1977). The tidal marshes in the Estuary were subsequently reduced by 90% from filling, diking, and conversion to salt ponds.

B. CURRENT ECOLOGICAL CONDITIONS

1. Habitat Types and Characterization

Bolinas Lagoon has a diversity of habitat types. The principal estuarine habitats are subtidal channels, intertidal flats, and emergent salt marsh, all of which are undergoing significant changes in total area and relative amounts. The previous section focused on the rate of sediment accumulation and loss of tidal prism. Between 1968 and 1988, this resulted in conversion of subtidal to intertidal habitat, and intertidal to emergent marsh and upland habitat as shown in Table 2, page 20. Between 1968 and 1988, subtidal habitat decreased by 60% and intertidal flat and emergent marsh habitat increased by 37% and 100%, respectively. Overall, the total area of the three core estuarine habitats has begun to decrease as the higher marsh areas convert to upland habitat (total estuarine habitat decreased by 7% in the 1968-88 period). The three principal habitats are bordered by sand bars, beaches and riparian forest. In close proximity are grasslands, coastal scrub, chaparral, and mixed evergreen forest. Coastal rocky intertidal reef, pebble beach, and open ocean are found nearby.

Each of the Lagoon's habitat types is described below from a community perspective. Obvious, strong links exist among subtidal, intertidal mudflat and salt marsh habitats such as the twice daily tidal flow and shared species of benthic microflora, invertebrates and fish. Generally, the intertidal flats and shallow subtidal habitats are the major sites of primary production and predation. Filter and deposit feeders in these flats use the primary production of benthic algae and diatoms, as well as detrital inputs from marsh and terrestrial sources. Surface feeding and probing shorebirds dominate the bird communities associated with these areas. The major prey of these birds are the soft bodied invertebrates and small crustaceans and gastropods. The primary food of the dominant fish are found in these subtidal shallows and intertidal flats. Therefore, the food webs associated with the subtidal shallows and intertidal flats would appear to be the most important within the Lagoon.

a. Subtidal Channels

The subtidal/open water portion of Bolinas Lagoon is strongly influenced by its connection with the Pacific Ocean. Daily tidal action introduces a substantial volume of ocean water which carries suspended organisms and actively swimming organisms. The most significant primary producers in this community are the phytoplankton and benthic diatoms (microflora) that become resuspended in the water column during daily tidal cycles. Generally, benthic diatoms and phytoplankton biomass is highest in the spring months and lowest in late fall and winter. Eelgrass and Maiden's hair (*Gracilaria* spp.), a red algae, are found occasionally in the deeper channels of the Lagoon (Gustafson 1968).

Zooplankton, the most significant grazer on phytoplankton, are primarily marine species such as copepods, cladocerans, ostracods, and arrow worms. During certain times of year,

1 zooplankton may be dominated by planktonic stages of benthic invertebrates such as bryozoans,
2 echinoderms, polychaetes, bivalves, and gastropods. Most of these would be derived from
3 organisms in the sediments of the Lagoon. Since many zooplankton feed on phytoplankton, they
4 exhibit similar seasonal abundance trends with spring maxima and winter minima.

5
6 Primary consumers of phytoplankton and zooplankton include fish such as topsmelt,
7 Pacific herring, and northern anchovy, filter-feeders such as clams and benthic worms, and birds
8 such as the northern shoveler. Common fish in the subtidal open water habitat at Bolinas Lagoon
9 are sharks, rays, herring, surf smelt, shiner surfperch, topsmelt and several species of flatfish
10 (Table 4); herring, smelt and perch are important prey for birds such as grebes, brown pelicans,
11 cormorants, ospreys, and terns that are found in the Lagoon (Table 3). Brown pelicans feed in the
12 Lagoon for pelagic fish species such as northern anchovy, topsmelt, and Pacific sardine. Terns
13 generally feed on the smaller fish found near the surface such as topsmelt and northern anchovy.
14 Harbor seals use the main channel to enter and exit the Lagoon and access favored haul-out and
15 pupping sites, but it is not known to what extent they forage within the Lagoon.

16
17 Benthos refers to organisms residing in areas of permanent or nearly permanent
18 submergence; however, the distinction is difficult in a shallow system such as Bolinas Lagoon
19 where much of the Lagoon bottom is exposed at low tides. Although discussed here, the benthic
20 community extends throughout the estuarine portions of the Lagoon.

21
22 The benthic community is characterized by the soft nature of the substratum, the lack of
23 vascular plant vegetation, and the predominance of benthic invertebrates that burrow into the
24 mud/sand surface generally within the top two feet of substrate. Many of the organisms live in an
25 environment in which oxygen is very limited. Adaptations to this low oxygen environment include
26 pumping mechanisms to utilize overlying oxygenated water, physiological adaptations to low
27 oxygen tension, and the ability to undergo anaerobic respiration under certain conditions.

28
29 Algae are easily consumed by a variety of organisms. Benthic meiofauna¹ forage directly
30 on benthic diatoms as well as other smaller organisms in the mud. Very little is known about this
31 group of organisms in Bolinas Lagoon, but they are assumed to form a substantial food base for
32 the larger epibenthic crustaceans such as amphipods, small crabs, and molluscs that occur in the
33 Lagoon (Table 5).

34
35 The ghost shrimp is common in sandy substrata within the Lagoon. Although it feeds on
36 subsurface organic material during its burrowing, it also pumps water from the surface through the
37 burrows and filter feeds on the epibenthic diatoms. The deposit feeders are a major group of
38 omnivores that obtain nutrients from the sediments of soft-bottom habitats (muds and sands). The
39 ecological role of deposit feeding in sediment turnover is a critical one. When burrowing deposit

¹Benthic meiofauna are classified as organisms within the size range of 1.0-0.1 mm (Nybakken 1982). The meiofauna consist of annelids, nematodes, small crustaceans, small polychaetes, and larval stages of various molluscs and crustaceans

TABLE 3. PREDICTED EFFECTS OF HABITAT CHANGE ON 85 BIRD SPECIES OF BOLINAS LAGOON.

Species of special concern designated with † (large scale declines may override local effects)

Species of local concern designated with #

Erratic and marginal species are excluded

INDEX OF ABUNDANCE represents the average maximum number of wintering individuals based on PRBO census data, 1972-1992: 1 = (1-10); 2 = (10-99); 3 = (100-499); 4 = (500-999); 5 = (1000-2500); 6 = (>2500); v = variable; may occur in any abundance category; ? indicates uncertain trend.

HABITAT symbols: ST ("subtidal") corresponds to open water (OW) and channel (C) habitats; (TF) tidal flat; (EM) emergent marsh; (SS) sand spit; (R) riparian; (U) upland.

CHANGE (D¹) predicted change in abundance as habitat values approach the 2008 model.

CHANGE (D²) observed change in abundance based on PRBOs 1972-1992 census data.

Symbols of population change: ↓ decrease; ↑ increase; ⇌ no significant change or status uncertain; ≈ dependent on management practices; * see comments in text

COMMON NAME	SCIENTIFIC NAME	INDEX	HABITAT	D ¹	D ²
Red-throated Loon	<i>Gavia stellata</i>	1	ST	↓	
Common Loon †	<i>Gavia immer</i>	1	ST	↓	
Pied-billed Grebe	<i>Podilymbus podiceps</i>	1	ST	⇌	
Horned Grebe	<i>Podiceps auritus</i>	2	ST	↓	↓
Eared Grebe	<i>Podiceps nigricollis</i>	2	ST	↓	↓
Western Grebe	<i>Aechmophorus occidentalis</i>	2	ST	↓	
Clark's Grebe	<i>Aechmophorus clarkii</i>	1	ST	↓	
Brown Pelican †	<i>Pelecanus occidentalis</i>	v	ST, SS	↓	
Double-crested Cormorant †	<i>Phalacrocorax auritus</i>	2	ST	⇌	
Pelagic Cormorant	<i>Phalacrocorax pelagicus</i>	1	ST	⇌	
Great Blue Heron †	<i>Ardea herodias</i>	2	ST, TF, EM, U	↓	
Great Egret #	<i>Casmerodius albus</i>	2	ST, TF, EM	↓	
Snowy Egret #	<i>Egretta thula</i>	2	ST, TF, EM	↓	↑?
Green Heron †	<i>Butorides striatus</i>	1	EM, R	↑	
Black-crown. Night-Heron #	<i>Nycticorax nycticorax</i>	2	TF, EM	↓	↓
Brant †	<i>Branta bernicula</i>	1	ST, EM	⇌	
Canada Goose	<i>Branta canadensis</i>	2	ST, TF, U	⇌	
Green-winged Teal	<i>Anas crecca</i>	4	TF	↓	
Mallard	<i>Anas platyrhynchos</i>	2	ST, TF, EM	⇌	
Northern Pintail	<i>Anas acuta</i>	3	ST, TF	↓	

TABLE 3. BIRD SPECIES

COMMON NAME	SCIENTIFIC NAME	INDEX	HABITAT	D ¹	D ²
Cinnamon Teal	<i>Anas cyanoptera</i>	2	TF, EM	↔	
Northern Shoveler	<i>Anas clypeata</i>	3	TF	↓	
Gadwall	<i>Anas strepera</i>	5	TF, EM	↔	
Eurasian Wigeon	<i>Anas</i>	1	ST, TF, EM	↓	
American Wigeon	<i>Anas americana</i>	5	ST, TF, EM	↓	
Canvasback	<i>Aythya valisineria</i>	2	ST, TF	↓	↓
Greater Scaup	<i>Aythya marila</i>	3	ST	↓	
Lesser Scaup	<i>Aythya affinis</i>	2	ST	↓	
Surf Scoter	<i>Melanitta perspicillata</i>	3	ST	↓	↓
White-winged Scoter	<i>Melanitta fusca</i>	2	ST	↓	↓
Common Goldeneye	<i>Bucephala clangula</i>	3	ST	↓	↑
Barrow's Goldeneye †	<i>Bucephala islandica</i>	1	ST	↓	
Bufflehead	<i>Bucephala albeola</i>	3	ST	↓	
Red-breasted Merganser	<i>Mergus serrator</i>	2	ST	↓	
Ruddy Duck	<i>Oxyura jamaicensis</i>	4	ST	↓	↓?
Osprey †	<i>Pandion haliaetus</i>	1	ST	↓	↑
White-tailed Kite †	<i>Elanus caeruleus</i>	1	EM, U	↑	
Northern Harrier †	<i>Circus cyaneus</i>	1	EM	↑	
Merlin †	<i>Falco columbarius</i>	1	TF, EM	↔	
Peregrine Falcon †	<i>Falco peregrinus</i>	1	TF, EM, U	↔	
Black Rail †	<i>Laterallus jamaicensis</i>	1	EM	↑	
Virginia Rail	<i>Rallus limicola</i>	2	EM	↑	
Sora	<i>Porzana carolina</i>	1	EM	↑	
American Coot*	<i>Fulica americana</i>	5	ST, TF, EM	↓	↓
Black-bellied Plover	<i>Pluvialis squatarola</i>	3	TF, EM	↓	
Semipalmated Plover	<i>Charadrius semipalmatus</i>	1	TF	↓	↑
American Avocet #	<i>Recurvirostra americana</i>	3	TF	↓	↑
Greater Yellowlegs	<i>Tringa melanoleuca</i>	2	TF	↓	↑
Willet	<i>Catoptrophorus semipalmatus</i>	4	TF, EM	↔	↑
Whimbrel	<i>Numenius phaeopus</i>	2	TF, EM	↓	↑
Long-billed Curlew †	<i>Numenius americanus</i>	3	TF	↓	↑
Marbled Godwit	<i>Limosa fedoa</i>	4	TF, EM	↓	↑
Black Turnstone	<i>Arenaria melanocephala</i>	3	TF, EM	↓	
Sanderling	<i>Calidris alba</i>	3	TF, SS	↓	

TABLE 3. BIRD SPECIES

COMMON NAME	SCIENTIFIC NAME	INDEX	HABITAT	D ¹	D ²
Western Sandpiper # **	<i>Calidris mauri</i>	5	TF, EM	↓	↑
Least Sandpiper	<i>Calidris minutilla</i>	5	TF, EM	↓	
Dunlin	<i>Calidris alpina</i>	6	TF, EM	↓	
Short-billed Dowitcher	<i>Limnodromus griseus</i>	1	TF	↓	
Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>	3	TF	↓	
Common Snipe	<i>Gallinago gallinago</i>	2	EM	↑	↓
Snowy Plover †	<i>Charadrius alexandrinus</i>	2	SS, TF	↓	↓
Spotted Sandpiper	<i>Actitis macularia</i>	1	TF, R	↔	
Killdeer	<i>Charadrius vociferus</i>	3	U, TF	↔	↓
Red-necked Phalarope	<i>Phalaropus lobatus</i>	v	ST, TF	↓	
Bonaparte's Gull	<i>Larus philadelphia</i>	2	ST, TF	↔	
Heermann's Gull	<i>Larus heermanni</i>	2	ST, TF, SS	↔	
Mew Gull	<i>Larus canus</i>	2	ST, TF	↔	
Ring-billed Gull	<i>Larus delawarensis</i>	2	ST, TF	↔	
California Gull †	<i>Larus californicus</i>	5	ST, TF	↔	
Herring Gull	<i>Larus argentatus</i>	2	ST, TF	↔	
Thayer's Gull	<i>Larus thayeri</i>	1	ST, TF	↔	
Western Gull	<i>Larus occidentalis</i>	3	ST, TF	↔	
Glaucous-winged Gull	<i>Larus glaucescens</i>	3	ST, TF	↔	
Forster's Tern	<i>Sterna forsteri</i>	3	ST, TF, SS	↓	
Elegant Tern †	<i>Sterna elegans</i>	na	ST, SS	↓	
Caspian Tern	<i>Sterna caspia</i>	na	ST, TF, SS	↔	
Short-eared Owl †	<i>Asio flammeus</i>	1	EM, U	↔	
Belted Kingfisher	<i>Ceryle alcyon</i>	2	ST	↓	
Marsh Wren	<i>Cistothorus palustris</i>	2	EM	↑	
Common yellowthroat †	<i>Geothlypis trichas</i>	2	EM	↑	
Savannah Sparrow	<i>Passerculus sandwichensis</i>	2	EM	↑	
Song Sparrow †	<i>Melospiza melodia</i>	3	EM	↑	
Swamp Sparrow	<i>Melospiza georgiana</i>	1	EM	↑	
Sharp-tailed Sparrow #	<i>Ammodramus caudacutus</i>	1	EM	↑	
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	2	EM	↑	

* American Coot numbers have varied greatly over the last 20 years with high counts of over 2000 individuals in winter in the early 1970s followed by a post-drought decline from which the population has not recovered (G. Page, pers. comm.)

** Western Sandpiper numbers peak at ~30,000 individuals during migratory periods.

TABLE 4. Fishes of Bolinas Lagoon. Status key: C=common, FC=fairly common, R=rare, S=seasonal, ?=unknown, *=found in CDFG surveys completed during 1994 and 1995.

Common Name	Species	Status
Pacific lamprey	<i>Entosphenus tridentatus</i>	?
White shark	<i>Carcharodon carcharis</i>	?
Grey smoothhound	<i>Mustelus californicus</i>	?
Brown smoothhound	<i>Mustelus henlei</i>	?
Leopard shark	<i>Triakis semifasciata</i>	C
Spiny dogfish	<i>Squalus acanthius</i>	?
Pacific angel shark	<i>Squatina californica</i>	?
Thornback	<i>Platyrhinoidis triseriata</i>	?
Big skate	<i>Raja binoculata</i>	?
Bat ray	<i>Myliobates californica</i>	C*
Green sturgeon	<i>Acipenser medirostris</i>	?
White sturgeon	<i>Acipenser transmontanus</i>	?
Pacific sardine	<i>Sardinops sagax</i>	?
Pacific herring	<i>Clupea harengus pallasii</i>	S*
Northern anchovy	<i>Engraulis mordax</i>	S*
Steelhead trout	<i>Oncorhynchus mykiss</i>	S*
Coho salmon	<i>Oncorhynchus kisutch</i>	S
Surfsmelt	<i>Hypomesus pretiosus</i>	C*
Plainfin midshipman	<i>Porichthys notatus</i>	C
Northern clingfish	<i>Gobiesox maeandricus</i>	?
Pacific hake	<i>Merluccius productus</i>	?
Pacific tomcod	<i>Microgadus proximus</i>	?
Topsmelt	<i>Atherinops affinis</i>	FC*
Jacksmelt	<i>Atherinopsis californiensis</i>	C*
Threespine stickleback	<i>Gasterosteus aculeatus</i>	C*

TABLE 4 (cont.). Fishes of Bolinas Lagoon. Status key: C=common, FC=fairly common, R=rare, S=seasonal, ?=unknown, *=found in CDFG surveys completed during 1994 and 1995.

Common Name	Species	Status
Bay pipefish	<i>Sygnathus leptorhynchus</i>	C*
Jack mackerel	<i>Trachurus symmetricus</i>	?
White seabass	<i>Atractoscion nobilis</i>	?
White croaker	<i>Geneonemus lineatus</i>	C
Barred surfperch	<i>Amphistichus argenteus</i>	C*
Redtail surfperch	<i>Amphistichus rodoterus</i>	C
Black perch	<i>Embiotoca jacksoni</i>	C
Striped surfperch	<i>Embiotoca lateralis</i>	C
Walleye surfperch	<i>Hyperproson agenteum</i>	C*
Silver surfperch	<i>Hyperproson ellipticum</i>	C*
Shiner surfperch	<i>Cymatogaster aggregata</i>	C*
Dwarf surfperch	<i>Micrometrus minimus</i>	C*
White surfperch	<i>Phanerodon furcatus</i>	C*
Rubberlip surfperch	<i>Rhacochilus toxotes</i>	C
Pile surfperch	<i>Damalichthys vacca</i>	C
Pacific butterfish	<i>Peprilus simillimus</i>	?
Rockfish (several species)	<i>Sebastes spp.</i>	C*
Striped bass	<i>Morone saxatilis</i>	R*
Kelp greenling	<i>Hexagrammos decagrammus</i>	?
Rock greenling	<i>Hexagrammos superciliosus</i>	?
Lingcod	<i>Ophiodon elongatus</i>	C*
Monkeyface-eel	<i>Cebidichthys violaceus</i>	C*
Rock eel	<i>Xiphister mucosus</i>	?
Saddleback gunnel	<i>Pholis ornata</i>	?
Penpoint gunnel	<i>Apodichthys flavidus</i>	?

TABLE 4 (cont.). Fishes of Bolinas Lagoon. Status key: C=common, FC=fairly common, R=rare, S=seasonal, ?=unknown, *=found in CDFG surveys completed during 1994 and 1995.

Common Name	Species	Status
Pacific sandlance	<i>Ammodytes hexapterus</i>	?
Tidewater goby	<i>Eucyclogobius newberryi</i>	?
Yellowfin goby	<i>Acanthogobius flavimanus</i>	?
Arrow goby	<i>Clevelandia ios</i>	C*
Cabezon	<i>Scorpaenichthys marmoratus</i>	C*
Staghorn sculpin	<i>Leptocottus armatus</i>	C*
Prickly sculpin	<i>Cottus asper</i>	C*
California halibut	<i>Paralichthys californicus</i>	FC*
Diamond turbot	<i>Hypsopsetta guttulata</i>	?*
English sole	<i>Parophyrus vetulis</i>	C*
Starry flounder	<i>Platichthys stellatus</i>	FC*
Pacific sanddab	<i>Citharichthys sordidus</i>	FC
Speckled sanddab	<i>Citharichthys stigmaeus</i>	C*

TABLE 5. Selected estuarine invertebrates of Bolinas Lagoon

(after Chan 1967, Payne 1968, Gustafson 1968, Powell 1980, Page *et al.* 1976, Stenzel *et al.* 1983, Morris, Abbott and Haderlie 1980). Terminology and nomenclature after Ricketts *et al.* 1985.

Intertidal "zones" of occurrence are given when information is available: TF 1 = high tidal flat; TF 2 = mid-tidal flat; TF 3 = low tidal flat (includes channels); EM = emergent habitat (marsh, riprap etc.). Substrate texture is given when available.

* indicates exotic (introduced) species.

§ indicates important prey item for shorebirds (Stenzel *et al.* 1983.)

+ indicates species found and identified during the CDFG survey of Bolinas Lagoon on 11/14/95

<u>Common name</u>	<u>PHYLLUM</u> <u>Scientific name</u>	<u>Zone</u>	<u>Substrata</u>
CNIDER	CNIDARIANS		
giant anemone	<i>Anthropleura xanthogrammica</i>		
aggregating anemone	<i>Anthropleura elegantissima</i>		
burrowing anemone	<i>Anthropleura artemisia</i>		
moon jelly	<i>Aurelia aurita</i>		
proliferating anemone	<i>Epiactis prolifera</i>		
burrowing anemone	<i>Halcampa crypta</i>	TF 1	sand, gravel
plumose anemone	<i>Metridium sentile</i>		
anemone	<i>Nematostella vectensis</i>	TF 1, EM	fine sediment
	<i>Obelia</i> spp.		
bell jelly	<i>Polyorchis montereyensis</i>		
	<i>Sarsia</i> spp.		
sea pen	<i>Stylatula elongata</i> +		
	<i>Tubularia</i> spp.		
by-the-wind sailor	<i>Velella velella</i>		
RIBBON WORMS	NEMERTEA		
white ribbon worm	<i>Carinoma mutabilis</i>	TF 3	sand, mud
	<i>Cerebratulus californiensis</i>		
red ribbon worm	<i>Lineus ruber</i> §	TF 1, 2	
	<i>Malacobdella grossa</i>		
alaska ribbon worm	<i>Micrura alaskensis</i>	TF 2, 3	mud
	<i>Micrura verrilli</i>		

purple ribbon worm	<i>Paranemertes peregrina</i> §	TF 3	mud
SEGMENTED WORMS	ANNELIDA		
Ophelid polychaete	<i>Armandia brevis</i>	TF 1, 2	sand
ophelid polychaete	<i>Armandia acuta</i>		
Bamboo worm	<i>Axiothella rubrocincta</i> §	TF 2	packed muddy sand
Spionid polychaete	<i>Boccardia proboscidea</i> §	TF 1	packed clay, mud
Spionid polychaete	<i>Boccardia hamata</i> §		
red tubed worm	<i>Capitella capitata</i> §	TF 1, 2, 3	mud
Eteone	<i>Eteone</i> spp. §	TF 1, 2	mud, fine sand
goniadiid polychaete	<i>Glycinde</i> sp. §	EM, TF 1	wrack
capitellid polychaete	<i>Heteromastus filiformis</i>	TF 1	mud
Lumbrineris	<i>Lumbrineris zonata</i> §	TF 2, 3	mud & sand
Hartman's mediomastus	<i>Mediomastus californiensis</i>	TF	mud
freshwater polychaete	<i>Neanthes limnicola</i>	TF 1	mud, freshwater
large mussel worm	<i>Nereis vexillosa</i>	TF 1, 2	sand
nephtyid polychaete	<i>Nephtys</i> sp. §	TF 1, 2	sand
nephtyid polychaete	<i>Nephtys caecoides</i>	TF 1, 2, 3	sandy mud
Red twine worm	<i>Notomastus tenuis</i>	TF 2	mud
ophelid polychaete	<i>Ophelia assimilis</i>	TF 3	sand
neriid polychaete	<i>Platyneries bicanaliculata</i> §	TF 2	rock, pilings, wrack
spionid polychaete	<i>Polydora brachycephala</i>	TF 3	clean sand, gravel
spionid polychaete	<i>Polydora muchalis</i> §	TF 1, 2	sand
spionid polychaete	<i>Polydora socialis</i> §	TF 2, 3	sand
spionid polychaete	<i>Pseudopolydora kempfi</i> §	TF 1	sand
orbinid polychaete	<i>Scoloplos acmeceps</i> §	TF 2, 3	
paraonid polychaete	<i>Scolecopsis squamatus</i>	TF 3	sand
spionid polychaete	<i>Streblospio benedicti</i>	TF 1	mud, fresh water
UNSEGMENTED WORMS	SIPUNCULA & ECHIURA		
peanut worm	<i>Phascolosoma agassizii</i>		
Sipunculid worm	<i>Sipunculus ingens</i>	TF 3	sand
fat innkeeper	<i>Urechis caupo</i>	TF 3	sand and sandy mud
ARTHROPODS	ARTHROPODA		
Amphipod	<i>Allorchestes angusta</i> §	TF 1, EM	marsh, algae, wrack
beach hopper	<i>Ampithoe lacertosa</i> §		algae
beach hopper	<i>Ampithoe valida</i> §	TF 1, EM	algae
tube-dwelling amphipod	<i>Ampelisca milleri</i>	TF 1, 2	mud
free-swimming amphipod	<i>Anisogammarus confervicolus</i> §	TF 1, EM	algae
free-swimming amphipod	<i>Anisogammarus pugettensis</i> §	TF 1	algae
barnacles	<i>Balanus</i> spp.		
Red ghost shrimp	<i>Callinasa californiensis</i> §	TF 1, 2	sand, mud
Brown rock crab	<i>Cancer antennarius</i> §	TF 3	rock

yellow rock crab	<i>Cancer anthonyi</i>		
dungeness crab	<i>Cancer magister</i>		
slender crab	<i>Cancer gracilis</i>		
hairy cancer crab	<i>Cancer jordani</i>		
red rock crab	<i>Cancer productus</i>		
skeleton shrimp	<i>Caprella californica</i> +		
green crab	<i>Carcinus maenas</i>		
mud-burrowing amphipod	<i>Corophium spp.</i> §	TF 1, 2	mud
bay shrimp	<i>Crangon fanciscorum</i>		
sand dwelling amphipod	<i>Eohaustorius sp.</i>	EM	sand
swimming shrimp	<i>Exosphaeroma amplicauda</i>		
tube-dwelling amphipod *	<i>Grandidierella japonica</i> * §	TF 2, 3	fresh water, wrack
mud crab	<i>Hemigrapsus oregonensis</i> §	TF 1, 2 EM	ubiquitous
purple shore crab	<i>Hemigrapsus nudus</i>	EM	riprap
red banded shrimp	<i>Heptacarpus spp.</i>		
spider crab	<i>Herbstia parvifrons</i>		
grass shrimp	<i>Hippolyte californica</i>		
Idotea	<i>Idotea sp.</i>		
tube-building tanaid	<i>Leptochelia dubia</i> §	TF 3	sand
purple olive shell	<i>Olivella biplicata</i>	TF 1	clean sand near mouth
rock crab	<i>Pachygrapsus crassipes</i>	EM	various
hairy hermit crab	<i>Pagurus hirsutiusculus</i> §	TF 2, 3	various
sand-dwelling amphipod	<i>Paraphoxus epistomus</i>	EM	sand
pea crab	<i>Pinnixa barnharti</i>		
pea crab	<i>Pinnixa longipes</i> §	TF 2	packed muddy sand
kelp crab	<i>Pugettia producta</i>		
green beach hopper	<i>Traskorchestia (=Orchestria)</i> §	EM, SS	marsh, wrack
blue mud shrimp	<i>Upogebia pugettensis</i> §	TF 3	mud
MOLLUSCS	MOLLUSCA		
angular unicorn shell	<i>Acanthina spirata</i>	TF 1, EM	
common limpet	<i>Acmea paradigitalis</i>	TF 1, EM	rock
amphissa snail	<i>Amphissa columbiana</i>		algae
sea lemon	<i>Anisodoris nobilis</i>		
sea hare	<i>Aplysia sp.</i>	TF 3	
hornmouth snail	<i>Ceratostoma foliatum</i>	TF 3	
California horn snail	<i>Cerethidia californica</i> §	EM, TF1	
fingered limpet	<i>Collisella digitalis</i>	TF 1	rock
basket cockle	<i>Clinocardium nuttallii</i> §	TF 2	sand
Pacific oyster	<i>Crassostrea</i>		
California basket clam	<i>Cryptomya californica</i> §	TF 2, 3	mud/sand
gem clam *	<i>Gemma gemma</i> §	TF 1, 2	mud
purple-hinged scallop	<i>Hinnites multirugosis</i>	TF 3	mud/sand/rock
nudibranch	<i>Hermisenda crassicornis</i>	TF 3	
chink shell	<i>Lacuna carinata</i>	TF 3	

filamentous algae snail	<i>Lacuna marmorata</i> §	TF 1, 2, 3	sand, algae
checkered littorina	<i>Littorina scutulata</i> §	EM, TF1	rock, pilings, wrack
Little macoma	<i>Macoma bathica (conspicua)</i>	TF 2, 3	mud
bent-nosed clam	<i>Macoma nasuta</i> §	TF 2, 3	sandy mud
white sand clam	<i>Macoma secta</i> §	TF 2, 3	sand
great beach hopper	<i>Megaloorchestra</i>	EM	sand, wrack
Hawaiian clam *	<i>Meretrix lusonia</i> *		
mossy chiton	<i>Mopalia mucosa</i>	TF 3	mud
soft-shelled clam *	<i>Mya arenaria</i> *	TF 3	mud
California mussel	<i>Mytilus californianus</i>		
bay mussel	<i>Mytilus edulis</i> §	EM, TF 1	rock, piling
Cooper's whelk	<i>Nassarius mendicus cooperi</i>	TF 3	
channeled purple dogwinkle	<i>Nucella (=Thais) canaliculata</i>	TF 1, 2	mussel beds
purple rock snail	<i>Nucella (=Thais) emarginata</i>	TF 2, 3	rock
wrinkled purple dogwinkle	<i>Nucella (=Thais) lamellosa</i>	TF 2, 3	barnacles
little olive	<i>Olivella baetica</i> +		
furry nudibranch	<i>Onchidoris</i> spp.		
geoduck	<i>Panope generosa</i>	TF 3	soft muck, sand, mud
Taylor's sea hare	<i>Phyllaplesia talyori</i>		
abalone jingle	<i>Pododesmus macrochisma</i>		pilings
moon snail	<i>Polinices lewisii</i>	TF 2	muddy sand
Rock cockle	<i>Protothaca staminea</i> §	TF 1, 2, 3	clayey gravel, cobbles
Washington clam	<i>Saxidomus nuttalli</i>	TF	coarse
Japanese littleneck *	<i>Tapes japonica</i>	TF 2	sandy
Japanese cockle *	<i>Tapes semidecussata</i>		
Black turban snail	<i>Tegula funebris</i>	TF 1	rock
European shipworm *	<i>Teredo navallis</i>		pilings
small clam	<i>Transennella tantillaz</i> §	TF 2, 3	sand
gaper (horseneck) clam	<i>Tresus nuttalli</i>	TF 2, 3	sand, cobbles near channels
rough piddock	<i>Zirifaea pilsbryi</i>		
PHORONID WORMS	PHORONIDA		
	<i>Pheronopsis viridis</i>		
ECHINODERMS	ECHINODERMATA		
White sea cucumber	<i>Leptosynapta albicans</i>	TF 3	sand, gravel
pink starfish	<i>Pisaster brevispinus</i>		
ochre starfish	<i>Pisaster ochraceus</i>		
INSECTS	INSECTA		
Kelp flies	<i>Anthomyiidae</i>	EM	wrack
Brine flies	<i>Ephydriidae</i> spp.	EM	
Mud beetle	<i>Heterocerus</i> sp. §	EM, TF 1	fresh water, wrack

Hymenoptera EM
Diptera EM

FLAT WORMS

PLATYHELMINTHES
Notoplana acticola
Hoploplana californica
Alloioplana californica

The organisms on this list do not necessarily reflect the species found during any survey; however, this list does propose organisms that are common to habitats found in the Bolinas Lagoon and, therefore, should be considered as inhabitants of the lagoon. In addition to this list, species of *Urochordata* (tunicates), *Bryozoa*, *Entoprocta*, and *Porifera* would be expected in Bolinas Lagoon. The reason for the lack of these organisms on a species list is possible because they have not been sampled for or, when found, identified.

1 feeders are removed from an area, organic debris quickly accumulates, subsurface oxygen is
2 depleted by bacterial decomposition, and anaerobic sulfur bacteria eventually bloom.
3

4 The predominant deposit feeders in subtidal habitat are polychaetes (segmented worms)
5 (Table 5). Most species of polychaetes are benthic, dwelling on or in the bottom at various depths.
6 The differences exhibited by various polychaete families reflect differences in ecological roles or
7 ways of life, particularly differences in food and habitat utilization. Some polychaetes are
8 carnivorous predators, some are herbivores, and still others may be omnivores, scavengers, filter
9 feeders, or deposit feeders. In turn, polychaetes are eaten by a variety of invertebrates, fishes, and
10 shorebirds (Morris *et al.* 1980).
11

12 Several molluscan deposit feeders occur both subtidally and intertidally (Table 5). The
13 littleneck clam, *Protothaca staminea*, is found in shallow burrows in coarse sand or sandy mud in
14 the middle to low intertidal zones of bays and coves. The common littleneck clam is a nonselective
15 suspension/filter feeder. Larvae, juveniles, and adults feed on phytoplankton, benthic diatoms,
16 and detritus.
17

18 Within the subtidal habitat, fish are the prime secondary consumers. Shiner surfperch,
19 arrow gobies, diamond turbot, and staghorn sculpin may be the most common (Gustafson 1968).
20 Arrow goby is one of the four most common fish in the Lagoon and inhabits the burrows of crabs
21 and ghost shrimp. Juveniles and adults consume copepods, ostracods, nematodes, oligochaetes,
22 and amphipods. Other food may include isopods, filamentous algae, and diatoms. The arrow
23 goby is consumed by Pacific staghorn sculpin, diamond turbot, round stingray, shovelnose
24 guitarfish, California killifish, and probably many species of piscivorous birds (Macdonald 1975).
25

26 The shiner surfperch is common to abundant in all Pacific coast estuaries and bays and
27 occurs both intertidally and subtidally. The peak abundance typically occurs in June (Onuf 1987).
28 They visit the Lagoon briefly to bear live young, and the newborn stay there briefly before
29 returning to the ocean. Juveniles and adults are omnivorous, but primarily eat copepods. Other
30 prey includes gammarid amphipods, algae, mussels, barnacle appendages, polychaetes, bivalves,
31 crab larvae, cladocera, isopods, and mysids (Bane and Bane 1971, Bane and Robinson 1970).
32 The shiner perch is eaten by many species of large marine fish and is a seasonally important prey
33 for piscivorous birds such as cormorant and great blue heron. Many waterfowl at Bolinas Lagoon
34 obtain their diet from the benthos including scoters, scaup, canvasback, 'bufflehead, and
35 goldeneye.
36

37 The Pacific staghorn sculpin is distributed throughout most Pacific coast estuaries and is
38 found primarily in sandy habitats. The larvae are planktivorous, while juveniles and adults are
39 carnivorous. The staghorn sculpin is an important predator of the ghost shrimp. Sharks,
40 stingrays, and bat rays are all found within the Lagoon (Table 4). These are the only fish common
41 in the Lagoon as large individuals and are important predators on molluscs and crabs.
42

1 b. Intertidal Mudflats

2
3 Intertidal mudflat is found between mean lower low water (MLLW) and mean high water
4 (MHW), and generally lacks vascular plants (eelgrass does occur in this zone and historically
5 occurred at Bolinas). Primary production in this environment is due to algae; however, grazers use
6 not only algae produced on the bottom, but also forage on organic matter brought in by tidal or
7 freshwater flows from surrounding vegetated areas. The obvious plants of the intertidal and
8 subtidal areas are the macroalgae. Several species of two green macroalgae genera, *Enteromorpha*
9 and *Ulva*, are common in the Lagoon in the intertidal flats (Gustafson 1968). These macroalgae
10 and the benthic diatoms are important primary producers in coastal lagoons and are consumed by a
11 large number of animals. Detritus and benthic diatoms are available to snails, crustaceans and
12 birds foraging on the sediment surface of the open flats.

13
14 As in the benthos, benthic meiofauna play a significant role in the grazing and processing
15 of primary production by benthic diatoms. Crabs, particularly the mud crab, are important grazers
16 on the mudflat. The mud crab feeds mainly on diatoms and green algae. On the higher intertidal
17 mudflats, the California hornsnail is a dominant grazer, feeding on fine organic detritus and
18 microorganisms occurring at the mud surface.

19
20 Fish that inhabit intertidal flats include the gobies and sculpin and species such as sharks
21 and rays (Table 4) move from the subtidal areas into flooded tidal flats to forage on the abundant
22 benthic invertebrates. Some small, channel-dwelling fish species (e.g., sculpin) are prey for
23 shorebirds (egrets, herons, and kingfishers) (Stenzel *et al.* 1983). Topsmelt and jacksmelt enter on
24 rising tides and are taken by osprey (J. Evens, unpubl. data).

25
26 The most distinctive feature of the intertidal mudflat is the abundance of shorebirds. At
27 Bolinas Lagoon the most numerous are the dunlin, least and western sandpiper, marbled godwit,
28 willet, and American avocet. The shorebirds employ diverse feeding strategies to exploit the
29 abundant invertebrates that inhabit the intertidal mudflats. Marbled godwits forage in shallow
30 water during tidal activity, on exposed mudflats, and in upland habitats. This species prefers to
31 forage on sandflats and sandy shore habitat as prey items (i.e., large, deep-living benthos) are
32 abundant in this type of substrate. Typical prey items include small snails and clams, sand crabs,
33 amphipods, marine worms, and grasshoppers. Willets have long bills, slightly shorter than that of
34 the marbled godwit, which are used to probe deeply into sandy and muddy substrate for prey.
35 Willets feed on small invertebrates and insects including sand crabs, amphipods, marine worms,
36 molluscs, and grasshoppers. Dowitchers, like other "surface" feeding shorebirds, are primarily
37 confined to tidally exposed portions of mudflat and feed on small invertebrates on and just below
38 the surface of the mud. Their diet includes marine worms, small burrowing crustaceans, and
39 midge and fly larvae. The western sandpiper is a common migrant occurring in flocks of up to
40 30,000 at the Lagoon (G. Page, pers. comm.). Western sandpipers are small shorebirds with
41 short bills, which restrict them to foraging on the surface of mudflats and along the water's edge.
42 Prey items include polychaete worms, small crustaceans and snails. American avocets have

1 strongly upcurved bills that allow them to forage in shallow water channels, low marsh, and on
2 mudflats. Their diet consists of insects and insect larvae, small crustacea, tiny snails and worms,
3 and seeds of aquatic and marsh plants.
4

5 Herons and egrets forage in a number of habitat types including shallow water in the
6 intertidal mudflats. Herons and egrets take fish and invertebrates in the intertidal flats but may
7 also forage extensively in salt marsh and upland areas. The American peregrine falcon (FE,SE) is
8 currently listed as endangered by both the United States Fish and Wildlife Service (USFWS) and
9 California Department of Fish and Game (CDFG). Peregrines take shorebirds and waterfowl in
10 open water and intertidal mudflat habitats. The peregrine is a seasonal visitor to the site, foraging
11 on a variety of bird species and rodents along the shoreline and exposed mudflats.
12

13 c. Emergent Salt Marsh 14

15 Emergent salt marsh occurs on the margins of Pine Gulch Creek delta, Kent Island and in a
16 narrow band along the fringes of the Lagoon. Salt marsh is found in a relatively narrow
17 elevational band between MHW and extreme high water (EHW). Benthic algae are an important
18 element of the primary production of tidal marshes (Zedler 1982). Algal mats in tidal marshes
19 consist of green algae such as *Enteromorpha* and bluegreen algae such as *Microcoleus* and
20 *Schizothrix*, and numerous species of diatoms. Light penetration through the vascular plant
21 canopy, temperature, and soil moisture are important factors affecting the abundance and type of
22 algae present. The higher the elevation of the marsh surface, the lower the diversity and abundance
23 of the algal mats. Thus, in areas of sparse vascular plant cover, algal biomass is generally higher.
24 Benthic diatoms provide a food source for a number of benthic invertebrates as described
25 previously for the intertidal mudflat.
26

27 The most apparent plants of the tidal marsh are the flowering plants. Two dominant
28 species are Pacific cordgrass (*Spartina foliosa*) and pickleweed (*Salicornia virginica*). Cordgrass
29 may have colonized the Lagoon since 1900 as it does not appear in earlier accounts of the Lagoon's
30 flora. Cordgrass cannot tolerate the high salinity levels sometimes found in the higher marsh
31 elevations but can tolerate longer periods of inundation, compared to other salt marsh species.
32 Like many halophytes, cordgrass occurs in discrete colonies as a result of vegetative reproduction.
33 Pickleweed occurs at higher elevations, approximately MHW to above tidal action where salt is still
34 present in the soil. Pickleweed has the widest elevational range of the plant species found in the
35 high marsh. The lower areas are dominated by pickleweed interspersed with fleshy jaumea
36 (*Jaumea carnosa*), arrow grass (*Triglochin concinnum*), and sea lavender (*Limonium*
37 *californicum*). Salt marsh dodder (*Cuscuta salina*) is a parasitic plant found in association with
38 pickleweed and other salt marsh species at various elevations. Alkali heath (*Frankenia grandifolia*)
39 can be found in the midrange elevation. Salt grass (*Distichlis spicata*) and saltbush (*Atriplex*
40 *watsonii*), interspersed with rush (*Juncus spp.*) are dominant in the higher areas. Where freshwater
41 flows into the Lagoon, brackish marsh forms with species such as cattails (*Typha latifolia*) and
42 bulrush (*Scirpus spp.*) predominate.

1 The primary omnivores in salt marsh are benthic invertebrates. Although
2 macroinvertebrates often play a major role in the breakdown of vascular plants, there is little or no
3 indication that they directly assimilate the organic material of the plant. Rather, they assimilate the
4 organic matter of the microbial decomposers on the surfaces of the detritus (Adams and Angelovic
5 1970). Salt marsh is relatively unimportant habitat for invertebrates compared with the adjacent
6 tidal flats and subtidal areas. Molluscan communities are usually dominated by epifaunal surface
7 feeders such as the horn snail, which are important grazers on marsh algal mats (Zedler 1982).

8
9 As with the mudflat, epibenthic invertebrates are a significant group of secondary
10 consumers and provide a forage base for a variety of fish. Fish species likely to inhabit tidal marsh
11 and channels include topsmelt, shiner surfperch, staghorn sculpin and longjaw mudsucker. Fish
12 using tidal marsh and channels employ two general strategies. Relatively efficient swimmers
13 species such as topsmelt and shiner surfperch move into tidal habitats on incoming tides to feed,
14 and move out on outgoing tides to avoid becoming stranded. Benthic species such as staghorn
15 sculpin and longjaw mudsucker remain in tidal channels in the salt marsh habitat and retreat into
16 burrows and depressions.

17
18 Herons and egrets are particularly abundant along tidal channels. The snowy egret (*Egretta*
19 *thula*) and great egret (*Casmerodius albus*) are resident species. Egrets are opportunistic foragers
20 and are found in a variety of habitats ranging from grasslands and agricultural lands to ponds,
21 bays, lagoons, and fresh, brackish, and salt marshes. Egrets forage alone on small reptiles,
22 amphibians, crustaceans, fish, young birds, small mammals, and invertebrates. Great blue herons
23 (*Ardea herodias*) are also permanent residents of the area. The great blue heron has similar habits
24 to egrets and will travel several miles to and from foraging and roost sites. They can be found
25 associated with egrets and use all of the same habitats. They also forage on similar items, but the
26 size of potential prey items can be quite large (Udvardy 1977).

27
28 Emergent marsh areas at the Lagoon support a variety of land birds, rails and raptors,
29 including the black rail and other special status species (Table 3). Small mammals such as the
30 California vole (*Microtus californicus*) also forage on marsh vegetation. Voles are herbivores and
31 are known to feed on grasses, sedges and other green vegetation (Ingles 1965). They can be
32 found in a variety of habitats including fresh and salt marshes, wet meadows, and grassy hillsides.

33 34 d. Sand Bars and Beaches

35
36 Stinson Beach sandspit and Kent Island are the major sandy areas of Bolinas Lagoon. The
37 beaches and dunes buffer areas from storm waves. Shorebirds, terns, gulls and brown pelicans
38 feed and loaf on the offshore bars and in the past snowy plover nested on the beach at the tip of the
39 spit. Harbor seals use Pickleweed Island as a haul-out and pupping area.

1 e. Freshwater Streams and Riparian Forest

2
3 Smaller areas of freshwater marsh intergrade with salt marsh in transition areas where
4 streams enter the Lagoon. Pine Gulch Creek is the major stream that flows into the Lagoon. The
5 other major stream that flows into the Lagoon is Easkoot Creek. Both creeks support remnant
6 populations of steelhead. Coho salmon are rare. Striped bass enter both Pine Gulch Creek and
7 Easkoot Creek. Riparian vegetation along Pine Gulch Creek provides habitat for invertebrates,
8 reptiles, amphibians, birds, and mammals.

9
10 Riparian birds are not included in Table 3 but are treated separately in this section. It is
11 expected that as the Pine Gulch Creek delta extends into the Lagoon, riparian forest will also
12 increase. Patches of riparian habitat that border the tidal habitats of the Lagoon are clearly visible
13 in Figure 9.

14
15 As the percentage of emergent marsh increases riparian habitat will increase in the Pine
16 Gulch Creek delta and along the landward margins of the expanding marshlands. Photographs
17 from 1952 and 1973 show the banks of Pine Gulch Creek nearly devoid of vegetation. During the
18 1970's, broad-leaved riparian plants occurred as a sparse band along the banks, but this riparian
19 coverage was held in check by cattle grazing. During the 1970's and early 1980's the course of the
20 creek turned southward and fed a small brackish sedge and cattail (*Scirpus/Typha*) marsh that
21 supported several marsh dependent birds such as rails, wrens, and sparrows. The storm of
22 January 1983 deposited a massive sediment load along the mouth of the creek. This eliminated the
23 brackish marsh, increased the elevation of the tidal marsh, and rerouted the creek northward to its
24 1994 position (Figure 9).

25
26 Due partly to the disposal of willow cuttings by a local business and partly to the cessation
27 of cattle grazing, a dense tangle of riparian vegetation grew dominated by red alder (*Alnus rubra*)
28 and willow (*Salix* spp.). Since the early 1980's, this riparian forest has been used by migrant
29 landbirds. Bird use of this area includes species never before recorded in California (sulphur-
30 bellied flycatcher, sedge wren), rare transient species (long-eared owl, mourning warbler, dusky-
31 capped flycatcher) and extremely rare breeders (yellow warbler, yellow-breasted chat). The
32 riparian habitat at the Pine Gulch Creek delta is primarily used as a migrant stop during the fall
33 months (August-October), while deciduous trees are still in leaf, and spring breeding habitat and
34 migrant roost cover for several rare species including green heron, red-shouldered hawk, long-
35 eared owl, yellow warbler, and yellow-breasted chat.

36
37 f. Other Nearby Habitat Types

38
39 Mixed evergreen forests extend up the canyons, gulches, and ridges of the Lagoon watershed,
40 grading into coastal scrub and annual/perennial grasslands on more exposed slopes. Some
41 chaparral is present, although it occurs more commonly inland. Coast redwood grows in the
42 shady canyon areas, and coast live oak, Douglas fir, and bay make up the mixed evergreen woods

on the ridges and canyon slopes. Large wading birds depend on the redwood habitat adjacent to the Lagoon. Approximately 100 pairs of herons and egrets nest in the redwood canyon at Audubon Canyon Ranch and 10 pairs of herons nest in trees near Francisco Mesa in Bolinas. Black-crowned night herons roost in the cypress trees along the edge of Francisco Mesa (Figure 9). Wintering monarch butterflies roost in trees and shrubs in the vicinity of the Lagoon.

2. Wildlife of Bolinas Lagoon

The primary management goal identified by the BLTAC (Section II) is maintaining the diversity and abundance of marine plants and invertebrates, fish, aquatic birds and marine mammals. The following is a summary of current knowledge of the occurrence and distribution of these taxa in the Lagoon.

a. Macroinvertebrates

Primary consumers and decomposers in Bolinas Lagoon include a wide variety of invertebrates (Table 5, page 32). Distribution of these species is determined largely by particle size of the substrate, tidal current, elevation and salinity. Occurrence of these common invertebrates by elevational zone and type of substrata used are given in Table 4, page 29.

Chan (1967), Gustafson (1968), and Powell (1980) observed uniform-age clam beds in the Lagoon and suggested that recruitment is low and abundance is declining (Madrone Assoc. 1981). However, studies by Wooden (1976), Peterson (1975), and Powell (1980) found that deposition and suspension feeders cluster in mixed species assemblages and that clam beds are often sharply demarcated from neighboring beds and that these beds are often of uniform age classes (in Powell 1980). Hence, questions concerning lack of recruitment at Bolinas may reflect normal age class distribution.

Powell (1980) found that the distribution of gaper and Washington clams was related to tidal exchange (flow) and substrate texture; at Bolinas Lagoon, these species occurred only near the entrance channel and in the central part of the Lagoon north of the main channel where the substrate was sandy. The sediment conditions that support gaper and Washington clams also are necessary to support *Macoma* spp., ghost shrimp, and other common macroinvertebrates. The only exception to the habitat preference Powell described for gaper and Washington clams was at the mouth of McKennan Gulch, an area of fine silt deposition. Powell attributes this anomaly to the fact that the McKennan Gulch delta was continually disturbed by bait diggers, and this disturbance approximates conditions in sandier bottom sites. Overall, Powell identified the silting process as the main limiting factor to clam beds in the Lagoon.

Prime clambeds, once accessible from the east side of the original, undeveloped sandspit, were buried by dredged sediments during the fill associated with the construction of Dipsea Road during the early 1950's. Prime shellfish habitat once covered a large proportion of the southern



1 half of the Lagoon, but now is restricted to a narrow band of sandy substrate near the Lagoon
2 mouth. Little recent information is available on the distribution and abundance of clams or other
3 macroinvertebrates in the Lagoon.

4 5 b. Fish

6
7 Table 4, page 29, provides a list of fish species found in Bolinas Lagoon in the late 1960's
8 and early 70's (Gustafson 1968, Ciguere 1970, Chan and Hansen 1972). The most abundant
9 species detected in Gustafson's (1968) year-long study of the Lagoon were surf smelt, jack smelt,
10 shiner surfperch, staghorn sculpin, topsmelt, speckled sanddab, English sole, Pacific herring,
11 dwarf surfperch, cabazon, and leopard shark. The Gustafson study found that "the data clearly
2 indicate that an enormous number of juvenile fish utilize the Lagoon." This finding supports the
3 observation that the Lagoon serves as an important nursery ground for juvenile flatfish; in
4 Gustafson's study speckled sanddab and English sole were the two most abundant species.

5
6 In general, fish abundance and species diversity are greater in the Lagoon from May to
7 September than from November to February (Gustafson 1969 in Allen 1984). This pattern mirrors
8 that known at other temperate mudflat-dominated estuaries where the immigration of marine fishes
9 is synchronized with the seasonal increase in the biomass of potential prey organisms (see previous
10 section; McLusky 1981).

11
12 Resident fish species at Bolinas Lagoon probably include arrow goby, staghorn sculpin,
13 shiner surf perch and other small, channel dwelling species. Some of the schooling, surface-
14 feeding fish like jacksmelt and topsmelt may enter on tidal cycles during most months, while other
15 species (anchovies, herring) are episodic and seasonal. Vast numbers of juvenile anchovies
16 migrating northward (Richardson 1980) sometimes enter the Lagoon. These fish are often
17 followed by flocks of brown pelicans and elegant terns. These episodic events are determined by
18 oceanographic conditions, occurring in warm water periods in late summer and early fall. Pacific
19 herring are seasonal visitors, but Bolinas Lagoon is not considered a spawning ground for this
20 species (Spratt 1981, Suer 1987). Bird numbers give some indication of the biomass of fish that
21 enter the Lagoon: 3,800 brown pelicans and 3,700 terns on August 24-25, 1985; 6,000 terns on
22 August 28, 1985; 6,000 pelicans and 2,500 terns on September 7-8, 1984; and 2-3000 terns on
23 September 26-28, 1984 (Shuford *et al.* 1989).

24
25 Juvenile leopard sharks and bat rays occur on the tidal flats and adults of both species enter
26 the Lagoon regularly to forage on large clams and probably to breed. Concentrations of leopard
27 sharks in summer occur on channel edges and sandier tidal flats where they are likely depositing
28 eggs.

29
30 Anadromous salmonids pass through the Lagoon *en route* to Pine Gulch Creek, McKennan
31 Creek, and Easkoot Creek. Juvenile striped bass, coho salmon (although they have not been seen
32 in recent surveys), and steelhead are found in all the creeks that feed the Lagoon (J. Churchman,

pers. comm.). Three freshwater species [threespine stickleback (*Gasterosteus aculeatus*), prickly sculpin (*Cottus asper*), and California roach (*Hesperoleucus symmetricus*)], are found in Pine Gulch Creek. The configuration of the mouth of the creek has changed considerably since Gustafson's work and the use of Pine Gulch by those more estuarine species has likely declined or been restricted downstream to the mouth of the creek. Small rainbow trout and steelhead are still found upstream (D. Gallagher, pers. comm.), but there is some question about the ability of these to grow to full size given the dual constraints of drought and water diversion associated with the mid-reaches of the creek (J. O'Connor, pers. comm.). Coho salmon were common in Pine Gulch (J. O'Connor, pers. comm.), but are no longer present. Coho salmon are petitioned for listing as threatened or endangered under the Endangered Species Act and management decisions will have to consider impacts on this species.

Easkoot Creek formerly supported coho salmon and steelhead populations. The local community may embark on a proposed creek restoration project that dovetails with the 1994 CalTrans dredging project near the current mouth of Easkoot Creek. The success of this restoration project could benefit these salmonid runs.

c. Birds

Since 1965, staff and volunteers of the Point Reyes Bird Observatory (PRBO) have conducted field research on the birds of Bolinas Lagoon and other estuaries in the Point Reyes area. The results of these surveys (Page *et al.* 1979, Shuford *et al.* 1989, G. Page, pers. comm.) provide information on seasonal use and waterbird abundance.

Table 3, page 26, lists 85 species of waterbirds found at Bolinas Lagoon. This list is reduced from a total of 122 waterbird species detected in PRBO's censuses. Species that occur very infrequently at the Lagoon were not included in Table 3 except for (1) species afforded special status on either State or Federal lists of threatened, endangered or candidate species (USFWS 1991, CDFG 1992), (2) CDFG "Species of Special Concern", (3) species dependent on Bolinas Lagoon for breeding or foraging habitat (great blue heron, common egret, black rail, osprey, snowy plover) or for traditional roost sites (black-crowned night heron, brown pelican, elegant tern), or (4) species which do not occur in the region with any predictability other than at Bolinas Lagoon (Eurasian wigeon, sharp-tailed sparrow). Of the 85 species in Table 3, 27% fall into one of these four categories.

Bolinas Lagoon is used primarily as a wintering destination by waterbirds, secondarily as a migrant stop, and relatively little by year-round or summer residents and local breeders (Shuford *et al.* 1989). Shuford *et al.* (1989) classified the 70 most numerous species using the Lagoon into five primary use patterns and found that two-thirds of those species occurred as winter residents. An exception to this general overall pattern is the importance of Bolinas Lagoon (and other local sites) as a staging area for abundant western sandpipers in spring (Shuford *et al.* 1989), a breeding site for great egrets and great blue herons (Pratt 1983), a roosting site for dispersing brown

1 pelicans and elegant terns, and a foraging area for the large breeding osprey population in the area.
2 Table 3, page 26, provides information on habitat use of the Lagoon by birds. Although there is
3 broad overlap in the types of habitat used, the subtidal and intertidal flats are of primary importance
4 to most of the waterbirds that use the Lagoon.

5
6 A key question is whether there have been changes in waterbird use of the Lagoon
7 associated with the observed reduction of subtidal habitat and increased intertidal and emergent
8 marsh habitat. Based on PRBO waterbird data for the Lagoon (1972-1992; Table 3) and the
9 measured habitat changes in the 1968-88 period (Table 2, page 20), the changes in waterbird
10 abundance do indeed follow what one would reasonably predict for that period as a result of the
11 habitat changes. For example, the 60+% decrease in subtidal habitat between 1968 and 1988
12 suggests that the Lagoon might have become less suitable for diving birds, the species most
13 dependent on that habitat (Table 3). The 1972-92 PRBO data are in agreement. Seven species
14 (eared and horned grebes, canvasback, surf and white-winged scoters, American coot, and ruddy
15 duck) decreased in abundance, while only one species (common goldeneye) showed a weak
16 upward trend. Five species showed no up or down trend: western grebe, double-crested
17 cormorant, greater scaup, bufflehead, and red-breasted merganser.

18
19 U.S. Fish and Wildlife Service waterfowl census data for the same period indicate that the
20 abundance patterns of four of these species were counter to strong upward trends for California as
21 a whole: the scoters, Greater Scaup, and Bufflehead increased strongly. In addition, Ruddy Ducks
22 showed no downward trend in the state-wide data. This suggests that the observed changes in
23 waterfowl abundance at Bolinas Lagoon are attributable to habitat changes at the Lagoon rather
24 than merely reflecting some larger regional trends.

25
26 Similarly, the 37% increase in intertidal habitat from 1968 to 1988 has been accompanied
27 by increased abundance of 10 of the species of waterfowl and shorebirds most dependent on it
28 (e.g., Northern shoveler, gadwall, semi-palmated plover, willet, whimbrel, long-billed curlew,
29 marbled godwit, western sandpiper, greater yellowlegs, and American avocet) (Table 3). Ten
30 intertidal-dependent species showed no up or down trend (black-bellied plover, black turnstone,
31 sanderling, least sandpiper, dunlin, long-billed dowitcher, green-winged teal, mallard, northern
32 pintail, and American wigeon). None of the most intertidal-dependent shorebird or waterfowl
33 species declined.

34
35 Counter to the pattern at Bolinas Lagoon, the Fish and Wildlife census data indicate that
36 mallards, Northern pintails, Northern shovelers, and American wigeon were in sharp decline
37 statewide. In addition, Bodega Marine Lab shorebird census data for roughly the same period
38 shows no increasing trends similar to Bolinas Lagoon.

39
40 Overall, Bolinas Lagoon is an important biological resource that supports: 1) a high species
41 diversity of aquatic birds, 2) an egret and heron rookery, 3) a wintering site for waterfowl,
42 shorebirds, and raptors, 4) a black-crowned night heron roost, 5) traditional roost for fish-eating

1 flocks of pelicans, cormorants, and terns, 6) a riparian migrant stop-over (Pine Gulch Creek), 7)
2 habitat for twenty species of special concern (see Table 3), 8) breeding habitat for several
3 threatened species (snowy plover and black rail), and 9) foraging habitat for several raptors of
4 special concern (osprey, peregrine falcon, and merlin).

5 6 d. Harbor Seals

7
8 The population of harbor seals (*Phoca vitulina richardsi*) in the Gulf of the Farallones are
9 estimated to comprise 20% of the California population (Allen *et al.* 1989). Harbor seals have
0 been closely monitored in the San Francisco Bay area and at Bolinas Lagoon since 1970. Both the
1 total population and the number of pups at Bolinas Lagoon have increased in recent years. Bolinas
2 Lagoon and adjacent waters are important to the Gulf's harbor seal population. Surveys by PRBO
3 between 1971 and 1976 found a maximum of 66 seals hauled-out in the Lagoon, whereas the most
4 recent surveys (July 1994) found 288 seals in the Lagoon (B. Stewart, pers. comm.). The number
5 of pups has increased from 12 pups in 1978-79; 40 in 1992; and 28 in 1993 (Allen *et al.* 1984,
6 Allen and B. Stewart, pers. comm., 1995). This increase in harbor seal abundance also occurred
7 in other locations in the Gulf of the Farallones (Allen, *et al.* 1989).

8
9 Seals are present throughout the year in the Gulf of the Farallones and within Bolinas
0 Lagoon (Allen *et al.* 1989). Bolinas Lagoon differs from other sites in that peak numbers occur
1 during molt (May-July) after the pupping season (Allen *et al.* 1984). The increase in the summer
2 population coincides with seasonal declines at Double Point and Tomales Bay (Allen 1989).

3
4 Haul-out sites secure from disturbance are critical for harbor seal populations (Allen, *et al.*
5 1984, 1989). Haul-out sites provide seals with resting, breeding, and nursery areas. These sites
6 are used daily throughout the year and successively from year to year. The haul-out sites on
7 Bolinas Lagoon have been Kent Island and Pickleweed Island (Figure 9) with exposed sand bars
8 along the main channel providing secondary sites. At Bolinas, harbor seals use haul-out sites
9 primarily during daylight hours with peak numbers in early afternoon (Allen, *et al.* 1984 and
0 1989). During the breeding months, no relationship occurs between tide and number of animals
1 hauled-out (Allen *et al.* 1984) whereas during the non-breeding season more animals hauled out at
2 low tide.

3
4 Harbor seals are opportunistic feeders and forage on shallow water estuarine and marine
5 species of fish, cephalopods and crustaceans. Many of their preferred prey species (e.g.,
6 jacksmelt, topsmelt, starry flounder, and shiner perch) occur in Bolinas Lagoon (Table 4, page
7 29), but no feeding studies have been conducted in the Lagoon.

C. FUTURE PREDICTED ECOLOGICAL CONDITIONS

1. Summary of Habitat Changes

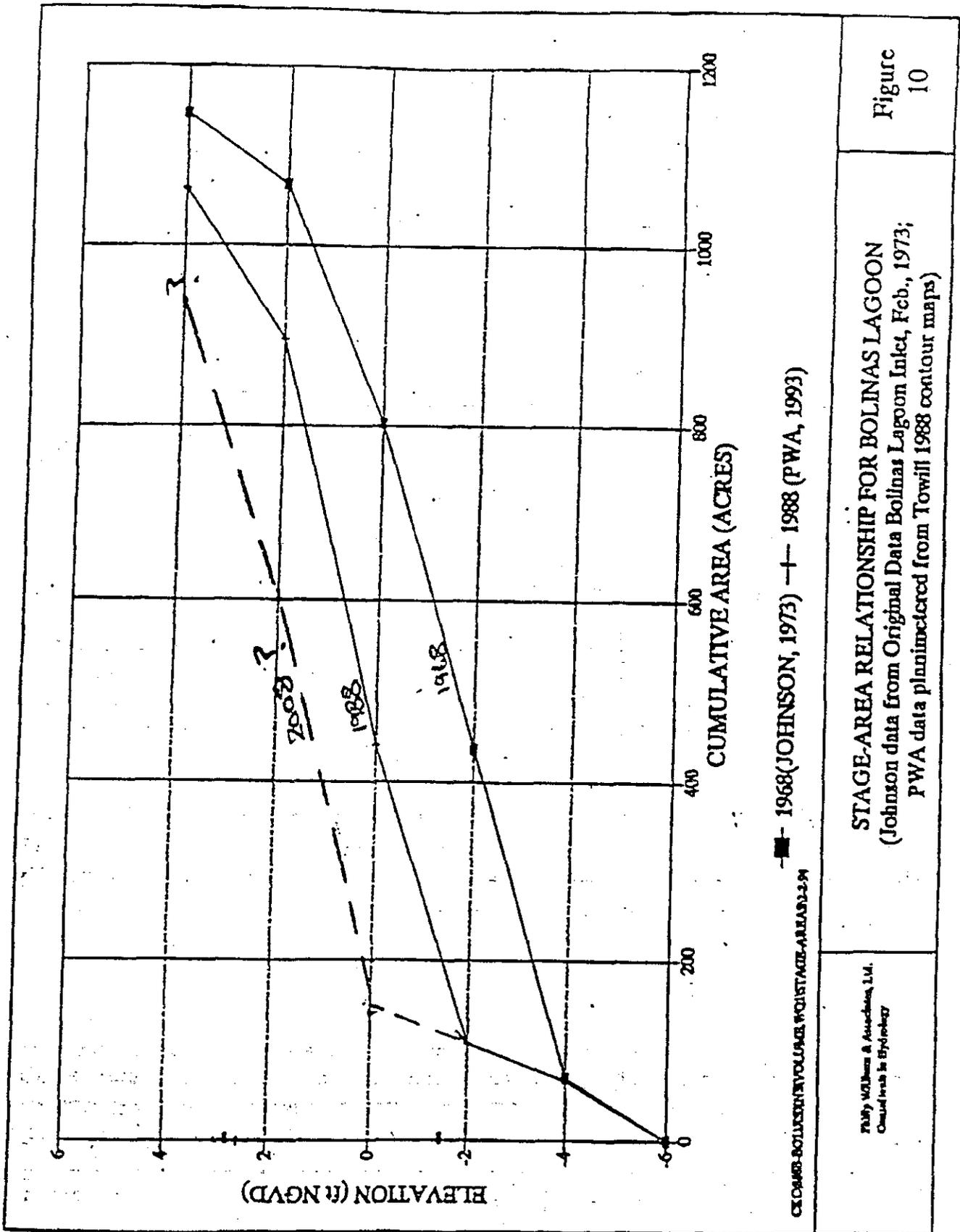
Increased sedimentation and loss of tidal prism will result in narrowing and loss of tidal channels, conversion of subtidal habitat to emergent tidal marsh, increase in the Pine Gulch Creek delta and riparian zone, and (potentially) intermittent closure of the Lagoon mouth and reduction of tidal influence (Figure 5, page 15). Based on a simple linear extrapolation of the trend in loss of tidal prism between 1968 and 1988, the generalized elevation/area relationship of the Lagoon would change over the next 20 years (1988-2008) as indicated in Figure 10. This would result in a continued loss of total estuarine habitat (subtidal, intertidal flat, and emergent marsh) and changes of area among the three habitat types as shown in Table 2. The actual morphologic evolution of the Lagoon would depend on many factors which have not yet been analyzed, such as the rate of extension of the Pine Gulch Delta, the rate of colonization of mudflats by cordgrass and pickleweed, and the influence of wave energy in the Lagoon on limiting sedimentation. Also, tectonic subsidence of the Lagoon floor or accelerated sea level rise would act to restore tidal prism. However, using Figure 10 and Table 2, it is estimated that between 1988 and 2008, subtidal habitat area will decrease by 40% (down nearly 80% compared to 1968); intertidal flat area is expected to decrease 30%; emergent salt marsh habitat type area will have increased more than 50% (400% increase compared to 1968); and upland habitat will increase by 11% as estuarine and wetland habitats are converted to uplands.

2. Changes in Fish and Wildlife

If habitat types continue to change as predicted in Table 2, there will be significant changes in the diversity and abundance of Lagoon life and ecological functions. The previous sections identified the major ecological relationships within the Lagoon; because trophic interactions are complex and are not confined within specific habitat types, the loss of acreage of one habitat type can have profound effects on species in other habitat types. For similar reasons, the loss or gain in acreage of a given habitat type does not usually translate directly into a similar percentage increase or decrease in the abundance of species that use that habitat type. Little empirical data are available on changes in the diversity and abundance of taxa at the Lagoon with the exception of aquatic birds; significantly, the changes in bird species composition follow those predicted from the observed habitat changes. Below is a discussion of how fish and wildlife species diversity and abundance may be affected by the predicted physical changes.

a. Macroinvertebrates

Little quantitative information is available from Bolinas Lagoon regarding changes in the diversity or abundance of macroinvertebrates over the last 20 years; hence, no specific trends in populations can be identified. In general, however, conversion of subtidal channel and tidal flat to emergent marsh will result in a diminution of habitat available to large filter feeders and a



1 concurrent decline in their populations. Johnson (1970) found a species diversity gradient with a
2 higher diversity of organisms at lower tidal elevations in Tomales Bay; Barbour *et al.* (1973)
3 observed the same pattern at Bodega Bay mudflats. In their analysis of this observed trend,
4 Barbour *et al.* suggested that filter feeders do not occur at higher elevations where tidal inundation
5 is less frequent, but deposit feeders (organisms that ingest the substrate) prosper at both high and
6 lower elevations because their feeding method requires less time submerged. This model of
7 "additive succession" (more species at increasingly lower zones) suggests that, in reference to
8 invertebrate communities at Bolinas Lagoon, there will be a decrease in species diversity with an
9 increase in elevation of intertidal and emergent marsh habitat.

10
11 There is a strong correlation between the regularity of tidal flushing and the
12 observed diversity and abundance of aquatic food chain members. Well-flushed systems contain
13 diverse and abundant marine populations while intermittent lagoons have depauperate flora and
14 fauna (Mudie *et al.* 1974, Greenwald 1984); hence, Lagoon mouth closure would have a
15 significant adverse impact on these species. Additional studies on the distribution, relative
16 abundance, age class distribution and recruitment patterns of selected invertebrates are needed and
17 are part of the recommended ecological monitoring plan (see Section VI).

18 19 b. Fish

20
21 Fish populations have not been studied since the early 1970's and no specific trends in
22 populations can be identified. With a progressive loss of subtidal channel and intertidal flat, and
23 channel habitat and as the average depth of the Lagoon decreases and the extent of emergent marsh
24 increases, the amount of habitat available to marine and estuarine fish of all ages will decrease.
25 Closure of the Lagoon mouth would eliminate use by pelagic fish; anadromous fish would enter
26 the Lagoon if freshwater flows, high tides, or storm surges opened the Lagoon at the appropriate
27 times.

28
29 Anecdotal accounts suggest that some fish populations have declined in recent years. Local
30 residents remember when coho salmon were common in Pine Gulch and Easkoot creeks (J.
31 Churchman, J. O'Connor, pers. comm.). This species is now rare in these tributaries, probably
32 resulting from the cumulative effects of local drought, siltation, fishing, land use, and water
33 diversion.

34 35 c. Bird Populations

36
37 As discussed in the previous Section, between 1972 and 1992 observed waterbird
38 abundance patterns correlated closely with what would be expected from the 1968-88 habitat
39 changes: (1) most intertidal-dependent shorebirds and waterfowl trended upward along with the
40 increase in intertidal habitat, (2) subtidal dependent waterfowl generally showed decreasing trends
41 mirroring the decrease in subtidal habitat, (3) only one of the subtidal dependent waterfowl species
42 showed a trend opposite to that predicted by habitat change, and (4) many of these species'

abundance trends at Bolinas Lagoon was counter to regional or statewide trends, and (5) species dependent on emergent marsh wetland vegetation increased with increases in habitat.

The positive correlation between habitat change and the abundance of species most dependent on that habitat in the 1968-88 period strengthens the case for looking at likely future changes in abundance as the Lagoon's tidal prism continues to shrink, resulting in further changes among habitat types. This section discusses the implications of predicted abundance changes in column D1 of Table 3, page 26, which includes 78 waterbird species and seven additional wetland-dependent landbirds that occur regularly or are species of special concern at Bolinas Lagoon. Table 3 also provides preferred habitat types for each species and a rough indication of abundance for all but four species.

A majority of species are likely to decline in numbers as the predicted changes occur and the habitat mix shifts toward a greater extent of emergent salt marsh and reduced area of intertidal flat and subtidal habitat (Table 2, page 20). Of the 85 species in Table 3, 47 (55%) are predicted to decline in abundance by 2008, 14 species (17%) will increase, and 24 species (28%) will not be directly affected. The species expected to decline in abundance are those most dependent on the two wettest of the estuarine habitats: the permanently open water (subtidal) and the areas submerged at each high tide (intertidal flats).

The predicted changes indicate an overall loss of avian abundance at Bolinas Lagoon. Of the 47 species predicted to decline in abundance, nearly half (21 species or 45%) fall into the four highest abundance categories, whereas only one of the 14 species predicted to increase is even moderately abundant (Table 3).

Based on these estimated changes, we predict that Bolinas Lagoon will decrease in importance as an overwintering location and migratory stop for shorebirds and waterfowl on the Pacific Flyway, while a few low-abundance species dependent on salt marsh and the encroaching upland benefit from the shift to higher and drier habitats.

d. Harbor Seals

Harbor seals are the only mammal that will be significantly affected by changes in the circulation patterns of Bolinas Lagoon. From 1968 to 1988, when subtidal habitat decreased by 60% percent, the harbor seal population, including the number of pups, more than doubled (B. Stewart, pers. comm.). As described above, harbor seal populations increased in other nearby areas. It is not known what minimum extent of habitat, or what habitat mix, is needed to support this population. For example, the extent to which seals forage in the Lagoon is not known. Hence, it is difficult to predict how seals will be affected by the continued loss of subtidal habitat. Certainly, access into and out of the Lagoon is important to the Lagoon's harbor seal population.

D. SUMMARY OF PHYSICAL AND ECOLOGICAL INFORMATION

For at least 7000 years, there was a dynamic equilibrium of sedimentation balanced by sea level rise and tectonic subsidence. This equilibrium was perturbed by human activities beginning in 1849 with intensive logging, clearing and grazing in the Lagoon's watershed. Based on the most complete information available, it is estimated that the Lagoon is losing tidal prism to sedimentation at about 1.4 million cubic feet per year. Between 1968 and 1988, the Lagoon lost an estimated 25% of its tidal prism and 7% of its estuarine habitat.

Barring an earthquake or a dramatic increase in the rate of sea level rise, and without intervention, the rate of tidal prism loss is expected to continue, resulting in further losses of total estuarine habitat. By 2008, the Lagoon will have a significantly different mix of the three major estuarine habitats, with area of the two that support the greatest biological diversity and abundance (subtidal and intertidal flats) reduced by an estimated 43% from 1968. Emergent salt marsh, therefore, is expected to increase by over 300% from 1968 levels.

Available data on changes in abundance of bird species on the Lagoon indicate that diving birds (grebes and diving ducks) have decreased since 1972, generally correlated with the loss of subtidal habitat. At the same time, species most dependent on intertidal flats (shorebirds and dabbling ducks) have increased, consistent with a temporary increase in their primary habitat. The abundance trends of both groups at Bolinas Lagoon has tended to be counter to statewide trends or trends elsewhere in the region. Based on predicted physical changes, waterfowl and shorebirds -- the groups with the greatest abundance and species diversity that are dependent on the Lagoon's estuarine habitats--will decline as the subtidal channels and intertidal flats shrink. By 2008, the Lagoon will be a significantly less valuable migration and overwintering location on the Pacific Flyway (although more valuable for neotropical migrants), where estuarine habitats have already suffered huge losses and degradation.

The loss of the wettest estuarine habitats would be offset to a small degree by increases in salt marsh and riparian habitats. Salt marshes at Bolinas Lagoon support a relatively low diversity of birds, fish, and invertebrates compared to the lower elevation estuarine habitats. The salt marshes do provide habitat for a few special status species, and the riparian habitats at Pine Gulch Creek provide breeding and migratory habitat for passerines (songbirds).

Although little empirical information is available on changes in the abundance of taxa other than birds, we expect that the Lagoon will lose significant diversity in estuarine invertebrates and fish species. Such changes, as reflected by changes in bird diversity, may have occurred already (monitoring of these populations is highly recommended). While harbor seal populations have increased, at some point the loss of channels and overall access, having increased the potential for disturbance, will deter seals from using the Lagoon.

VII. CONCLUSIONS AND MANAGEMENT RECOMMENDATIONS CONCERNING SEDIMENTATION AND ECOLOGICAL CHANGES

If present physical and ecological trends continue, there will be a continued loss of estuarine habitat and the diversity and abundance of Lagoon life as subtidal and intertidal habitats are converted to emergent marsh and uplands. These changes are largely the result of past alterations of the watershed by humans. These developments are counter to the management goals and objectives of the MCOSD, GFNMS and the BLTAC:

"[the Lagoon should be] forever held by the county, and its successors, in trust for the... establishment, preservation, restoration, improvement or maintenance of intertidal and subtidal marine biological reserves.."(from the State Legislation that transferred the tidelands to the County (Appendix A).

"the primary purpose of managing the area and of these implementing regulations is to protect and to preserve the marine birds and mammals, their habitats, and other natural resources from those activities which pose significant threats"(The Point Reyes-Farallon Islands National Marine Sanctuary Final Rule, Federal Register Jan. 28, 1981, p. 937).

Goal I is to preserve and restore the ecological values of Bolinas Lagoon. Objectives are to 1) Preserve the abundance and diversity of Lagoon life (especially native aquatic birds, marine mammals, fish, and marine plants and invertebrates); 2) Preserve and enhance, over the long term, an ecological system including aquatic habitats (subtidal, intertidal, marsh, riparian, sand bar, and beach) that best protects the abundance and diversity of Lagoon life; 3) Restore water quality and hydraulic functions that will decrease sedimentation and prevent the loss of rich estuarine habitats. (Goals and Objectives; see Section II).

Based on the observed, predicted, and prudently assumed physical and ecological trends, it is likely that remedial actions are necessary to meet the stated management goals and objectives. Only additional study of the Lagoon, as outlined later in this section, will provide information regarding the applicability, impacts, efficacy, and costs of the following possible actions. Given the present lack of such information, this report makes no recommendation regarding a preferred action or combination of actions, nor are the following actions presented in order of priority.

- Watershed Management

Watershed management involves a combination of land use, erosion control, sediment entrapment, and maintenance practices to reduce sediment entering the Lagoon from the surrounding watershed. It is not yet known whether sediment management on its own can contribute significantly to reducing the Lagoon's sediment inputs because major sources of sediment, except for Pine Gulch Creek, are not presently known. Further study of the Lagoon's watershed, as proposed below, may supply this information.

1 • Fill Removal

2
3 Tidal prism may be increased through the removal of illegal fills. The removal of legal fills
4 which, in whole or part, are not longer needed or cannot be used for development purposes
5 due to constraints imposed by the Local Coastal Plan or other planning constraints should
6 also be explored.

7
8 • Restore Tidal Prism at Seadrift Lagoon

9
10 Tidal prism could be increased by restoring tidal action to Seadrift Lagoon. Studies would
11 determine the feasibility of opening Seadrift Lagoon so that it becomes part of Bolinas
12 Lagoon's hydrodynamic system and contributes to an increase in the Lagoon's tidal prism.

13
14 • Pine Gulch Creek Restoration

15
16 Several restoration projects should be investigated. This would include identification of
17 erosion problems in the watershed; bank stabilization on the upper creek reaches where past
18 land use practices contributed to bank erosion; and eliminating the berms on the lower
19 reaches to allow for sheet flow and sediment deposition and streambed course changes
20 during storm events.

21
22 • Dredging

23
24 Dredging can vary from limited one-time spot dredging to large scale, ongoing maintenance
25 dredging. Limited dredging could occur in areas where hydrologic studies indicate
26 sediment removal would open channels and promote ongoing tidal scouring. Maintenance
27 dredging removes a predetermined amount of accumulated sediments to restore the tidal
28 prism as it existed at a set time in the past. Further hydrological studies are required to
29 identify the range of dredging options, their efficacy and costs.

30
31 It should be noted that the Lagoon is within the GFNMS whose regulations (Appendix A)
32 state that:

33
34 *"Prohibited activities include to dredge or otherwise alter the seabed in any way...except
35 for routine maintenance and navigation, ecological maintenance, and mariculture."*

36
37 The Final EIS for the Sanctuary (Appendix A) states that:

38
39 *"dredging exceptions would allow for navigational projects, the maintenance of existing
40 facilities, mariculture and a possible U.S. Army Corps of Engineers project for selective
41 dredging in Bolinas Lagoon to help restore its natural ecology, which may be threatened by
increased sedimentation due to development further inland (Perry [sic] 1979, pers.*

comm.). The suggested regulatory restriction will allow limited and ecological sound dredging (particularly along the mainland) at levels fairly certain not to harm breeding grounds, haul out areas and foraging areas."

Dredging may result in substantial adverse impacts from:

"...potential threats to particularly sensitive marine resources. Foremost among these adverse impacts would be increased turbidity levels, disruption or displacement of benthic and intertidal communities [with adverse affects in higher trophic levels], and human intrusions near marine bird and marine mammal concentrations." (Final EIS for the Point Reyes-Farallon Island Marine Sanctuary (pp F-78-79).

- No Action

A no action alternative cannot be ruled out at this time, given the present lack of knowledge regarding, among other things, Lagoon dynamics and whether increased sediment inflows over the past 20 years represent an ongoing trend or were the result of an unusually high frequency of heavy storms.

The challenge, therefore, is to identify technically feasible, cost-effective, and environmentally acceptable ways to meet the goals and objectives of maintaining a functioning estuarine lagoon and the diversity and abundance of Lagoon life. Constraints on implementing any remedial action include the following:

- (1) sensitivity of the Lagoon's resources,
- (2) uncertainty about physical variables affecting sedimentation,
- (3) uncertainty in predicting the effects and efficacy of remedial actions,
- (4) potentially high costs of dredging, and
- (5) difficulty in obtaining permits from agencies.
- (6) difficulty of identifying an appropriate site to dispose of dredge spoils

Consequently, it is recommended that a Sediment Management Plan (SMP) be developed that would address these constraints. Below, a framework for a SMP is presented that would:

- (1) insure intervention at appropriate levels when needed,
- (2) base intervention on observed physical and ecological changes,
- (3) take advantage of natural processes such as watershed restoration and earthquakes,
- (4) develop a decision-making framework,
- (5) monitor key variables, and
- (6) modify, update and improve the decision making process with information obtained from monitoring.

For these reasons, the following research activities are suggested as the basis for full development of a SMP. This research incorporates evaluation of various remedial actions to ensure that any intervention in Lagoon processes could occur when needed and at an appropriate level of intensity.

1. Detailed Survey of the Lagoon [Estimated Cost: \$150,000]

A complete bathymetric/topographic survey of the Lagoon would be conducted to establish baseline morphologic conditions for use in comparison with earlier surveys and to provide input data for a detailed hydrological model of the Lagoon. The survey should identify and map all developed and undeveloped fill sites. These data would be used to evaluate the effectiveness of various dredging strategies for restoring the Lagoon's tidal prism and for monitoring the effectiveness of watershed management actions.

2. Physical and Hydrological Analysis [Estimated Cost: \$340,000]

It is necessary to develop a hydrological model that would provide the basis for selecting a preferred dredging strategy with consideration of the effects of other remedial actions. Based on the hydrological analyses, alternatives for dredging and other sediment removal projects from the Lagoon would be prioritized based on cost effectiveness and minimization of ecologic disruption. It is possible that smaller pilot projects would also be recommended in the plan to assist in determining priorities.

- *Characterization of hydrology.* Identifying flood frequency, possibility of sea level rise, typical sediment delivery, and seasonal hydrographs.
- *Geomorphic analysis.* Interpretation of geomorphic evolution of the waters, adjacent shoreline and the Lagoon itself based on historic information and coring data. A preliminary sediment budget for the Lagoon would be developed.
- *Hydrodynamic analysis.* The Lagoon hydrodynamics would be simulated with a numerical model calibrated with tide records within the Lagoon. The model would include Seadrift Lagoon and explore the feasibility and the benefits of including Seadrift Lagoon in the Lagoon's tidal prism. In addition, the effects of the Bolinas Groin and the Seadrift seawall would be included in the analysis.
- *Littoral transport and lagoon closure analysis.* Measurements of shallow water wave energy and the response of Lagoon inlet to different wave and tide conditions would be carried out.

3. Watershed Analysis, Project Design and Prioritization [Estimated Cost: \$380,000]

A survey of the watershed to identify critical erosion sites and potential sediment deposition areas upstream of the Lagoon would be carried out. This would include all watershed lands and would require close cooperation with agencies such as the GGNRA, Point Reyes

National Seashore, Mt. Tamalpais State Park and private landowners. Problem areas would be identified and prioritized by cost and their estimated amount of sediment reduction. Once the main sources of sediment are identified (Pine Gulch Creek is already known as a primary contributor), projects that would reduce sediment delivery to the Lagoon would be evaluated. Specific projects to reduce erosion from critical sites such as road cuts, slides, gully and creek banks would be identified, analyzed for cost effectiveness, and prioritized. Improvements in land management such as grazing or reestablishment of native vegetation would be assessed. A potentially important management tool to reduce sediment delivery to the Lagoon is to restore natural depositional areas such that sediment can deposit before it is carried into the Lagoon itself. Improvement of effectiveness of natural floodplain sediment deposition areas to capture sediment before it reaches the Lagoon would also be prioritized.

4. Ecologic Analysis

[Estimated Cost: \$150,000]

The discussion in the previous Sections of this report provided an assessment of observed and expected physical and ecological changes in the Lagoon. Empirical data on waterbirds indicate that bird abundance has followed expected trends based on changes in the relative abundance of habitat types. A snapshot assessment of other taxa (e.g., macroinvertebrates, fish) is recommended to evaluate the effects of remedial actions and to monitor the results compared to preaction conditions. The ecological analysis would also identify key resources that may be potentially impacted by remedial actions (e.g., clambeds).

5. Development of a Monitoring Plan

[Estimated Cost: \$40,000]

Monitoring of physical and ecological variables will allow an evaluation of the success of remedial actions when implemented and an updating and improvement of the decision making process. Physical variables would be values for total tidal prism, rates of sedimentation, water quality, tidal channel depths, tidal exchange ratios or elevation area relationships that are expected to be correlated with changes in the abundance and diversity of fish and wildlife species. The abundance and diversity of macroinvertebrates and fish should be monitored to establish baseline information and continued periodic monitoring of birds and harbor seals is recommended.

Next, a process would be established for public input into the development and improvement of the management plan and the selection of a preferred course of action. Based upon these results, one or a number of remedial actions may be proposed to restore wetland habitat or slow the rate at which wetland is likely to be converted to upland. Alternatively, a decision could be reached to not intervene and to let "nature take its course".

6. EIR/S for Remedial Actions

[Estimated Cost: \$440,000]

If and when remedial actions are identified and proposed, an EIR/S may be required depending on the likely impacts of the activity. Remedial action such as dredging of estuarine habitats, conversion of upland habitat to estuarine habitat, major watershed

1 projects to reduce erosion and sediment delivery to the Lagoon, or modification of Seadrift
2 Lagoon may trigger either a CEQA or NEPA review. A key feature of the SMP is to
3 provide the required information to facilitate the issuance of permits by consultation and
4 approval of regulatory agencies prior to the time when remedial actions need to be
5 implemented.

VIII. DAILY MANAGEMENT ISSUES AND RECOMMENDATIONS

A. JURISDICTION AND REGULATORY FRAMEWORK

Numerous agencies have jurisdictional, planning or regulatory oversight of the Lagoon or its watershed as described in Appendix B. To better implement management goals among the various agencies and entities, communication and coordination should be improved and formalized.

The MCOSD has the primary role in managing the natural resources of the Lagoon. The BLTAC, which serves as the technical advisor to the MCOSD for all matters potentially affecting the Lagoon, has provided a forum for discussing issues relating to the Lagoon and for coordinating management efforts. The BLTAC consists of representatives from government, interested groups, and local communities. The previous plan (Madrone Assoc. 1981) recommended that the role and function of the BLTAC be expanded and formalized. The BLTAC has continued to serve and protect the Lagoon through the volunteer efforts of its members. Currently, the following agencies and groups are represented on the BLTAC:

- Audubon Canyon Ranch
- Point Reyes Bird Observatory
- Golden Gate National Recreation Area
- U.S. Army Corps of Engineers
- Gulf of the Farallones Marine Sanctuary
- College of Marin Marine Biology representative
- California Department of Fish and Game
- Point Reyes National Seashore
- U.S. Geological Survey
- Bolinas Rod and Boat Club
- Town of Bolinas
- Stinson Beach (2)
- Member-at-large

The Sediment Management Plan has both a watershed element and a dredging element. Mt. Tamalpais State Park controls watershed lands and the U.S. Fish and Wildlife Service would be a critical agency in approving any dredging that occurs in the Lagoon. It is recommended that BLTAC members be added from Mt. Tamalpais State Park and the U.S. Fish and Wildlife Service.

B. OWNERSHIP PATTERNS

The majority of Bolinas Lagoon is held in public ownership, either by the County of Marin or Golden Gate National Recreation Area. Although the GFNMS does not hold title to the Lagoon or the submerged tidelands, management authority flows from federal legislation which regulates some uses and activities as defined in the Sanctuary Regulations (Appendix A), FEIS and the Sanctuary Management Plan. Smaller public holdings are those of the College of Marin, which maintains a marine biology station (on Wharf Road in Bolinas), the Bolinas Public Utility District and the Bolinas-Stinson Beach School District. CalTrans owns several scattered parcels along Highway 1 for road maintenance and repair.

Various lands in and around the Lagoon are privately owned as well. An extensive area on the east side of the Lagoon including a redwood grove with a major heron and egret rookery, is owned by Audubon Canyon Ranch (ACR), a private, non-profit environmental protection, education and research organization. Other private holdings include the Seadrift subdivision, lands near Pine Gulch Creek, and lands along the entrance to the lagoon in Bolinas.

C. RECREATION, EDUCATIONAL AND SCIENTIFIC USES

Recreational use of Bolinas Lagoon includes bird watching, nature photography, fishing, clamming, shrimping, boating, use of manually-powered craft (e.g., kayaks, canoes, sailboards), bicycling, walking, jogging, and picnicking. The coliform quarantine established in the 1970's has reduced clamming activity in the Lagoon, but has not restricted the harvesting of shrimp for use as bait. It might be expected that clamming would again become a popular activity if the quarantine is lifted; however, clam populations may have declined since the time in the 1960's when several hundred clammers per season used the Lagoon.

Canoeing, kayaking, motorboating and jet-skiing have been the subject of much controversy. The main concern is their disturbance to harbor seals hauled-out on Kent and Pickleweed Islands. Studies have indicated that the approach of manually-powered craft and motorboats disturb the seals. However, the seals generally haulout during low tides, when there is reduced boating activity. Because of the shallowness of the Lagoon even in the main channels and the prominence of a sandbar at the mouth, boating and kayaking/canoeing occurs mainly during high tides. At low tides, kayaks/canoes are forced into the channels bringing them into close proximity to seal haul-out sites.

Of the public agencies with an interest in Bolinas Lagoon, the MCOSD staff has the most contact with Lagoon visitors. During patrols, scheduled walks, or in the course of performing land management activities, the MCOSD rangers and naturalist work to educate the public about the fragility of the Lagoon's resources in an effort to encourage respect for and minimize abuse of those resources. On occasion, the MCOSD has prepared and distributed educational brochures to inform the public of the harbor seal population's sensitivity to disturbance. An historical collection

of studies and plans related to the Lagoon and its resources is archived in the District's administrative offices in San Rafael.

On weekdays at ACR's 1,000 acre Bolinas Lagoon Preserve, nature tours of the ranch led by trained docents are offered free of charge to classes from Bay Area schools. The public may visit on weekends and holidays (weekdays by appointment only) mid-March through mid-July. Pamphlets describing self-guiding tours are also available at the ranch. The Ranch maintains an extensive permanent exhibit which features the ecology, geology, and history of the Bolinas Basin. Other facilities include a bookstore, picnic area, and restrooms. One of the great natural attractions at ACR's Bolinas Lagoon Preserve is a nesting colony of approximately 100 pairs of great blue herons and great and snowy egrets which can be observed nesting in the tops of redwood trees.

The Bolinas Lagoon ecosystem is complex, combining unusual geological conditions with rich biological resources. The Lagoon has therefore been the subject of numerous amateur and professional studies. The behavior and habitats of harbor seals have been extensively studied in the Lagoon, as well as aspects of the ecology of shorebirds. PRBO has studied and monitored the number of birds using the Lagoon since the 1970's. New studies of clam and other benthic invertebrate populations in Bolinas Lagoon are needed to update studies from the 1970's. The Lagoon has also been the subject of hydrological studies over the years; however, additional studies with consistent methodologies are recommended.

D. RESOURCE MANAGEMENT ISSUES AND RECOMMENDATIONS

The primary goal identified by the MCOSD and BLTAC is to preserve the abundance and diversity of Lagoon life, and consistent with this Goal, to maintain and enhance the opportunities for education, research, recreation, navigation, and aesthetic enjoyment of Bolinas Lagoon. State Legislation that transferred the tidelands to the County (Appendix A) included the following (partial) stipulations that the management of the Lagoon should provide:

For the establishment, preservation, restoration, improvement or maintenance of intertidal and subtidal marine biological reserves...nature study... research... preservation of areas of unique ocean phenomenon for marine activities and water sports...natural beauty and biological resources.

For the establishment, improvement and conduct of a harbor...and accommodation of commerce and navigation, which shall include accommodation for shallow draft vessels.

There is hereby reserved for the people of the State of California the absolute right to fish in the waters of the lands with the right of convenient access to the waters.

However, the State Attorney General (letter dated March 19, 1973; Appendix A) concluded that:

1 *the Legislature, in enacting this statute, intended merely that the various uses listed*
2 *...should collectively define the permissible limits of use of the granted lands by the*
3 *County of Marin, but not that each and every listed use need be implemented by the*
4 *County." [and] "the fact the various authorized uses appear to be largely incompatible also*
5 *indicates that they were not intended to be mandatory."*

6
7 Some uses of the Lagoon may conflict directly with resource management goals. Other
8 conflicts may arise because of the public's ignorance of the sensitivity of the wildlife on the
9 Lagoon. The MCOSD and BLTAC have continually recommended an educational approach to
10 reducing human-wildlife conflicts at the Lagoon. The question then is how best to educate the
11 public: Are the current programs effective? What role should the Open Space naturalist and
12 rangers play in the process? Should other organizations and agencies play a more active role in this
13 process? Although law enforcement is not a solution for reducing conflicts, should the MCOSD
14 rangers be given some minimal enforcement powers?

15
16 The following discussion of MCOSD management issues stresses the importance of
17 education and recommends measures to increase the public's awareness of the potential
18 consequences of their actions.

19 20 1. Education

21 22 a. Public Education

23 24 *Issue*

25 Audubon Canyon Ranch (ACR) and MCOSD offer educational opportunities
26 for visitors to the area at no charge. At ACR the importance of the Bolinas
27 Lagoon ecosystem is emphasized to visitors through permanent exhibits and
28 interpretative programs. Additional educational information specifically about
29 the Lagoon would provide the most effective mechanism for protecting the
30 Lagoon's biological resources.

31 32 *Recommendation*

33 The use of kiosks and signs are generally opposed by the local communities,
34 particularly where the aesthetics of the Lagoon are degraded. The MCOSD
35 should support efforts by ACR, GFNMS, PRBO, BLTAC and College of
36 Marin to develop a Lagoon research facility at the College of Marin Marine
37 Biology Station buildings in the town of Bolinas. Development of an
38 educational center could be explored at ACR and the Stinson Beach/GGNRA
39 Visitor Center. Activities of the educational center could include monthly
40 presentations and the development of educational materials for use by local
41 schools. Distribution of educational materials from the Stinson Beach/GGNRA
42 visitor center began in 1995.

b. Nature Interpretation and Education*Issue*

MCOSD rangers' interactions with the public at the Lagoon and naturalist-led discussions and walks are an excellent way to educate the public about the sensitive nature of the Lagoon and on the unique natural resources of the area. The MCOSD naturalist, originally funded by the Marin Community Foundation at the request of the nonprofit Bolinas Lagoon Foundation until the County Parks budget could accommodate the position, was to devote significant time to Bolinas Lagoon; however, the naturalist now conducts programs on MCOSD lands throughout the County as well as on the Lagoon. Although 20% of the naturalist's outings are conducted at the Lagoon, additional educational offerings at the Lagoon are desirable.

Recommendation

MCOSD rangers should increase their presence at the Lagoon, specifically at high-use times (such as minus tides during daylight hours, weekends etc.) when potential impacts to the resources are greatest and when high use offers the greatest contact time for interacting with and educating the public. Lagoon oriented talks at West Marin schools and libraries would allow both school age children and senior citizens--two groups that may not be able to join regularly scheduled tours--the opportunity to learn more about the Lagoon. A video documentary would also be an effective educational tool for school use that would be available for wide circulation through the County Library System. GGNRA staff should also offer interpretative material at Stinson Beach.

c. Volunteerism*Issue*

Volunteer labor has been organized for Lagoon enhancement projects.

Recommendation

The MCOSD, GGNRA and Point Reyes National Seashore should coordinate volunteers to assist in activities such as exotic species removals and clean-ups. The MCOSD currently uses volunteers for such activities. The GGNRA and Point Reyes National Seashore use volunteers for trail maintenance and erosion work to reduce sediment deposition in the Lagoon. GFNMS has the Beach Watch Program with volunteers monitoring (for animals, oil spills) portions of the Lagoon and Stinson Beach. ACR uses volunteers extensively in its education and resource management programs and for monitoring and collecting data on biological resources. Such efforts should be continued and their

1 effectiveness increased by interagency coordination and an overall planning
2 effort. However, care should be exercised when determining which projects
3 are appropriate for volunteer assistance.
4

5 2. Law Enforcement

6 a. Enforcement Powers

7 *Issue*

8
9 Although the real answer to resolving conflicts between human use and
10 ecological values is education, occasional enforcement of the codes and
11 regulations designed to protect the Lagoon's resources is necessary. MCOSD
12 rangers who patrol the Lagoon have no law enforcement powers. MCOSD
13 does have a full-time deputy sheriff on staff but, given enforcement
14 responsibilities on other District lands, the deputy sheriff is seldom assigned to
15 the Lagoon. For minor or major infractions, MCOSD rangers must call the
16 Sheriff or Stinson Beach (GGNRA) Rangers. Sheriff response time is on the
17 order of 45 minutes to 1 hour; Stinson Beach Ranger response time is highly
18 variable. CDFG has enforcement powers concerning fishing and harvesting
19 regulations on the Lagoon.
20
21

22 *Recommendation*

23 Rangers should continue to explain the reasons for the regulations protecting
24 natural resources of the Lagoon. Public awareness and public education is the
25 best way to minimize conflicts between humans and wildlife. However,
26 MCOSD rangers should be given an appropriate level of training and authority
27 required to detain individuals and write citations. This does not mean that law
28 enforcement becomes paramount, only that when needed, the MCOSD rangers
29 will not have to rely on the ineffective methods currently used. When necessary
30 to increase public agency presence at the Lagoon, MCOSD rangers should
31 request the assistance of special agents of the National Marine Fisheries
32 Service, which is charged with enforcing the Federal Marine Mammal
33 Protection Act, to educate the public or enforce regulations.
34

35 b. Ranger patrol time at the Lagoon

36 *Issue*

37
38 Current staffing of MCOSD rangers allows only one day per week at the
39 Lagoon. This level of patrol is insufficient at current use levels. The MCOSD
40 naturalist was originally funded to provide the Lagoon with a full-time
41 naturalist; the rangers currently attempt to provide this function with a much
42 smaller time commitment devoted to the Lagoon.

1
2 *Recommendation*

3 MCOSD should increase ranger/naturalist presence at specific times when
4 human use may be greatest (e.g., minus tides for clamming and ghost-
5 shrimping, high tides for boaters, weekends etc.).
6

7 c. Jurisdiction

8
9 *Issue*

10 The patchwork of land ownership and jurisdictions makes enforcement
11 problematic.
12

13 *Recommendation*

14 The GGNRA has jurisdiction over the southern portion of the Lagoon along
15 Highway 1 whereas MCOSD has management and enforcement responsibilities
16 on the remaining perimeter lands. Discussions between GGNRA and MCOSD
17 concerning relevant issues, enforcement and daily management effort, and
18 unresolved problems would lead to better coordination and more effective
19 management. Boundaries between public and private lands should be
20 surveyed, in particular at the tip of the Stinson Beach sandspit and the southern
21 end of the Lagoon to minimize encroachments and clarify property boundaries
22 (Figure 11).
23

24 3. Public Access

25
26 a. Camping

27
28 *Issue*

29 The MCOSD prohibits camping at Bolinas Lagoon. Individuals on boats may
30 stay overnight on the Lagoon by permit from MCOSD. Individuals in cars and
31 campers occasionally "camp" or overnight in the turnouts along Highway 1,
32 although this is also prohibited but rarely enforced by the Sheriff.
33

34 *Recommendation*

35 MCOSD rangers should continue to explain the MCOSD codes and enforce the
36 prohibition on camping. However, MCOSD rangers are rarely present at night;
37 GGNRA rangers may enforce the prohibition as is done on other lands in the
38 GGNRA. Access to the CalTrans turnout across from Pike County Gulch most
39 used for overnighting should be blocked with visually unobtrusive barriers.
40

41 b. Pull-outs around the Lagoon
42

Issue

Pull-outs around the Lagoon are used by the public for sight-seeing, nature observation, picnics and other Lagoon compatible uses. However, the pull-outs are also used as campsites for overnight stays by people in campers and motor-homes (see above). Motor-homes have dumped effluent into the Lagoon from these turnouts. Turnouts are also used occasionally for commercial sales. The CalTrans turnout is currently used for CalTrans soil/dirt storage which may contribute to the spread of exotic plants in the Lagoon.

Recommendation

Continue to allow compatible uses of the turnouts. Prohibitions on camping, commercial use and dumping should be enforced by MCOSD and local law enforcement agencies. The County Sheriff's office should enforce Marin County Municipal Code Section 7.52.040(b) (overnight parking of "housecars") along Highway 1 in the vicinity of the Lagoon. MCOSD should request CalTrans to identify and use alternative material storage sites that are not adjacent to the Lagoon.

c. Trail use

Issue

Certain trail uses, particularly along the Pine Gulch Creek delta and other sensitive areas, damage trails and cause erosion.

Recommendation

a. Equestrian Use of Trails

Horses should be prohibited from sensitive areas, such as Pine Gulch Creek delta, during the rainy season. Trail damage and erosion resulting from equestrian use should be monitored to determine whether horses should be excluded from the trails in the immediate vicinity of the Lagoon year-round.

b. Bicycle Use of Trails

MCOSD prohibits mountain bicycle use in the Bolinas Lagoon Open Space Preserve. Mountain bike prohibitions should be enforced. MCOSD rangers should be given the training and authority necessary to detain individuals and issue citations.

4. Contaminants and Fill

a. Oil spill protection

1 *Issue*

2 The Lagoon's resources are sensitive and extremely vulnerable to oil spill
3 contamination. In 1971 a large oil spill caused considerable damage to the
4 coastal ecosystems on Stinson and Bolinas Beaches. Fortunately, the oil spill
5 did not cause much damage to the Lagoon, but it did show that the Lagoon is
6 vulnerable to such events.

7
8 *Recommendation*

9 The CDFG, Office of Oil Spill Prevention and Response, is the lead agency for
10 oil spills. The organization *Clean Bay*, funded by the petroleum industry, has
11 been contracted to develop contingency plans and coordinate emergency oil spill
12 clean-ups. The BLTAC has worked with the U.S. Coast Guard and *Clean Bay*
13 to develop the protocols for emergency response at the Lagoon with two full-
14 day practice drills. The plans call for storing booms at the Bolinas Fire Station
15 and at Seadrift and constructing holdfasts at either side of the Lagoon mouth to
16 anchor the booms (Appendix I). These plans should be updated and
17 implemented with regular practice drills to keep both the Coast Guard and *Clean*
18 *Bay* crew chiefs aware of the specifics of the Lagoon and the details for an
19 emergency response. The MCOSD rangers should familiarize themselves with
20 the emergency plans and the MCOSD should become an active participant in the
21 planning process and practice drills. MCOSD ranger trucks should be outfitted
22 with HAZMAT containment/clean-up equipment. A HAZMAT equipment
23 location should be established at the College of Marin Marine Biology Station to
24 be maintained and used by the Bolinas and Stinson Beach fire departments to
25 contain and clean-up small contaminant spills.

26
27 *Clean Bay* is the lead company in responding to oil spills. The 24 hour
28 response number is (510) 685-2800. Currently PRBO, in cooperation with
29 CDFG, is developing an oil spill contingency plan for the Gulf of the Farallones
30 to coordinate quick-response oil spill containment, to monitor impacts to
31 biological communities, and to examine the effects of low level chronic oil
32 contamination exposure. The MCOSD should investigate whether additional
33 funds for oil spill response could be acquired to implement the specifics of the
34 Lagoon emergency response plan.

35
36 Time is a critical component in the effective clean-up of an oil spill. MCOSD
37 should develop an Incident Command Structure that would be used until State
38 and Federal agencies arrive. This system would provide better communications
39 leadership in the early stages of clean-up. Previous clean-up plans called for
40 equipment to be stored in the Bolinas/Stinson area for initial protection of the
41 Lagoon by local fire agencies. The feasibility of this idea should be investigated
42 and, if appropriate, implemented into the clean-up response plan. Also, the

1 MCOSD should work cooperatively with the Lagoon's various jurisdictional
2 agencies to see that only one comprehensive clean-up plan is developed and
3 implemented rather than each agency devising its own.
4

5 The first call in the case of a spill at Bolinas Lagoon is to the Coast Guard,
6 followed by Ed Ueber, the Director of the Gulf of Farallones Marine Sanctuary.
7 A Site Response Strategy, co-written by the Department of Fish and Game and
8 Oil Spill Prevention and Response (OSPR), can be found in Appendix I.
9

10 b. Old Bolinas Dump
11

12 *Issue*

13 The old Bolinas Dump at Glass Beach has the potential to contain toxic
14 materials. Whereas the Stinson Beach Dump (recently removed as part of the
15 CalTrans mitigation for the Lone Tree Slide) had some toxics from automobile,
16 road construction, and household materials, the Bolinas Dump may have
17 received materials from old industrial sources such as the former tinnery
18 (canning) factory.
19

20 *Recommendation*

21 Borings should be taken to determine whether toxic materials were deposited in
22 the dump. Groundwater from the dump should also be monitored, and the
23 dump itself should be considered as a possible future mitigation site.
24

25 c. Bolinas Public Utility District and the Stinson Beach County Water District
26

27 *Issue*

28 Some concerns remain that sewage spills may occur and pollute the Lagoon.
29 Such spills and discharges into the Lagoon, in conjunction with a hepatitis
30 epidemic, led to the shellfish quarantine established in the early 1970's.
31 SBCWD has managed the upgrading and replacement of onsite wastewater
32 systems since 1978, assumed responsibility for newly constructed systems in
33 1988, and adopted a state of the art wastewater ordinance in late 1994 with the
34 review and approval of the Regional Water Quality Control Board (RWQCB).
35 BPUD re-engineered the Wharf Road pump station and designed sewage
36 treatment ponds for the downtown sewer area.
37

38 BPUD is still working to solve the Bolinas Mesa drainage and onsite systems
39 management problems. New onsite systems and failing systems are still the
40 responsibility of the Marin County Department of Environmental Health.
41 Although the probability of effluent contamination is now remote, it is always a
42 possibility.

1
2 *Recommendation*

3 BPUD and SBCWD should continue updating systems as required by the
4 Regional Water Quality Control Board. The BPUD and SBCWD systems
5 should continue to be closely monitored and, in the event of effluent discharge
6 into the Lagoon, the public and agencies with jurisdiction should be notified
7 immediately. The Regional Water Quality Control Board sewage spill report
8 number is (510) 286-1522.
9

10 d. Old Causeway Site

11
12 *Issue*

13 Areas east of the old causeway (recently removed at the Lagoon's south end)
14 have been illegally filled over the past 20 to 30 years.
15

16 *Recommendation*

17 Fill should be removed from this area. This can be accomplished by the
18 MCOSD recommending to appropriate regulatory/monitoring agencies that the
19 Lagoon in this area be restored as mitigation for sewage spills or other
20 accidents/activities requiring environmental mitigation. In any future Lagoon
21 mitigation or restoration project, these parcels should be designated as potential
22 fill removal areas.
23

24 e. Removal of sunken dredge and tires

25
26 *Issue*

27 The dredge used to create the artificial Seadrift Lagoon is partially submerged
28 and abandoned. In addition, numerous tires broken loose from the Dipsea
29 Road bulkhead are now stuck in the mud and exposed at low tides.
30

31 *Recommendation*

32 The Bolinas Foundation and a special committee from the BLTAC should work
33 together to develop and implement a feasible solution to the removal of the
34 dredge. Tires could be removed during a future volunteer clean-up day at the
35 lagoon.
36

37 5. Boats, Kayaks, Sailboards and Personal Watercraft (Jet-skis, Waverunners etc.)

38
39 a. Moorings

40
41 *Issue*

42 The Bolinas Rod and Boat Club, formed in the late 1950's, owns and maintains

1 approximately twenty moorings in the Lagoon's mooring basin. Also within
2 the basin are some thirty or more private moorings that are used at various times
3 of the year. The historical mooring basin is defined as the area between the
4 Stinson sandspit on the south, the Seadrift boat ramp to the east, and Kent
5 Island to the north and the town of Bolinas to the west. Due to the constant
6 movement of sediments and channel configurations, mooring sites cannot be
7 permanent installations, but must be movable and relocated periodically to
8 maintain access to navigable water. The Bolinas inner channel is presently
9 being used for the majority of the moorings, with a lesser number of moorings
10 located in the main channel. Whenever the Bolinas inner channel becomes
11 unnavigable, the main channel becomes the mooring area. Use by commercial
12 fishermen has declined over the past decades due to difficulty in Lagoon access
13 and reductions and limits on fish stocks. Use by recreational boaters and sport
14 fishermen has not increased significantly over the same time period.

15
16 *Recommendation*

17 Current Bolinas Rod and Boat Club moorings and moorings by other individual
18 boaters should be maintained. New moorings are allowed by permit only under
19 GFNMS regulations. New, unauthorized moorings should be reported to
20 GFNMS. The MCOSED and the Bolinas Rod and Boat Club should work
21 together on resource conservation goals, enforcement of the 5 mph speed limit,
22 harbor seal disturbance awareness and other potential conflicts and issues
23 relating to boat use in the Lagoon.

24
25 b. Alternative boat haul-outs

26
27 *Issue*

28 The Bolinas Rod and Boat Club and individual boaters have used an area across
29 from Volunteer Canyon (at the Highway 1, 15.32 mile marker) as an alternate
30 access point for boat haul-outs approximately 6 to 15 times a year. Other than
31 the primary boat access at Bolinas Beach, this is the only alternative boat access
32 open to the public; the boat launch at Seadrift is not available to the Bolinas Rod
33 and Boat Club or other public boaters.

34
35 *Recommendation*

36 Allow the Bolinas Rod and Boat Club and individual boaters to continue use of
37 the alternative boat access haul-out. Monitor use and impacts from this activity
38 and limit use if conflicts arise with natural resource conservation goals.

39
40 c. Speed limits

1 *Issue*

2 The MCOSD code specifies a 5 mph speed limit in the Lagoon.

3
4 *Recommendation*

5 The speed limit should continue to be enforced by MCOSD rangers and the
6 County Sheriff.

7
8 d. 72-hour anchorage limit

9
10 *Issue*

11 MCOSD specifies a maximum anchorage time limit of 72 hours; longer
12 anchorages may increase the probability of boat abandonment.

13
14 *Recommendation*

15 MCOSD should continue to enforce the 72-hour anchorage limit.

16
17 e. Kayaking, canoeing, rafting, other muscle-powered and sail craft etc.

18
19 *Issue*

20 Use of these craft in the Lagoon has the potential to disturb wildlife, in
21 particular harbor seal haul-outs and pupping areas. Commercial kayak
22 operators lead a total of approximately 30 group trips per year (average of 10
23 per group). None of the groups use the Lagoon for basic instruction, the
24 overall focus being viewing wildlife in a scenic location. All operators
25 contacted identified potential resource conflicts as an issue and stated that they
26 were careful to avoid harassment of harbor seals. There may be greater
27 problems with individual kayak, canoe, and other craft users rather than
28 groups. All commercial operators believe that group use will not increase
29 significantly in the future, citing the small area and difficulty with access and
30 tides. It is more difficult to predict how individual use of water craft may
31 increase in the future, but the same access and tide problems may provide some
32 level of deterrence.

33
34 *Recommendation*

35 The MCOSD should consider limiting the number of commercial groups using
36 the Lagoon through its existing permit process. Permits could be used to limit
37 the number of groups using the Lagoon on any given day or sensitive time of
38 year (e.g., harbor seal pupping season). MCOSD and BLTAC should work
39 collaboratively to develop group size limits, seasonal use restrictions, and
40 specified launch sites. (Seasonal use restrictions should apply to all users, not
41 only those in watercraft). MCOSD should contact kayaking organizations
42 whose members use the Lagoon to inform them of the sensitivity of the

Lagoon's resources, particularly harbor seal haul-outs.

f. Sailboards

Issue

Windsurfing may disturb sensitive wildlife including harbor seals.

Recommendation

Windsurfers occasionally use the Lagoon but are limited by water depth and access. Use by windsurfers should be monitored.

g. Personal motorized watercraft (Jet-skis and waverunners)

Issue

Personal watercraft are occasionally used on the Lagoon.

Recommendation

The newly revised MCOSED code prohibits the use of personal watercraft on the Lagoon. The 5 mph speed limit (see above) would effectively eliminate use of jet skis independent of an outright ban.

6. Fishing

a. Shellfish quarantines

Issue

A shellfish quarantine established in the early 1970's has not been officially removed. This quarantine should not be confused with the paralytic shellfish quarantines issued seasonally or longer by the California Health Services Department. The quarantine was established due to a hepatitis epidemic and high fecal coliform counts from sewage discharge from the Town of Bolinas. Sewage system upgrades have since corrected the discharge problem.

It is not clear whether the quarantine is still in effect. Ken Hansen, a representative of the California Department of Health Services-Environmental Management Branch, recently stated that there is currently no State closure and that he does not feel that the State has the mandate to close the sport harvest (pers. comm., May 16, 1994 to T. Moore, CDFG). Furthermore, the CDFG has not enforced the quarantine for years. In researching this same issue, MCOSED has not been able to find any State representative who could say with certainty whether or not the quarantine is still in effect.

Recommendation

Enlisting the aid of local state legislators, if necessary, MCOSD should request the California Department of Health Services to determine the status of the quarantine. If the quarantine is lifted, the MCOSD should work with CDFG to regulate harvesting to protect clam populations and reduce potential disturbance to wildlife such as harbor seals. Clam populations may have declined due to habitat loss and degradation as a consequence of sediment accumulation within the Lagoon (T. Moore, CDFG, pers. comm.).

b. Ghost-shrimping

Issue

Ghost-shrimping by licensed recreational and commercial users is allowed with suction tube harvesting and other manual methods. Motor driven hydraulic harvesting is prohibited. A limit of 50 shrimp (ghost and blue shrimp in combination) is allowed for noncommercial licensed individuals. Concerns about ghost-shrimping include potential depletion of the resource, disturbance to wildlife, and over-harvesting for commercial purposes.

Recommendation

CDFG enforces harvest limits and the prohibition against hydraulic harvesting. CDFG should monitor the shrimp population to determine use areas and limits to avoid population declines. Shrimping has declined significantly from prior levels (B. Stewart, unpublished data); this may reflect a decline in numbers on the Lagoon from loss of habitat unrelated to harvest effort (T. Moore, CDFG, pers. comm.).

7. Sediment Control

a. Pine Gulch Sediment Trap

Issue

Removal of sediments from the Pine Gulch Creek sediment trap is permitted by the California Coastal Commission, Corps of Engineers, and CDFG. Sediments must be removed between 1 August and 1 October. MCOSD removes the gravel which BPUD uses for road maintenance. Because most sediments are deposited in the winter, the one annual excavation during this time period removes a total of 200-600 cubic yards of material compared with an estimated annual sediment load of 4,000 cubic yards for the creek (estimate from Ritter 1970).

Recommendation

MCOSD should determine, in consultation with appropriate permitting agencies, whether sediments from the trap could be removed during the winter such that more frequent sediment removals would be possible.

b. Culvert maintenance

Issue

The County Public Works Department and CalTrans (Pt. Reyes maintenance facility) clean out the culverts of streams that cross the Bolinas-Olema Road and Highway 1 around the perimeter of the Lagoon. CalTrans hauls away sediments cleared from the culverts; this beneficial practice requires a small peninsula paralleling the stream for equipment access. The County sidecasts sediments along the outflow channels on the margin of the Lagoon and along the Bolinas-Fairfax Road. This creates small berms, impedes tidal flushing, decreases the tidal prism, and feeds silt to streams flowing into the Lagoon.

Recommendation

The County Public Works Department should follow CalTrans practices. All sediments should be removed entirely and transported offsite rather than sidecast along the culverts and channels. CalTrans-Pt. Reyes maintenance procedures along Highway 1 should be followed by the County: weeds are removed mechanically and no herbicides are used; sediments and gravels are not placed on the shoulders of the roadways (a natural cementum roadbase material is used). The County should develop a set of best management practices for maintenance activities. These practices should be regularly reviewed by the Public Works Department. If possible, the current CalTrans-Pt. Reyes maintenance practices should be documented in a Memorandum of Understanding approved by MCOSD, Department of Public Works, and CalTrans.

c. Timing of culvert maintenance

Issue

Culverts are not always cleaned out in a timely manner prior to the rainy season, with the result that debris and sediments accumulated in culverts are flushed into the Lagoon at the onset of the rainy season.

Recommendation

Every August, prior to the onset of the rainy season, MCOSD should send a letter to those individuals at CalTrans and the County's Department of Public Works responsible for culvert maintenance, reminding them to inspect and, if

1 necessary, clean out their respective culverts that flow into the Lagoon. In light
2 of staff cutbacks at CalTrans, MCOSED and CalTrans should explore the
3 feasibility of having the work privately contracted so that it may be performed in
4 a timely manner.

5
6 d. Removal of downed trees from the Pine Gulch Creek delta

7
8 *Issue*

9 Large trees occasionally fall into the channel of Pine Gulch Creek and could
10 have the effect of altering the creek's course.

11
12 *Recommendation*

13 If a fallen tree will alter the creek's course such that the new course would
14 threaten nearby structures or agricultural lands or render useless the existing
15 sediment trap, it should be removed. Otherwise, the tree should be allowed to
16 remain and the creek allowed to establish a new course.

17
18 e. Erosion control in the watershed

19
20 *Issue*

21 The Sediment Management Plan (Section VII) included components to
22 evaluate sediment loads from stream courses entering the Lagoon and identify
23 erosion control projects within the watershed.

24
25 *Recommendation*

26 New development within the Bolinas Lagoon watershed should comply with
27 countywide plan policies requiring a 100 ft. setback from all stream banks. The
28 MCOSED and other watershed property owners should investigate the
29 development and implementation of (1) riparian management plans, (2) Best
30 Management Practices for agricultural areas and road maintenance, (3) surveys
31 of roads with high erosion potential (e.g., Pikes Gulch), (4) County regulations
32 pertaining to logging and/or tree removal practices, and (5) sediment source
33 reduction in stream courses with apparent high sediment loads (e.g., Pine
34 Gulch Creek, Pike County Gulch, and Wilkins Gulch). A potentially valuable
35 sediment management tool is restoring natural depositional areas on stream
36 course flood plains. For example, allowing Pine Gulch Creek to overtop its
37 banks would allow substantial sediment deposition on upland areas (see
38 discussion under Agricultural Practices, below).

39
40 8. Agricultural Practices

41
42 a. Water diversions on Pine Gulch Creek

1
2 *Issue*

3 The commercial farmers along Pine Gulch Creek (represented by the Pine
4 Gulch Creek Association) use the creek waters for irrigation. The critical period
5 is from July through October when water use may exceed creek flows.
6 Individual water users are sensitive to the impacts of water diversions on creek
7 resources, in particular salmonid populations, but cumulative diversions may be
8 significant. The summer seasonal dams and summer pumping from small pools
9 may completely eliminate flows in the lower reaches of the creek. The loss of
10 the Coho salmon run (reputed to exist as recently as the early 1960's) may be
11 attributable to a combination of factors including past and current land use
12 practices.

13
14 *Recommendation*

15 Freshwater requirements of the creek's fish populations should be investigated.
16 Limits should be placed on the amount of water that may be withdrawn from the
17 creek so as to maintain sufficient creek flow to sustain the creek's fish
18 population. Farmers using the creek waters for irrigation purposes should be
19 encouraged to (1) monitor the effects of their diversions, (2) acquire permits for
20 water diversions and dam construction from the State Water Quality Control
21 Board, the California Department of Fish and Game, and other appropriate
22 permitting agencies, (3) adopt water conservation measures (drip irrigation,
23 water scheduling to minimize evaporation, etc.), and (4) install protective
24 measures to protect fish from entrainment. MCOSD should be prepared to seek
25 the assistance of the CDFG and other permitting authorities if summer water
26 diversions continue to completely stop the flow of the creek. MCOSD should
27 also seek the volunteer assistance of the Pine Gulch Creek Association to
28 determine the number and location of diversions, determine the volume of each
29 diversion, and monitor the flow of Pine Gulch Creek.

30
31 b. Agricultural runoff

32
33 *Issue*

34 All the farmers along the creek are currently organically certified under state and
35 federal law. However, runoff and water from drainage tiles/channels may carry
36 contaminants into the Lagoon.

37
38 *Recommendation*

39 MCOSD should open and maintain communication with local farmers regarding
40 farming practices to determine changes in practices that may potentially affect
41 the Lagoon.
42

1 c. Channelization of the creek
23 *Issue*

4 The creek banks have been stabilized on the lower reaches with berms to
5 prevent flooding. This stabilization, together with growth of riparian vegetation
6 on the lower reaches and delta, has resulted in loss of delta meandering and
7 dispersed sheet flows and, correspondingly, more sediments deposited directly
8 into the Lagoon.
9

10 *Recommendation*

11 Farmers on the lower reaches of the creek have expressed interest in allowing
12 high winter flows to sheet across farmland to deposit silts and organic matter
13 necessary for soil enrichment. The opportunity for such practices should be
14 explored but impacts on aquatic resources, in particular salmonids, should also
15 be considered.
16

17 9. Wildlife Disturbance
1819 a. Wildlife Disturbance
2021 *Issue*

22 The disturbance of the Lagoon's wildlife resources is a primary day to day
23 management issue of concern to the MCOSD and BLTAC. Human activities
24 may disturb wildlife in numerous ways: kayaking, boating, fishing, ghost-
25 shrimping, clamming, picnicking, bird watching groups, low-flying planes,
26 loose pets etc. Some activities are prohibited by MCOSD code (allowing dogs
27 into the Bolinas Lagoon Open Space Preserve) or by federal law (harassment of
28 marine mammals). In some cases it is clear that disturbance is prohibited by
29 law; in other cases, some disturbance will arise from other permitted uses of the
30 Lagoon. For example, birding groups may disturb birds in the Pine Gulch
31 Creek riparian forest. Disturbance to harbor seals will become an acute problem
32 if the erosion of Pickleweed Island continues; alternative haul-out sites (Kent
33 Island, the shore to the east of Pickleweed Island) are subject to greater human
34 and dog use and disturbance.
35

36 *Recommendation*

37 MCOSD rangers and naturalists should continue to educate the public
38 concerning wildlife disturbance. MCOSD should consider expanding its permit
39 process to limit public use, including the number of commercial kayaking/canoe
40 groups, during the harbor seal pupping season or during other times when
41 Lagoon resources are particularly susceptible to disturbance. Flying motorized
42 aircraft at less than 1000 ft. over the Lagoon is prohibited by Sanctuary

1 regulations, and GFNMS should investigate reports of low-flying aircraft with
2 the goal of educating or citing violators (see Appendix A). Alternative harbor
3 seal haul-out sites should be protected from human intrusion by unobtrusive
4 signs where boats and kayaks put-in, by educating the public by other means
5 (see above section on Education) and by enforcing MCOSD prohibitions against
6 dogs on the Lagoon. When necessary to increase public agency presence at the
7 Lagoon, MCOSD rangers should request the assistance of special agents of the
8 National Marine Fisheries Service, which is charged with enforcing the Federal
9 Marine Mammal Protection Act, to educate the public or enforce regulations
10 regarding the protection of marine mammals.

11 12 10. Exotic Species

13 14 a. Exotic plants

15 16 *Issue*

17 Introduction and spread of nonnative plant and animal species may significantly
18 impact and threaten native populations and habitat values. For example, scotch
19 broom and pampas grass are spreading widely in the Lagoon uplands and
20 watershed. Wandering jew and German ivy have formed a dense ground cover
21 in the Pine Gulch Creek riparian forest excluding native plant species and
22 reducing habitat values for native mammals and birds. Nonnative species at
23 Kent Island need removal. Appendix E lists exotic plants and level of concern
24 for the Lagoon.

25 26 *Recommendation*

27 MCOSD should continue to use volunteers to remove nonnative vegetation
28 where practical. Volunteer work has been used with success in removing
29 nonnative vegetation on Kent Island. Where volunteer labor cannot effectively
30 eliminate the problem (e.g., Pine Gulch Creek), the MCOSD should consider
31 the use of herbicides. The MCOSD should also work with the NPS, PRNS,
32 GGNRA and private landowners (e.g., Stinson Beach, Seadrift and Bolinas
33 Nursery) to control the spread of these invasive species at the Lagoon and in the
34 watershed.

35 36 11. Monitoring

37 38 a. Resource monitoring

39 40 *Issue*

41 Monitoring is necessary so that potential impacts to biological resources can be
42 avoided. Monitoring is recommended to (1) establish water quality baselines in

1 the Lagoon and its tributaries, (2) quantify and identify sources of
2 sedimentation and rate of tidal prism loss, (3) evaluate existing and future fish
3 and wildlife population status and trends, (4) determine the effects of any
4 remedial actions taken with respect to reducing sediment delivery to the Lagoon
5 or dredging to remove sediments. Every 10 years a high quality bathymetric
6 study with complete analysis should be conducted.
7

8 *Recommendation*

9 Fish and invertebrates should be monitored by CDFG; harbor seal disturbance
10 should continue to be monitored by MCOSD or the Marine Mammal Center
11 (e.g., disturbance to harbor seals from watercraft, impacts of human and pet
12 activity at alternative haul-out sites); disturbance to sensitive wildlife habitat
13 should be monitored by MCOSD rangers and naturalist. The MCOSD naturalist
14 and rangers, working in consultation with the BLTAC, PRBO and ACR,
15 should continue their program to monitor human use levels and resource
16 conflicts. With scientific oversight, monitoring of wildlife populations and
17 Lagoon use by humans may be done with volunteer help to evaluate the effects
18 of tidal prism loss on these interactions and the effects of remedial actions.
19 Monitoring will be of great value if human use of the Lagoon increases or if
20 human use patterns change.
21

22 12. Land Preservation

23 *Issue*

24 The 1981 Bolinas Lagoon Resource Management Plan identified a number of
25 privately owned areas in the Bolinas Lagoon watershed that should be
26 preserved as open space and/or protected from significant disruption due to their
27 high habitat value. In an effort to preserve such ecologically significant lands,
28 the MCOSD recently purchased several privately owned undeveloped lots in
29 Stinson Beach containing wetlands adjacent to the Lagoon. In addition, the
30 MCOSD now holds three separate conservation easements encumbering the
31 wetlands, mesa, and Lagoon portions of the Tompkins property, thereby
32 ensuring permanent protection of the most ecologically sensitive portions of the
33 property. Nonetheless, many lands that contribute to the health of the Lagoon
34 and its watershed remain unprotected.
35
36

37 *Recommendation*

38 1. Working cooperatively with private landowners, MCOSD should continue its
39 efforts to preserve ecologically significant lands within the Bolinas Lagoon
watershed by acquiring outright ownership or by acquiring conservation
easements over them.

1 2. MCOSD should continue to monitor, on a regular basis, conservation
2 easements it holds within the Bolinas Lagoon watershed to ensure that property
3 owners are abiding by the terms of the easements.

4
5 3. MCOSD, in cooperation with BLTAC and local community representatives,
6 should continue to monitor development and planning proposals that affect
7 ecologically significant watershed lands in an effort to minimize disruption of
8 such lands. When appropriate, MCOSD should attempt to acquire outright
9 ownership or easements by dedication from the project sponsor/land owner.

10
11 4. A non-profit conservation organization should supplement MCOSD's land
12 preservation efforts by working to acquire ownership of or easements over
13 ecologically significant lands in the Bolinas Lagoon watershed.

14 15 13. Specific Land or Easement Acquisitions

16 17 a. Stinson Beach

18 19 1) Tip of the Stinson Beach Sandspit (APN 195-300-07, 15)

20 21 *Issue*

22 The tip of the sandspit is owned by the Seadrift Homeowners Association and
23 has a C-O-A (Coastal Open Area) zoning designation. Formerly, the tip
24 supported breeding snowy plovers (federally threatened), burrowing owls
25 (California Department of Fish and Game Species of Special Concern) and
26 roosts for species such as elegant terns. Human use of the sandspit, especially
27 since the early 1980s, has reduced overall habitat values. In addition,
28 construction activities and the establishment of non-native plants have
29 eliminated plover nesting habitat.

30 31 *Recommendation*

32 The tip of the sandspit should be returned to as natural a state as possible.
33 Toward this end, vehicular access to the sandspit should be prohibited (by
34 means of installing unobtrusive barriers), and non-native vegetation and
35 construction debris should be removed. Educational signs should be installed to
36 inform visitors of the area's sensitivity to human use. In addition, MCOSD, or
37 a nonprofit conservation organization, should attempt to acquire a conservation
38 easement encumbering the tip of the sandspit.

39 40 2) Undeveloped Lots on East Side of Calle del Arroyo (APN 195-061-12, 14, 21 and 41 195-101-09, 15)

1 *Issue*

2 A number of privately-owned, undeveloped lots contain wetlands subject to
3 adverse impacts from potential development.
4

5 *Recommendation*

6 MCOSD should acquire the remaining undeveloped lots on the east side of Calle
7 del Arroyo as they become available so that all wetlands at the Lagoon's edge
8 can be preserved and managed as necessary to maintain and/or enhance habitat
9 values. Alternatively, MCOSD, or a nonprofit conservation organization,
10 should attempt to acquire conservation easements over these lots' wetlands and
11 adjacent uplands.
12

13 3) Avella Parcel (APN 195-101-16)

14
15 *Issue*

16 During the 1980's, fill was placed in portions of this two-acre parcel which has
17 wetlands restoration potential.
18

19 *Recommendation*

20 MCOSD should continue efforts to acquire this parcel so that all wetlands along
21 the Lagoon's edge can be preserved and managed as necessary to maintain
22 and/or enhance habitat values. Alternatively, MCOSD, or a nonprofit
23 conservation organization, should attempt to acquire a conservation easement
24 encumbering the property's wetlands and adjacent uplands.
25

26 4) Parcels on East Side of Dipsea Road

27
28 *Issue*

29 Both of the previous plans prepared for Bollinas Lagoon have proposed that the
30 open areas (Parcel C in the Map of Norman's Seadrift Subdivision and Lots
31 204 and 205 in the Parcel Map - Lands of Robert A. & Barbara N.
32 Roumiguere, Donald A. & Katherine M. Beacock, James L. Norman & John
33 Corins Trust) on the east side of Dipsea Road remain undeveloped and be
34 reserved for passive uses such as nature viewing. Parcel C and Lots 204 and
35 205 are still zoned for residential use (C-RSPS: Coastal-Residential Single
36 Family Planned Seadrift Subdivision District) even though they are unbuildable
37 according to the Marin County Local Coastal Plan. Furthermore, Lot 205 is
38 burdened by an Open Space Easement (Recorder's Serial Number 86-15532)
39 held by the County of Marin.
40

41 *Recommendation*

42 The County's Community Development Agency should apply a more

1 appropriate zoning designation to these open areas, such as C-O-A (Coastal
2 Open Area), given that they are unbuildable per the Local Coastal Plan. In
3 addition, the County of Marin should assign the Open Space Easement it holds
4 over Lot 205 to the Marin County Open Space District, which has the staff and
5 experience necessary to periodically monitor such easements.
6

7 b. Bolinas
8

9 1) Weber/Wilkins Ranch (APN 195-290-13, 24)
10

11 *Issue*

12 Both of the previous plans prepared for Bolinas Lagoon recommended
13 acquisition of the Wilkins/Weber Ranch to preserve wetland and bird habitat.
14 Although the BLTAC supports responsible, organic agriculture in the Lagoon
15 watershed, its first preference is to restore Lagoon wetlands that were converted
16 to agricultural use. Portions of the Weber/Wilkins Ranch adjacent to the
17 Lagoon have untapped wetlands restoration potential.
18

19 *Recommendation*

20 MCOSD should acquire those portions of the Weber/Wilkins Ranch east of
21 Bolinas-Olema Road whenever they become available. Once acquired, MCOSD
22 should recommend to appropriate regulatory/monitoring agencies that the
23 former wetlands in this area be restored as mitigation for sewage spills or other
24 accidents/activities requiring environmental mitigation.
25

26 c. Other Lands
27

28 The above lists should not be construed as precluding public or private
29 acquisition of other unspecified lands for the purpose of preserving the
30 Lagoon's wetlands or maintaining the ecological health of the Lagoon and its
31 watershed. This plan recommends that the MCOSD, or a nonprofit conservation
32 organization, acquire or otherwise act to preserve riparian habitat along Pine
33 Gulch Creek; other unprotected wetlands along the periphery of the Lagoon not
34 mentioned above; upland grassland feeding areas; and other privately owned,
35 unprotected lands adjacent to the Lagoon that have wetlands restoration
36 potential.
37

38 d. Public Trail Access
39

40 *Issue*

41 Persons wishing to gain access to trails in the Pine Gulch Creek delta must pass
42 through private property prior to reaching MCOSD lands.

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Recommendation

MCOSD should obtain public access easements to formalize public access to the Pine Gulch Creek delta and other destination points on MCOSD lands. Access to habitats that are sensitive to human incursions, however, should not be encouraged. All public uses should be subject to seasonal closure when necessary to ensure protection of the harbor seal population and other sensitive Lagoon resources.

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APPENDIX A

- LEGISLATION CONVEYING THE TIDELANDS TO THE COUNTY OF MARIN
- STATE ATTORNEY GENERAL'S OPINION REGARDING USES OF BOLINAS LAGOON
- THE POINT REYES-FARALLON ISLANDS NATIONAL MARINE SANCTUARY.
FINAL RULE. FEDERAL REGISTER JAN. 28, 1981
- PORTION OF FINAL EIS, POINT REYES ISLANDS MARINE SANCTUARY RELATED TO
SEABED ALTERATION

may, if the sentence has been suspended, pronounce judgment after said suspension of the sentence for any time within the longest period for which the defendant might have been sentenced, but if the judgment has been pronounced and the execution thereof has been suspended, the court may revoke such suspension and order that the judgment shall be in full force and effect, and the person shall be delivered over to the proper officer to serve his sentence, less any credits herein provided for. In any case of revocation and termination of probation, including, but not limited to, cases in which the judgment has been pronounced and the execution thereof has been suspended, upon such revocation and termination the court may, in lieu of any other sentence, commit the defendant to the Youth Authority if the defendant is otherwise eligible for such commitment. If probation has been revoked either before or after judgment has been pronounced, the order revoking probation and the judgment, if any, may be set aside for good cause upon motion made before pronouncement of judgment or, if judgment has been pronounced, within 30 days after the court has notice that execution of the sentence has commenced. If an order setting aside the judgment or the revocation of probation or both is made after the expiration of the probationary period, the court may again place the defendant on probation for such period and with such terms and conditions as it could have done immediately following conviction.

SEC. 2. Section 1731.5 of the Welfare and Institutions Code is amended to read:

1731.5. After certification to the Governor as provided in this article a court may commit to the authority any person convicted of a public offense who comes within subdivisions (a), (b), and (c), or subdivisions (a), (b), and (d), below:

- (a) Is found to be less than 21 years of age at the time of apprehension.
- (b) Is not sentenced to death, imprisonment for life, imprisonment for 90 days or less, or the payment of a fine, or after having been directed to pay a fine, defaults in the payment thereof, and is subject to imprisonment for more than 90 days under the judgment.
- (c) Is not granted probation.
- (d) Was granted probation and probation is revoked and terminated.

The Youth Authority shall accept a person committed to it pursuant to this article if it believes that the person can be materially benefited by its reformatory and educational discipline, and if it has adequate facilities to provide such care

CHAPTER 786

An act to add Section 21103 to the Government Code, relating to the Public Employees' Retirement System, declaring the urgency thereof, to take effect immediately.

[Approved by Governor August 23, 1969. Filed with Secretary of State August 23, 1969.]

The people of the State of California do enact as follows:

SECTION 1. Section 21103 is added to the Government Code, to read:

21103. A person who has been retired under this system for service may be reinstated from retirement pursuant to this article, without regard to the requirements of Section 21101, upon his application to the board if all of the following conditions occur:

- (1) Upon such reinstatement, he will be appointed by a state board or commission to the position to which such board or commission is entitled to appoint an employee exempt from civil service under the provisions of Article XXIV of the Constitution;
- (2) In the judgment of the board or commission he has special knowledge, experience and qualifications respecting the activities of such board or commission; and
- (3) He has not attained age 73.

A person appointed pursuant to this section shall be retired on the first day of the calendar month succeeding that in which he attains age 73.

SEC. 2. This act is an urgency statute necessary for the immediate preservation of the public peace, health or safety within the meaning of Article IV of the Constitution and shall go into immediate effect. The facts constituting such necessity are:

In order that the state may immediately receive the benefit of the skill and experience of retired employees, it is necessary that this act take effect immediately.

CHAPTER 787

An act to amend Section 1 of Chapter 800 of the Statutes of 1957, relating to lands in Bolinas Bay.

[Approved by Governor August 23, 1969. Filed with Secretary of State August 23, 1969.]

The people of the State of California do enact as follows:

SECTION 1. Section 1 of Chapter 800 of the Statutes of 1957 is amended to read:

Section 1. There is hereby granted to the County of Marin, hereinafter called "county," a political subdivision of the State of California, and to its successors, all the right, title and interest now held by the State of California by virtue of its sovereignty and the Bolinas Harbor District, in and to all lands, salt marsh, tidelands, submerged lands, and swamp and overflowed lands in Bolinas Bay situated and lying within the boundaries of the Bolinas Harbor District as such boundaries existed on the effective date of this act, to be forever held by the county, and its successors, in trust for the uses and purposes and upon the express conditions following, to wit:

(a) That the lands shall be used by the county, and its successors, for purposes in which there is a general statewide interest as follows:

(1) For the establishment, improvement and conduct of a harbor, and for the construction of all works, facilities, and appliances incidental, necessary or convenient for the promotion and accommodation of commerce and navigation, which shall include accommodation for shallow-draft vessels seeking shelter from ocean waters during adverse weather conditions consistent with the preservation of the natural features of the lagoon.

(2) For the construction, reconstruction, repair and maintenance of roadways, parking facilities, power, telephone, telegraph or cable lines or landings, water and gas pipelines, and all other transportation and utility facilities or betterments incidental, necessary or convenient for the promotion and accommodation of any of the uses set forth in this section.

(3) For the construction, reconstruction, repair, maintenance and operation of parks, playgrounds, and bathing facilities, recreation and fishing piers, public recreation facilities, and for all works, facilities, utilities, structures and appliances incidental, necessary or convenient for the promotion and accommodation of any such uses.

(4) For the establishment, improvement and conduct of a small boat harbor, marina, aquatic playground and similar recreational facilities, and for the construction, reconstruction, repair, maintenance and operation of all works, facilities, utilities, structures and appliances incidental, necessary or convenient for the promotion and accommodation of any of such uses.

(5) For the establishment, preservation, restoration, improvement, or maintenance of intertidal and subtidal marine biological reserves, restoration and maintenance of shellfish and related fishery resources, development of nature study trails and areas, exhibits, research projects, preservation of areas of unique ocean phenomena for marine activities and water sports, and the natural beauty and biological resources and activities related thereto, subject to the prior approval of the Fish and Game Commission as to those matters which are subject to regulation by the commission pursuant to the Fish and Game Code.

(b) The county, or its successors shall not, at any time, grant, convey, give or alienate said lands, or any part thereof, to any individual, firm or corporation for any purposes whatever; provided, that the county, or its successors, may grant franchises thereon for limited periods, not exceeding 25 years, for wharves and other public uses and purposes; and may lease the lands, or any part thereof, for limited periods, not exceeding 25 years, for purposes consistent with the trust upon which the lands are held by the State of California, and with the requirements of commerce and navigation, and collect and retain rents and other revenues from such leases, franchises and privileges. Such lease or leases, franchises and privileges may be for any and all purposes which shall not interfere with commerce and navigation.

Nothing contained in this paragraph (b) shall be deemed to affect the validity, or term of any franchise previously granted by the county under the Franchise Act of 1937 (Chapter 2 (commencing with Section 6201), of Division 3 of the Public Utilities Code), and any such franchise shall be effective with respect to said land when title thereto passes to said county hereunder.

(c) The lands shall be improved, preserved, restored, or maintained without expense to the state; provided, however, that nothing contained in this act shall preclude expenditures for any public purpose not inconsistent with commerce, navigation and fishery, by the state, or any board, agency or commission thereof, when authorized or approved by the county, nor by the county of any funds received for such purpose from the state or any board, agency or commission thereof.

(d) In the management, conduct, operation and control of the lands or any improvements, betterments, or structures thereon, the county or its successors shall make no discrimination in rates, tolls or charges for any use or service in connection therewith.

(e) The State of California shall have the right to use without charge any transportation, landing or storage improvements, betterments or structures constructed upon the lands for any vessel or other watercraft owned or operated by the State of California.

(f) There is hereby reserved to the people of the State of California the absolute right to fish in the waters of the lands with the right of convenient access to the waters over the lands for these purposes.

(g) There is hereby excepted and reserved to the State of California all deposits of minerals, including oil and gas, in the land, to the State of California, or persons authorized by the State of California, the right to prospect for, mine, and remove such deposits from the land, but this exception and reservation shall not apply to dredged or other materials such

as gravel, mud, and silt removed in connection with the creation, maintenance or operation of the harbor and other objectives contemplated therein.

(h) The lands herein described are granted subject to the express reservation and condition that the state may at any time in the future use the lands or any portion thereof for highway purposes without compensation to the county, its successor or assigns, or any person, firm or public or private corporation claiming under it, except that in the event improvements, betterments or structures have been placed upon the property taken by the state for highway purposes, compensation shall be made to the person entitled thereto for the value of his interest in the improvements, betterments or structures taken or the damages to such interest.

Within three years from the effective date of the amendment to this act enacted at the 1969 Regular Session of the Legislature the county shall prepare and submit a reasonable plan pursuant to which the lands shall be substantially improved, restored, preserved, or maintained by the county without expense to the state. The county shall submit the plan to the Department of Harbors and Watercraft. The Department of Harbors and Watercraft shall review the plan for compliance with the provisions of this act and, not later than the 30th day after receipt of the plan, shall transmit such plan together with its comments, to the State Lands Commission for approval by the State Lands Commission. If the State Lands Commission determines that the county has failed to submit a reasonable and workable plan as herein required, all right, title, and interest of the county in and to all lands granted by this act shall cease and all right, title and interest in the lands shall revert and rest in the state. If the State Lands Commission approves the plan, the lands shall be substantially improved, restored, preserved, or maintained by the county without expense to the state in accordance with the plan in a period of not less than five years from the date of such approval. If the State Lands Commission determines that the county has failed to so improve, restore, preserve, or maintain such lands, all right, title, and interest of the county in and to all lands granted by this act shall cease and all right, title and interest in the lands shall revert and rest in the state.

SEC. 2. This act shall not be operative and shall have no force and effect unless and until the County of Marin files, with the state, a document acceptable to the state, certifying that the county has assumed and will discharge the existing indebtedness of the Bolinas Harbor District specified in Marin County Resolution No. 69-59 confirming the dissolution of said district. Nothing contained herein shall be deemed to impose any other obligations upon the county not specifically set forth therein.

CHAPTER 788

An act to amend Sections 11052 and 11055 of the Education Code, relating to work experience education.

(Approved by Governor August 22, 1969. Filed with Secretary of State August 26, 1969.)

The people of the State of California do enact as follows:

SECTION 1. Section 11052 of the Education Code is amended to read: 11052. The minimum schoolday in any high school, except in an evening high school, a regional occupational center, an opportunity school and in opportunity classes, a continuation high school, in continuation education classes, in late afternoon or Saturday occupationally organized vocational training programs conducted under a federally approved plan for vocational education, and for students enrolled in a work experience education program approved under the provisions of Article 4 (commencing with Section 8351) of Chapter 4 of Division 7, is 240 minutes.

SEC. 2. Section 11055 of the Education Code is amended to read: 11055. The minimum day in special day or Saturday vocational training programs and for students enrolled in a work experience education program approved under the provisions of Article 4 (commencing with Section 8351) of Chapter 4 of Division 7 is 180 minutes.

CHAPTER 789

An act to add Sections 12032 and 12033 to the Penal Code, relating to firearms.

(Approved by Governor August 22, 1969. Filed with Secretary of State August 26, 1969.)

The people of the State of California do enact as follows:

SECTION 1. Section 12032 is added to the Penal Code, to read:

12032. Notwithstanding any provision of law or of any local ordinance to the contrary, when any firearm is in the possession of any officer of the state, or of a county, city and county or city, and such firearm is otherwise subject to sale as unclaimed property, abandoned property or as an exhibit filed in any criminal action or proceeding, the firearm shall not be sold but shall, with respect to firearms which were exhibits in criminal actions or proceedings and which are not subject to the provisions of Section 12032 or 12033, or may, with respect to firearms which are unclaimed or abandoned property, be de-



OFFICE OF THE ATTORNEY GENERAL

Department of Justice

STATE BUILDING, SAN FRANCISCO 94102

March 19, 1973

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G06-00(d)

Re: BOLINAS LAGOON PLAN
Indexed Letter No. SO IL 72/38

Dear Mr. Golden:

This is in response to your request for the views of this office concerning the following question:

Does the "Bolinás Lagoon Plan" submitted by the County of Marin comply with the terms of Chapter 787, Statutes of 1969, even though its conceptual scope is limited to only some of the uses authorized by the statute?

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Our conclusion is that the plan, if otherwise "reasonable and workable" within the meaning of the statute, is not rendered inadequate because its scope does not include all of the uses authorized by the statute. It also appears, however, that before the State Lands Commission may consider the adequacy of the plan submitted by the County of Marin, the County must first provide the Commission with either an environmental impact report or a "negative declaration" concerning the effect of the plan on the environment, pursuant to the provisions of the California Environmental Quality Act of 1970, Pub. Res. Code §§ 21000-21174, and the Guidelines issued thereunder by the Resources Agency, 14 Cal.Admin. Code §§ 15000-15166.

We do not discuss whether, apart from the question of statutory interpretation concerning the plan's required scope, the plan is "reasonable and workable." As with the "substantial improvement" determinations made by the Commission in connection with other statutory grants, this is primarily a factual question and is committed to the Commission for decision. It is the Commission's responsibility to decide such factual matters as whether the plan is "reasonable and workable" as is, whether specific additions or changes are required, or whether the plan is sufficiently detailed for the Commission to make an informed decision.

Introduction.

By way of background, the lands which were granted to the County of Marin by Statutes of 1969, chapter 787, and which are the subject of the "Bollinas Lagoon Plan" submitted by the County for approval, were originally granted in trust by the State of California to the Bollinas Harbor District by Statutes of 1957, chapter 800. The latter statute provided that:

"[S]aid lands shall be used by said district, and its successors, for the establishment, improvement and conduct of a harbor, including an airport or aviation facilities, and for the construction, maintenance and operation thereon of wharves, docks, piers, slips, quays and other utilities, structures, facilities and appliances necessary or convenient for the promotion and accommodation of commerce and navigation by air as well as by water, and for the construction, maintenance and operation thereon of public buildings and public parks and playgrounds, and for public recreational purposes. . . ."

In September 1966, the Harbor District released its plan for the development of the lagoon. As described by the State Department of Fish and Game in its December 1970 report, The Natural Resources of Bollinas Lagoon, Their Status and Future, "the concept involved an almost complete transformation of the lagoon into a complex of marinas, commercial developments, boating lagoon, fishing harbor, small boat basin, parks, swimming areas, administrative offices, service and repair facilities, motel, restaurant, boat storage areas, wildlife areas, etc." Although the plan had its supporters, it also generated vigorous opposition from many quarters. The Harbor District was dissolved by the voters of the District in March 1969.

Later that same year, the Legislature amended the 1957 grant by granting the same lands to the County of Marin. Stats. 1969, ch. 787. Section 1 of chapter 787 provides that the lands are granted "in trust for the uses and purposes and upon the express conditions following, to wit:

"(a) That the lands shall be used by the county, and its successors, for purposes in which there is a general statewide interest as follows:

"(1) For the establishment, improvement and conduct of a harbor, and for the

construction of all works, facilities, and appliances incidental, necessary or convenient for the promotion and accommodation of commerce and navigation, which shall include accommodation for shallow-draft vessels seeking shelter from ocean waters during adverse weather conditions consistent with the preservation of the natural features of the lagoon.

"(2) For the construction, reconstruction, repair and maintenance of roadways, parking facilities, power, telephone, telegraph or cable lines or landings, water and gas pipelines, and all other transportation and utility facilities or betterments incidental, necessary or convenient for the promotion and accommodation of any of the uses set forth in this section.

"(3) For the construction, reconstruction, repair, maintenance and operation of parks, playgrounds, and bathing facilities, recreation and fishing piers, public recreation facilities, and for all works, facilities, utilities, structures and appliances incidental, necessary or convenient for the promotion and accommodation of any such uses.

"(4) For the establishment, improvement and conduct of a small boat harbor, marina, aquatic playground and similar recreational facilities, and for the construction, reconstruction, repair, maintenance and operation of all works, facilities, utilities, structures and appliances incidental, necessary or convenient for the promotion and accommodation of any of such uses.

"(5) For the establishment, preservation, restoration, improvement, or maintenance of intertidal and subtidal marine biological reserves, restoration and maintenance of shellfish and related fishery resources, development of nature study trails and areas, exhibits, research projects, preservation of areas of unique ocean phenomena for marine activities and water sports, and the natural beauty and biological resources and activities related thereto, subject to the prior approval of the Fish and Game Commission as to those matters which are subject to regulation by the commission pursuant to the Fish and Game Code."

In addition, section 1(h) of the new grant provides in part as follows:

"Within three years from the effective date of the amendment to this act enacted at the 1969 Regular Session of the Legislature the county shall prepare and submit a reasonable plan pursuant to which the lands shall be substantially improved, restored, preserved, or maintained by the county without expense to the state. The county shall submit the plan to the Department of Harbors and Watercraft. The Department of Harbors and Watercraft shall review the plan for compliance with the provisions of this act and, not later than the 30th day after receipt of the plan, shall transmit such plan, together with its comments, to the State Lands Commission for approval by the State Lands Commission. If the State Lands Commission determines that the county has failed to submit a reasonable and workable plan as herein required, all right, title, and interest of the county in and to all lands granted by this act shall cease and all right, title and interest in the lands shall revert and rest in the state."

In compliance with this latter provision, the County has submitted its "Bolin's Lagoon Plan" (hereinafter referred to as "the Plan") for review by the Department of Navigation and Ocean Development (formerly the Department of Harbors and Watercraft) and for approval by the State Lands Commission. The Plan concentrates almost exclusively on the uses and purposes set forth in section 1(a)(5) of the statute. As stated on page 2 of the Plan's Summary of Requirements and Proposals: "Restoration and preservation of the intertidal and subtidal marine environment is this plan's primary emphasis. Such a goal permits a dual use of the area for nature education and scientific research purposes of a character unmatched anywhere else in California, especially within the boundaries of a major metropolitan area." Toward this end, the Plan proposes a scientific monitoring system for recording water quality, biological characteristics, and circulation within the lagoon, as they are or would be affected by current or potential land uses in and adjacent to the lagoon; construction of orientation and observation points for visitors; construction of bicycle and hiking trails; possible development of educational exhibits and facilities; and enactment of planning and regulatory measures aimed at preserving and protecting the ecology of the lagoon.

Regarding the other uses listed in section 1(a) of the statute, particularly the "accommodation for shallow-draft

vessels seeking shelter from ocean waters during adverse weather conditions" mentioned in section 1(a)(1), the Plan states that "monitored rehabilitative dredging" will be undertaken by the County in cooperation with the U. S. Army Corps of Engineers, and that there will be "minor channel and related improvements aimed at perpetuating the access of shallow draft vessels to authorized areas." (Summary of Requirements and Proposals, p. 1) The clear import of the plan, however, is that the character and extent of such proposed improvements will be determined and limited by their effect upon the lagoon's ecology.

The Plan makes no mention of a small boat harbor and marina, which is authorized by section 1(a)(4), and does not contemplate construction of a full-fledged "harbor of refuge," if that term is defined as including the onshore jetties which previous plans have indicated as necessary to provide a stabilized and safe channel for small craft entering the lagoon. These omissions are explained by the fact that two reports incorporated as part of the Plan, the Department of Fish and Game's report entitled, The Natural Resources of Bolinas Lagoon, Their Status and Future (December 1970), and the Conservation Foundation's report entitled, An Environmental Management Program for Bolinas Lagoon, California (February 1971), both indicate that any substantial improvements within the lagoon (such as would be required in connection with a small boat harbor and marina), and onshore jetties (which would be required for a fully effective harbor of refuge), either will have, or would probably have a substantially detrimental effect upon the ecology of the lagoon.

As stated in the Fish and Game report, at page 13:

" . . . The Department believes that boating facilities should not exceed the minimal needs of a harbor of refuge and should be confined to the provision of a launching and retrieval area for trailered boats to be operated in conjunction with an upland dry storage area for stay-over craft.

"If the various planning bodies decide that a large harbor or boat basin is necessary in the Bolinas Bay area, the Department recommends that they consider alternatives to Bolinas Lagoon because:

- "1. No all-weather harbor can be created in the lagoon without permanent removal of the sandbar at the mouth and/or the

construction of a jetty system, the effects of which, on the adjoining ocean front, Duxbury Reef, and adjacent bluffs are unknown.

- "2. Substantial boating facilities and construction within the lagoon will produce deterioration - probably irreversable - of the ecological and physical equilibrium of the lagoon."

Page 15 of the Conservation Foundation's report on the lagoon contains the following statement concerning the propriety, from an environmental standpoint, of constructing a harbor of refuge in the lagoon:

"Construction of a harbor of refuge would be detrimental to the marine ecosystem. A jetty system for a harbor entrance could affect sand nourishment of Stinson Beach by interfering with littoral drift, and internal improvement for berthing and turning would disturb the marine ecosystem and the Kent Island refuge. Further, Duxbury Reef makes navigation in the Bolinas Bay dangerous in storms."

Even such limited improvements as the Plan does contemplate, such as dredging of the lagoon mouth and the channels to existing boat mooring facilities, are to be carefully monitored in order to insure that they are consistent with maintenance and protection of the lagoon's ecology.

The question is thus presented whether the plan submitted by the County of Marin must provide for development in furtherance of all five purposes listed in section 1(a) of the statute, or whether the listed uses are merely permissible alternatives, permitting a plan which is limited in scope to less than all of the listed uses.

Statutory Interpretation.

After reviewing the language of the statute itself, the practical effects of a contrary interpretation, the administrative construction of similar grant statutes by the State Lands Commission, and substantially contemporaneous legislative enactments for the protection of the environment, we have concluded that the Legislature, in enacting this statute, intended merely that the various uses listed in section 1(a) of the statute should collectively define the permissible limits of use of the granted lands by the County of Marin, but not that each and every listed use need be implemented by the County.

Regarding the statutory language, the wording throughout the statute pertaining to "improvement," "restoration," "preservation," and "maintenance" of the lands granted is in the disjunctive, suggesting that the respective uses to which these words relate were themselves to be in the alternative. Section 1(c), for instance, provides that "the lands shall be improved, preserved, restored, or maintained without expense to the state." (Emphasis added.) Similarly, section 1(h) provides that the County shall submit "a reasonable plan pursuant to which the lands shall be substantially improved, restored, preserved, or maintained by the county." (Emphasis added.) "Improved" is the only word among the four just quoted which contemplates the type of activity which would be incidental to "the establishment, improvement and conduct of a harbor, and . . . the construction of all works, facilities, and appliances incidental, necessary or convenient for the promotion and accommodation of commerce and navigation" mentioned in section 1(a)(1) or "the establishment, improvement and conduct of a small boat harbor, marina, aquatic playground and similar recreational facilities" mentioned in section 1(a)(4). Since these latter uses involve works which are not now in existence, they cannot be "preserved," "restored," or "maintained." Use of the phrase "improved, preserved, restored, or maintained" suggests for example, that the granted lands may be preserved or restored, but not improved, at the discretion of the grantee. This alternative language indicates that section 1(a)(5), relating to preservation and restoration of the lagoon's ecology, is one of several alternative authorized uses, rather than one of a group of uses, all of which are mandatory.

In ordinary usage, use of the word "or" denotes the existence of an alternative, such as "either this or that." Houge v. Ford, 44 Cal. 2d 706, 712 (1955). If the Legislature had intended that all of the uses listed in section 1(a), some of which require improvements, be mandatory, it presumably would have used conjunctive language later in the statute, substituting "improved, preserved, restored, and maintained" for "improved, preserved, restored, or maintained" when referring to the uses to which the granted lands would be put.

Other language in the statute conforms with the view that the listed uses are permissible alternatives. Section 1(d) prohibits the County from discriminating in rates, tolls, or charges in the management, conduct, operation, and control of the lands "or any improvements, betterments, or structures thereon." (Emphasis added.) Similarly, section 1(e) states that the State of California shall have free use of "any transportation, landing or storage improvements, betterments or structures constructed upon the lands for any vessel or other watercraft" which the State owns. If all of the uses were mandatory, and improvements were therefore to be constructed in any event, the Legislature would presumably have

referred to "the improvements, betterments, or structures" and "the transportation, landing or storage improvements, betterments or structures constructed upon the lands for any vessel or other watercraft," rather than using the word "any," which suggests that there may be no such improvements at all, but if there are, then certain prohibitions or requirements apply.

Further evidence of legislative intent is revealed in certain wording contained in an earlier version of the bill, amended out prior to final passage. Assembly Bill 2295, later enacted into law as chapter 787 of the Statutes of 1969, was amended in the Assembly on May 13, 1969, to provide that "any restoration or preservation shall be effected in accordance with a plan or plans therefor prepared by the county and approved by the State Lands Division." (Emphasis added.) Use of the word "any" again suggests that each of the listed uses was intended to be in the alternative. If restoration or preservation was one of several uses under the grant, all of which were mandatory, the language employed would have been: "the restoration or preservation shall be effected . . ." Although this language was later amended out of the bill as redundant (AB 2295, July 10, 1969) after a later amendment had inserted the requirement that a plan be submitted within three years in any event, regardless of the County's intended use of the land (AB 2295, May 20, 1969), it is persuasive on the issue of whether the Legislature intended the listed uses to be alternative or mandatory.

The fact that the various authorized uses appear to be largely incompatible also indicates that they were not intended as mandatory. If certain statements in the Plan and in the reports of the Department of Fish and Game and the Conservation Foundation may be taken as true, it appears that if a "harbor" (section 1(a)(1)) or a "small boat harbor, marina, aquatic playground and similar recreational facilities" (section 1(a)(4)) were constructed, accomplishment of the preservation, restoration, or maintenance of the lagoon's ecology contemplated by section 1(a)(5) would thereby be rendered impossible. Conversely, if use for purposes of ecological preservation, restoration, or maintenance were made of the lands, use for these other purposes would be rendered impossible. Since all of the listed uses cannot be accomplished simultaneously on the granted lands, it would be unreasonable to construe the Legislature's language as requiring the County to attempt to implement each and every one of the listed purposes even though concurrent implementation was demonstrably impossible. It is a well-established principle of statutory construction that statutes must be given a reasonable and common sense construction -- one that will lead to wise policy rather than absurd results. Morris v. Oney, 217 Cal. App. 2d 864, 870 (1963). The more reasonable construction is that the uses were meant to be permissive alternatives.

Past administrative construction of similar grant statutes by the State Lands Commission in connection with its investigations into whether there has been "substantial improvement" in accordance with the terms of a particular statutory grant also supports the construction that the uses listed in this statute are permissive, not mandatory.

Grants by the State to counties, cities, and special districts generally contain language that the lands are granted "in trust for the uses and purposes and upon the express conditions following, to wit:" followed by a list of uses. E.g., Stats. 1962, 1st Ex. Sess., ch. 55 (City of Berkeley); Stats. 1957, ch. 302 (Port San Luis Harbor District). In recent years, these grants have contained an additional provision which generally reads as follows:

"If the State Lands Commission determines that the [grantee] has failed [within 10 years of the effective date of this act] to improve said lands as herein required, all right, title, and interest of said [grantee] in and to all lands granted by this act shall cease and said lands shall revert and vest in the State." (Emphasis added.)

If the uses contained in such listings were mandatory, it would follow that the Commission could not make a finding that the grantee had substantially improved the granted lands "as herein required" unless there had been substantial improvement in furtherance of each listed use.

The Commission has not so construed these grants, however, and has, in a number of instances, made findings of substantial improvement in situations where there was no improvement for some of the uses at all, substantial or otherwise. The Commission made an affirmative finding of substantial improvement regarding the grant to the City of Berkeley (Stats. 1962, 1st Ex. Sess., ch. 55), for instance, even though the city made no improvement of the granted lands for a belt line railroad, a golf course, or a convention center, although these were among the uses listed in the grant. Similarly, the City of Mill Valley was found by the Commission to have substantially improved its granted lands (Stats. 1959, ch. 496) even though no improvement was made in connection with one of the listed uses, "airport or aviation facilities." Also, in connection with the grant to the Port San Luis Harbor District (Stats. 1957, ch. 302), there was no improvement for an airport or aviation facilities, again a listed use, yet the Commission made an affirmative finding of substantial improvement.

In construing these statutes with a view to determining whether the granted lands had been improved "as herein required," the Commission repeatedly treated the list of uses in each statute as being a list of permissible alternatives, rather than a list of mandatory uses. The administrative construction placed upon a statute by the agency charged with its administration, while it is not necessarily controlling, is entitled to great weight, and courts generally will not depart from such construction unless it is clearly erroneous or unauthorized. Select Base Materials v. Board of Equalization, 51 Cal. 2d 640, 647 (1959). The statute now before the Commission for consideration, which contains a listing of uses similar in form and content to those contained in the statutes just discussed, is subject to the same construction placed upon these other statutes by the Commission; that is, the listed uses are not all mandatory, but are instead permissive in nature.

Substantially contemporaneous enactments of the Legislature on related subject matter also offer a guide to the legislative intent behind the statute under consideration, given the well-established principle of statutory construction that "every statute should be construed with reference to the whole system of law of which it is a part so that all may be harmonized and have effect." Select Base Materials v. Board of Equalization, supra, at 645. In 1970, the year following the enactment of this grant statute, the Legislature passed two measures designed to protect the environment which suggest that the Legislature did not intend by this grant to require the County of Marin to take action which would, contrary to the spirit of these enactments, be destructive of the environment.

One statute was the Environmental Quality Act of 1970, Stats. 1970, ch. 1433; Pub. Res. Code §§ 21000-21174, which established controls over public projects and private projects requiring public agency approval to "ensure that the long-term protection of the environment shall be the guiding criterion in public decisions." Pub. Res. Code § 21001(d). A review of the Act, particularly sections 21000 and 21001, which consist of a declaration of legislative findings, intent, and policy, reveals a profound Legislative concern for protecting the environment.

Even closer in point are the additions to the Public Resources Code effected by Statutes of 1970, chapter 1555. This statute added section 6375 to the Public Resources Code, which requires the State Lands Commission to identify those lands previously granted in trust to governmental agencies which have "unique environmental values of statewide interest" and to submit a report to the Legislature proposing methods for the protection of any such lands. Regarding yet

ungranted tide and submerged lands, section 6370 was added, requiring the State Lands Commission to "identify such lands which possess unique environmental values, including scenic, historic, natural, or aesthetic values of statewide interest," to "adopt regulations necessary to assure permanent protection to these lands," and to submit a report to the Legislature identifying lands having such unique environmental values. Also added was section 6372, declaring the intent of the Legislature that no further grants of state lands shall be made until submission of the report required by section 6370 to the Legislature.

Given the general concern for the environment expressed in the Environmental Quality Act of 1970; the more specific concern for the "unique environmental values" which might inhere in granted or ungranted tide and submerged lands, as expressed in sections 6370, 6372, and 6375 of the Public Resources Code; and the requirement that the County of Marin's grant statute be construed "with reference to the whole system of law of which it is a part," it seems unreasonable to conclude that the Legislature, a scant one year prior to these other enactments, meant not merely to permit uses under the grant which would have a deleterious effect upon the environment of Bolinas Lagoon, but actually to require the implementation of such uses. In this connection, we note that the County has requested that the State Lands Commission declare Bolinas Lagoon to be an area having "unique environmental values of statewide interest" pursuant to Public Resources Code section 6375.

All of the above factors bearing on the interpretation of the statutory grant to the County of Marin indicate that the Legislature, by listing certain uses, meant merely to limit use of the land only to those specified uses, as distinct from those statutory grants where it has committed the uses of the granted lands entirely to the discretion of the grantee, as long as the uses are consistent with the public trust for commerce, navigation, and fisheries. E.g., Stats. 1961, ch. 330 (granting lands to the City of Imperial Beach with the right to make "all improvements, betterments and structures of every kind and character proper, needful, useful, convenient or incidental to and for the development of commerce, navigation and fisheries, including, without limiting the generality of the foregoing, the following: [list of uses]." (Emphasis added.)) It does not appear that the legislative intent was to go even further and to insist that the granted lands be improved for all of the uses listed.

Regarding section 1(h) of the statute, which requires that the County's plan be reviewed by the Department of Harbors and Watercraft (now the Department of Navigation and Ocean Development) "for compliance with the provisions

of this act," we do not believe that such language requires the conclusion that the Plan must include a small boat harbor, marina, and full-fledged harbor of refuge, based on the assumption that otherwise the review of the Department of Navigation and Ocean Development would not have been required. Review and comment by the Department of Navigation and Ocean Development may be helpful to the State Lands Commission not only if the Plan does include a small boat harbor, marina, or harbor of refuge, but also on the question of whether the Plan should include such facilities in order to be "reasonable and workable." Such comments would be useful to the Commission in the exercise of its discretion on this issue. The Plan does contemplate dredging and "minor channel and related improvements" aimed at perpetuating access of shallow-draft vessels to the Lagoon, and such use of the Lagoon would be of concern to the Department of Navigation and Ocean Development.

Further, with particular regard to the "accommodation for shallow-draft vessels seeking shelter from ocean waters during adverse weather conditions," which appears to be of primary concern to the Department of Navigation and Ocean Development, given its historical concern with development of a chain of "harbors of refuge" along the California coast, see California Small Craft Harbors and Facilities Plan, Interim Report on Coastal Harbors of Refuge, prepared for the Division of Small Craft Harbors, Department of Parks and Recreation, by Leeds, Hill and Jewett, Inc., consulting engineers (January 1963), we note that development for such a purpose is qualified by the requirement that it be "consistent with the preservation of the natural features of the lagoon." Even if the statute were construed as making mandatory the construction of a harbor incorporating "harbor of refuge" facilities, the mandate in any case would be limited by the environmental considerations discussed earlier in this opinion. If the assertions concerning the environmental impact of construction of a harbor and a harbor of refuge that are contained in the Plan and the reports of the Department of Fish and Game and the Conservation Foundation may be taken as true, it appears that development for these purposes would be severely limited or perhaps rendered wholly impossible, in any case.

Application of the Environmental Quality Act of 1970.

As stated at the outset of this opinion, it is our view that before the Commission may review the Plan pursuant to its responsibilities for plan approval under section 1(h) of the statute, it must first be provided by the County with either an environmental impact report (hereinafter referred to as an "EIR") or a negative declaration concerning the environmental effects of the Plan.

After a review of the Plan and the reports of the Department of Fish and Game and the Conservation Foundation which are incorporated as part of the Plan, it appears that there is at least a possibility that the project may have a significant effect on the environment. The County is therefore required to conduct an "initial study" to determine whether the Plan "may have a significant effect on the environment," and to issue either a "negative declaration," if it is determined as a result of the initial study that there will be no significant effect upon the environment, or an environmental impact report, if it is determined that the Plan may have a significant effect upon the environment. Pub. Res. Code §§ 21060.5, 21062, 21065, 21067, 21083, 21151; 14 Cal. Admin. Code §§ 15024, 15026, 15030, 15031, 15033, 15037, 15038, 15039, 15050, 15060, 15061, 15064, 15080, 15083, 15084.

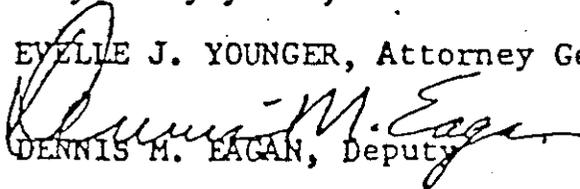
Further, the County must prepare the required negative declaration or environmental impact report prior to review of its plan by the State Lands Commission. Pub. Res. Code §§ 21061 (when EIR is required, it shall be considered by public agency prior to its approval of the project), 21100 (EIR required for project which state agency proposes to approve which may have a significant effect upon the environment); 14 Cal. Admin. Code §§ 15013 (EIR is useful planning tool and should be prepared as early in the planning process as possible), 15021 (defines "approval" as commitment of agency to definite course of action in regard to project intended to be carried out by any "person"), 15036 (defines "person" to include a county), 15061 (c) ("Where the project is to be undertaken by a local agency . . . , but requires state approval. . . , the state agency shall require the local agency to prepare the EIR or Negative Declaration, to be submitted with the request for approval of the proposed project. . . .").

We therefore recommend that the Commission advise the County of Marin that the Commission cannot act upon the Plan until either a negative declaration or an environmental impact report has been prepared, and that the Commission ask the County to prepare the appropriate document.

When the appropriate document is forthcoming from the County, the Commission may then proceed with its determination of whether the Plan is "reasonable and workable." As we have indicated previously, the Plan need not provide for development of all of the listed uses in order to qualify for approval by the Commission.

Very truly yours,

EVELLE J. YOUNGER, Attorney General


DENNIS M. EAGAN, Deputy

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16, 1981, after receiving Presidential approval on January 16, 1981. The Designation Document acts as a constitution for the Sanctuary, establishing its boundaries, purposes, and the activities subject to regulation. The regulations establish, in accordance with the terms of the Designation, the limitations and prohibitions on the activities regulated within the Sanctuary, the procedures by which persons may obtain permits for prohibited activities, and the penalties for committing prohibited activities.

DATE: These implementing regulations are expected to become effective upon the expiration of a period of 60 calendar days of continuous session of Congress after their transmittal to Congress concurrent with publication. This 60-day period is interrupted if Congress takes certain adjournments and the continuity of session is broken by an adjournment *sine die*. During the first 60 days after publication the Governor of California may certify that any terms of the Designation are unacceptable as they apply to State waters, in which case the Designation and regulations shall be modified and may be withdrawn entirely. Therefore, the effective date can be determined by calling or writing the contact identified below. Notification will also be published in the *Federal Register* when the regulations become effective.

ADDRESS: NOAA invites public review and comment on these final regulations. Written comments should be submitted to: Director, Sanctuary Programs Office, Office of Coastal Zone Management, National Oceanic and Atmospheric Administration, 3300 Whitehaven Street, NW., Washington, D.C. 20235.

FOR FURTHER INFORMATION CONTACT: Dallas Miner, Director, Sanctuary Programs Office, Office of Coastal Zone Management, 3300 Whitehaven Street, NW., Washington, D.C. 20235, (202) 634-4236.

SUPPLEMENTARY INFORMATION: Title III of the Marine Protection, Research and Sanctuaries Act of 1972, as amended, 16 U.S.C. 1431-1434 (the Act), authorizes the Secretary of Commerce, with Presidential approval, to designate ocean waters as far seaward as the outer edge of the Continental Shelf as marine sanctuaries to preserve or restore distinctive conservation, recreational, ecological, or aesthetic values. Section 302(f)(2) of the Act directs the Secretary to issue necessary and reasonable regulations to control activities permitted within a designated marine sanctuary. The authority of the Secretary to administer the provisions of the Act has been delegated to the

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

15 CFR Part 936

The Point Reyes-Farallon Islands National Marine Sanctuary

AGENCY: National Oceanic and Atmospheric Administration (NOAA), Department of Commerce.

ACTION: Final rule.

SUMMARY: The Office of Coastal Zone Management within NOAA is issuing the Designation and final regulations for the Point Reyes-Farallon Islands National Marine Sanctuary off the coast of California (the Sanctuary). The Sanctuary was designated on January

Assistant Administrator for Coastal Zone Management within the National Oceanic and Atmospheric Administration, U.S. Department of Commerce (the Assistant Administrator).

On January 16, 1981, the Assistant Administrator received the President's approval to designate as a national marine sanctuary an area of the waters off the coast of California between the Farallon Islands and the mainland from Point Reyes Headlands to Rocky Point extending seaward to a distance of 3 nautical miles (nmi) beyond territorial waters along the mainland, and out to 12 nmi from the mean high tide line of the Farallon Islands. This area was so designated on January 16, 1981. However, since the Sanctuary includes waters within the seaward boundary of the State of California, the Governor of California has 60 days in which to certify that any of the terms of the Designation are unacceptable to the State, in which case the terms certified will not become effective within State waters. In this event, the regulations must be modified accordingly or the entire Designation may be withdrawn if it no longer meets the objectives of the Act, the regulations, and the original Designation (see 15 CFR 922.25(e)).

In addition the Act as amended by Public Law 96-332 provides that the Designation becomes effective unless Congress disapproves it or any of the terms by a concurrent resolution adopted by both Houses "before the end of the first period of sixty calendar days of continuous session" after transmittal of the Designation to Congress (Sections 302(b)(1) and 302(h)). As noted by the President in his statement of August 29, 1980, signing Public Law 96-332, this provision raises constitutional questions but will be treated as a "report-and-wait" provision in accordance with that statement. Consequently, the regulations will not become effective until after the 60-day period described in Section 302(h). This period does not include those days on which either House is adjourned for more than 3 days to a day certain and is broken by an adjourned *sine die*. In view of Congress' schedule for the next few months, it is unlikely that these regulations will be effective before April 1981. Notification of the effective date will be published in the Federal Register at that time.

The waters included in the Sanctuary contain a variety of marine and nearshore habitats including bays, estuaries, rocky shores, grass beds, nesting sites, haulout areas and kelp beds. Topography and currents render the region one of the most productive off

California. Marine mammals, birds, fish, plants and benthic resources are abundant in the Sanctuary year round. Although the area is close to several large metropolitan areas and sustains a variety of human uses, the rugged coastline remains undeveloped, and a large portion is protected by the Point Reyes National Seashore. However, use of the natural resources of the Point Reyes-Farallon Islands waters is increasing, and additional pressure is being placed on these resources from a number of human activities. Accordingly, the primary purpose of managing the area and of these implementing regulations is to protect and to preserve the marine birds and mammals, their habitats, and other natural resources from those activities which pose significant threats. Such activities include: hydrocarbon exploration and exploitation except for the laying of pipeline outside 2 nmi from the Islands, Bolinas Lagoon or Areas of Special Biological Significance (Section 936.6(a)(1)); discharges except for fish cleaning wastes and chumming materials, certain discharges incidental to vessel use of the area such as effluents from marine sanitation devices, engine exhaust and cooling waters, biodegradable galley wastes, and deck wash down, and municipal waste outfalls and dredge disposal with a certified permit (Section 936.6(a)(2)); construction on or alteration of the seabed except for navigational aids, for certified pipelines or outfalls, and for certain other minor activities (Section 936.6(a)(3)); the unnecessary operation of certain commercial vessels within 2 nmi of sensitive habitats and the operation of certain aircraft at lower than 1000 feet within 1 nmi of these areas (Section 936.6(a)(4) and (5)); and removing or harming historical or cultural resources (Section 936.6(a)(6)). All prohibitions must be applied consistently with recognized principles of international law.

The regulation of fishing in the Sanctuary waters will remain the responsibility of the California Department of Fish and Game, the Pacific Regional Fishery Management Council, and the National Marine Fisheries Service pursuant to the Fishery Conservation and Management Act of 1976, 16 U.S.C. 1801 *et seq.* (see Article 5, Section 1 of the Designation Document), although fishing vessels are subject to the same discharge regulations as other vessels (Section 936.6(a)(2)).

On March 31, 1980 NOAA published proposed regulations for the Sanctuary in the Federal Register (43 FR 20907) and

at the same time issued a Draft Environmental Impact Statement (DEIS) which described in detail the proposed regulatory regime and alternatives to it. After consideration of the comments, an FEIS was issued on October 3, 1980, which described a somewhat revised regulatory regime. Some additional comments were received on the FEIS, but the regulations discussed in the FEIS and those published here are substantially identical. The significant comments on the proposed regulations and the regulatory elements of the impact statements and NOAA's responses to them follow:

(1) *Comment:* Certain commenters maintained that no sanctuary should be designated since existing regulatory authorities already provide enough protection for the natural resources. They felt a marine sanctuary would only add an unnecessary and expensive layer of Federal bureaucracy.

Response: The many Federal and State agencies which exercise authority in the Point Reyes-Farallon Islands area provide a considerable degree of regulatory protection. However, no mechanism currently exists to provide comprehensive management, research, coordination, and assessment for the extraordinary diversity of natural resources concentrated in the waters around Point Reyes and the Farallon Islands.

The marine sanctuary program, unlike other programs which have jurisdiction in the area of the proposed sanctuary, provides a mechanism to focus on this particular geographically defined marine area and to provide comprehensive management and planning to protect the resources of the site. Other statutes either focus on management of much smaller areas, single resources, or have resource protection only as an ancillary goal. Marine sanctuary planning and management also provides for research and monitoring of the condition of the resources to assure long-term protection and maximum safe use and enjoyment; other statutes do not provide in most cases the same geographically focused, comprehensive research and monitoring effort. An educational/interpretive element of the program heightens public awareness of the value of the resources and thereby reduces the potential for harm; again, this aspect of the marine sanctuary program is unavailable under the present system.

Although certain uses of the area do not now seriously threaten resource quality, their impacts will become more significant as activities increase. The current multitude of regulatory authorities, many of which have different objectives and jurisdictions, are unlikely to be able to respond to future activities on the basis of ecosystem issues. Because these waters contain so many beneficial uses, the special planning and study possible in a marine sanctuary is necessary to ensure that they are used and preserved in the future as effectively as possible.

(2) *Comment:* The proposed regulation prohibiting the dumping of dredge materials in the marine sanctuary should be changed so that NOAA can allow the disposal of

nontoxic, dredged material in the marine sanctuary on a case-by-case basis.

Response: Until the designation of the permanent disposal site, NOAA will allow the continued use of the interim site, on a case-by-case basis. Other than for disposal at the existing interim site, NOAA has not modified its proposed prohibition of ocean dumping. Since it appears that the permanent disposal site will be established outside the proposed sanctuary boundaries, further modification of the proposed regulation was unnecessary. Certain potentially harmful effects will be avoided by the proposed regulation. The disposal of dredged material may harm marine biota by smothering and increased turbidity, even if the material is not toxic. These effects of ocean dumping are likely to cause the most damage in shallow, nearshore waters that have a high concentration of benthic organisms. In addition, dumping may interfere with fish trawling operations in waters less than 100 fathoms (183 m).

The Assistant Administrator for Coastal Zone Management must certify each permit for ocean dumping or proposed Corps of Engineers (COE) disposal activities at the interim site as consistent with the purposes of the sanctuary. Because of the infrequent use of the site and existing regulations on disposal, the disposal will not pose threats to sanctuary resources, nor will the certification of permits at the interim site be administratively burdensome. First, the interim disposal site has not been used since 1978. Between 1973 and 1978 about 50,000 cubic feet per year were dumped at the 100 fathom site. However, several dredging projects currently in various stages of planning may require deep ocean disposal before the final designation of a disposal site in 1982. Plans currently call for all dredged material disposal at the Alcatraz disposal site within San Francisco Bay, largely because of the great expense of transporting dredged material to the interim dumpsite.

Second, under the 1977 regulations issued pursuant to the Marine Protection Research and Sanctuaries Act of 1972 (MPRSA), no ocean disposal of "toxic" wastes is allowed. All proposed dumping must comply with the regulations implementing Title I of the MPRSA, including findings that the activity will not "unduly degrade" the marine ecosystem. (42 FR 2477, Part 922, Subpart B). Thus, although before those regulations went into effect the 100 fathom site might have been used for disposing dredged material classified as polluted, the current regulations impose more protective standards to control use of the interim site. Certification will assure a special review by NOAA which will take into account the possible impacts described above.

(3) *Comment:* Section 936.6(a)(4) of the proposed regulations which prohibits, to the extent consistent with international law, vessels engaged in the trade of carrying cargo or supplying offshore hydrocarbon installations from entering the waters within one nautical mile of the Farallon Islands, Bolinas Lagoon, and Areas of Special Biological Significance designated by the State, should be amended to exclude such vessel traffic from two nautical miles around these sensitive areas.

Response: NOAA has adopted this recommendation. The expanded area would provide a greater measure of assurance that marine mammals and birds in such a sensitive area would not be disturbed by such vessel traffic. It would also increase the buffer zone between sensitive habitat and any pollutants from vessel operations or accidents. While discharge of oil is prohibited in the area by other authorities, a buffer zone is the only viable protection from the impacts of accidental discharges. The expanded buffer zone would not conflict with any customary shipping routes or with any of the options considered by the U.S. Coast Guard in its port access routes study for this area, and would not impose any additional costs on shipping. Any potential increase in the cost of enforcing sanctuary regulations is justified by the added environmental protection.

(4) *Comment:* The sanctuary regulations should require vessels transiting the sanctuary to adhere to the U.S. Coast Guard's Vessel Traffic Separation Scheme (VTSS). Some commenters also suggested that tankers and barges transporting hydrocarbons be excluded from the proposed sanctuary.

Response: Although the suggested changes might decrease the risks of vessel accidents and associated polluting incidents to some presently unquantifiable degree, the provisions appear premature in light of the on-going Coast Guard evaluation of vessel routing issues. NOAA will coordinate its future review of both these issues closely with the Coast Guard after the results of the study are available.

The Coast Guard estimates that virtually all commercial vessel traffic currently complies with the San Francisco VTSS. Making the VTSS mandatory within the sanctuary would therefore not substantially change present operating conditions. In addition, under International Law, foreign flag vessels beyond the limits of the territorial sea cannot be regulated except under limited circumstances. Any regulation of navigation on the high seas must be endorsed by the International Maritime Consultative Organization (IMCO) to be recognized under international law, and apply to foreign flag traffic.

The Coast Guard must seek IMCO's designation of any mandatory Port Access Route (PAR) or VTSS in international waters. Thus the full cooperation of the Coast Guard is essential in order to deal effectively with vessel navigation issues. The Coast Guard is currently conducting a port access route study for the central and northern California Coast, and the entrance to San Francisco is under careful consideration as part of the study. Under the 1978 amendments to the Ports and Waterways Safety Act, the Coast Guard has the authority to make shipping lanes mandatory and will exercise that authority if that is the best course of action. Recommendations from the study will be available in January 1981. Several of the options under consideration would eliminate the northern VTSS which goes through the Gulf of the Farallones and would require all vessels to enter San Francisco Bay from either the western or the southern lanes. The

implementation of any such option would virtually eliminate the need for any separate regulation of hydrocarbon transport in the Sanctuary. Even though such a measure would not in itself prohibit vessel traffic, including hydrocarbon transport, through the Sanctuary, failure to utilize a designated VTSS has sufficiently influenced the determination of liability in case of an accident that most ships' masters adhere to such systems and would likely avoid the Gulf. NOAA has commented on the PAR study, and the Coast Guard will take the proposed Point Reyes-Farallon Islands marine sanctuary into consideration in its decision. Finally, NOAA will consult with the Department of the Interior concerning the routing of vessels related to future oil and gas exploration and development.

The Designation Document

The Act and NOAA's general marine sanctuary regulations (15 CFR Part 922, 44 FR 44831, July 31, 1979) provide that the management system for a marine sanctuary will be established by two documents, a Designation Document and the regulations issued pursuant to Section 302(f)(2) of the Act. The Designation Document will serve as a constitution for the Sanctuary, establishing among other things the purposes of the Sanctuary, the types of activities that may be subject to regulation within it, and the extent to which other regulatory programs will continue to be effective.

As approved by the President on January 18, 1981, the Point Reyes-Farallon Islands National Marine Sanctuary Designation Document provides as follows:

Final Designation Document

Designation of the Point Reyes-Farallon Islands National Marine Sanctuary Preamble

Under the authority of the Marine Protection, Research and Sanctuaries Act of 1972, P.L. 92-532, as amended (the Act), the waters along the Coast of California north and south of Point Reyes Headlands, between Bodega Head and Rocky Point and surrounding the Farallon Islands, are hereby designated a National Marine Sanctuary for the purposes of preserving and protecting this unique and fragile ecological community.

Article 1. Effect of Designation

Within the area designated as the Point Reyes-Farallon Islands National Marine Sanctuary (the Sanctuary) described in Article 2, the Act authorizes the promulgation of such regulations as are reasonable and necessary to protect the values of the Sanctuary. Article 4 of the Designation lists those activities which may require regulation, but the listing of any activity does not by itself prohibit or restrict it. Restriction or prohibition may be accomplished only through regulation, and additional activities may be regulated only by amending Article 4.

Article 2. Description of the Area

The Sanctuary consists of an area of the waters adjacent to the Coast of California of approximately 948 square nautical miles (nmi), extending seaward to a distance of 6 nmi from the mainland and 12 nmi from the

Farallon Islands and Noonday Rock, and including the intervening waters. The precise boundaries are defined by regulation.

Article 3. Characteristics of the Area That Give it Particular Value

The Sanctuary includes a rich and diverse marine ecosystem and a wide variety of marine habitat, including habitat for 23 species of marine mammals. Rookeries for over half of California's nesting marine birds and nesting area for at least 12 of 18 known U.S. nesting marine birds are found within the boundaries. Abundant fish and shellfish are also found within the Sanctuary.

Article 4. Scope of Regulation

Section 1. *Activities Subject to Regulation.* In order to protect the distinctive values of the Sanctuary, the following activities may be regulated within the Sanctuary to the extent necessary to ensure the protection and preservation of its marine features and the ecological, recreational, and aesthetic value of the area:

- a. Hydrocarbon operations.
 - b. Discharging or depositing any substance.
 - c. Dredging or alteration of, or construction on, the seabed.
 - d. Navigation of vessels except fishing vessels or vessels travelling within a Vessel Traffic Separation Scheme or Port Access Route designated by the Coast Guard outside the area 2 nmi from the Farallon Islands, Bolinas Lagoon or any Area of Special Biological Significance, other than that surrounding the Farallon Islands, established by the State of California prior to designation.
 - e. Disturbing marine mammals and birds by overflights below 1000 feet.
1. Removing or otherwise harming cultural or historical resources.

Section 2. *Consistency with International Law.* The regulations governing the activities listed in Section 1 of this Article will apply to foreign flag vessels and persons not citizens of the United States only to the extent consistent with recognized principles of international law, including treaties and international agreements to which the United States is signatory.

Section 3. *Emergency Regulations.* Where essential to prevent immediate, serious, and irreversible damage to the ecosystem of the area, activities other than those listed in Section 1 may be regulated within the limits of the Act on an emergency basis for an interim period not to exceed 120 days, during which an appropriate amendment of this Article will be proposed in accordance with the procedures specified in Article 6.

Article 5. Relation to Other Regulatory Programs

Section 1. *Fishing and Waterfowl Hunting.* The regulation of fishing, including fishing for shellfish and invertebrates, and waterfowl hunting, is not authorized under Article 4. However, fishing vessels may be regulated with respect to discharges in accordance with Article 4, Section 1, paragraph (b), and mariculture activities involving alteration or construction of the seabed can be regulated in accordance with Article 4, Section 1, paragraph (c). All regulatory programs pertaining to fishing and to waterfowl

hunting, including regulations promulgated under the California Fish and Game Code and Fishery Management Plans promulgated under the Fishery Conservation and Management Act of 1976, 16 U.S.C. 1801 *et seq.*, will remain in effect, and all permits, licenses, and other authorizations issued pursuant thereto will be valid within the Sanctuary unless authorizing any activity prohibited by any regulation implementing Article 4. Fishing as used in this Article and in Article 4 includes mariculture.

Section 2. *Defense Activities.* The regulation of activities listed in Article 4 shall not prohibit any Department of Defense activity that is essential for national defense or because of emergency. Such activities shall be consistent with the regulations to the maximum extent practicable.

Section 3. *Other Programs.* All applicable regulatory programs will remain in effect, and all permits, licenses, and other authorizations issued pursuant thereto will be valid within the Sanctuary unless authorizing any activity prohibited by any regulation implementing Article 4. The Sanctuary regulations shall set forth any necessary certification procedures.

Article 6. Alterations to This Designation

This Designation may be altered only in accordance with the same procedures by which it has been made, including public hearings, consultation with interested Federal and State agencies and the Pacific Regional Fishery Management Council, and approval by the President of the United States.

[End of Designation Document]

Only those activities listed in Article 4 are subject to regulation in the Sanctuary. Before any additional activities may be regulated, the Designation must be amended through the entire designation procedure including public hearings and approval by the President.

Public Review and Comment

NOAA invites public review and comment on these final regulations. Written comments should be submitted to: Director, Sanctuary Programs Office, Office of Coastal Zone Management, National Oceanic and Atmospheric Administration, 3300 Whitehaven Street, N.W., Washington, D.C. 20235.

Dated: January 19, 1981.

Donald W. Fowler,

Deputy Assistant Administrator for Coastal Zone Management.

Accordingly, Part 936 is proposed as follows:

**PART 936—THE POINT REYES/
FARALLON ISLANDS MARINE
SANCTUARY REGULATIONS**

Sec.

- 936.1 Authority.
- 936.2 Purpose.
- 936.3 Boundaries.
- 936.4 Definitions.
- 936.5 Allowed activities.
- 936.6 Prohibited activities.

936.7 Penalties for commission of prohibited acts.

936.8 Permit procedures and criteria.

936.9 Certification of other permits.

936.10 Appeals of administrative action.

Authority: Sec. 302(d), (f), (g), and 303 of Title III, Marine Protection, Research and Sanctuaries Act of 1972, 16 U.S.C. 1431-1434, Sections 302(f), 302(g) and 303 of the Act.

§ 936.1 Authority.

The Sanctuary has been designated by the Secretary of Commerce pursuant to the authority of Section 302(a) of Title III of the Marine Protection, Research and Sanctuaries Act of 1972, 16 U.S.C. 1431-1434 (the Act). The following regulations are issued pursuant to the authorities of Sections 302(f), 302(g), and 303 of the Act.

§ 936.2 Purpose.

The purpose of designating the Sanctuary is to protect and preserve the extraordinary ecosystem, including marine birds, mammals, and other natural resources, of the waters surrounding the Farallon Islands and Point Reyes, and to ensure the continued availability of the area as a research and recreational resource.

§ 936.3 Boundaries.

The Sanctuary consists of an area of the waters adjacent to the coast of California north and south of the Point Reyes Headlands, between Bodega Head and Rocky Point and the Farallon Islands (including Noonday Rock), and includes approximately 948 square nautical miles (nmi²). The coordinates are listed in Appendix I.

The shoreward boundary follows the mean high tide line and the seaward limit of Point Reyes National Seashore. Between Bodega Head and Point Reyes Headlands, the Sanctuary extends seaward 3 nmi beyond State waters. The Sanctuary also includes the waters within 12 nmi of the Farallon Islands, and between the Islands and the mainland from Point Reyes Headlands to Rocky Point. The Sanctuary includes Bodega Bay, but not Bodega Harbor.

§ 936.4 Definitions.

(a) "Administrator" means the Administrator of the National Oceanic and Atmospheric Administration.

(b) "Areas of Special Biological Significance" (ASBS) means those areas established by the State of California prior to the designation of the sanctuary except that for purposes of these regulations, the area established around the Farallon Islands shall not be included.

(c) "Assistant Administrator" means the Assistant Administrator for Coastal

Zone Management, National Oceanic and Atmospheric Administration.

(d) "Person" means any private individual, partnership, corporation, or other entity, or any officer, employee, agent, department, agency or instrumentality of the Federal Government or any State or local unit of government.

(e) "Vessel" means watercraft of any description capable of being used as a means of transportation on the waters of the Sanctuary.

§ 936.5 Allowed activities.

All activities except those specifically prohibited by Section 936.6 may be carried on in the Sanctuary subject to all prohibitions, restrictions, and conditions imposed by any other authority. Recreational use of the area is encouraged.

§ 936.6 Prohibited activities.

(a) Except as may be necessary for national defense, in accordance with Article 5, Section 2 of the Designation, or as may be necessary to respond to an emergency threatening life, property or the environment, the following activities are prohibited within the Sanctuary unless permitted by the Assistant Administrator in accordance with Sections 936.8 or 936.9. All prohibitions shall be applied consistently with international law.

(1) *Hydrocarbon operations.* Hydrocarbon exploration, development, and production are prohibited except that pipelines related to operations outside the Sanctuary may be placed at a distance greater than 2 nmi from the Farallon Islands, Bolinas Lagoon, and Areas of Special Biological Significance where certified to have no significant effect on sanctuary resources in accordance with § 936.9.

(2) *Discharge of substances.* No person shall deposit or discharge any materials or substances of any kind except:

(i) Fish or parts and chumming materials (bait).

(ii) Water (including cooling water) and other biodegradable effluents incidental to vessel use of the sanctuary generated by:

(A) marine sanitation devices;

(B) routine vessel maintenance, e.g., deck wash down;

(C) engine exhaust or

(D) meals on board vessels.

(iii) Dredge material disposed of at the interim dumpsite now established approximately 10 nmi south of the southeast Farallon Island and municipal sewage provided such discharges are certified in accordance with Section 936.9.

(3) *Alteration of or construction on the seabed.*

Except in connection with the laying of pipelines or construction of an outfall if certified in accordance with Section 936.9, no person shall:

(i) Construct any structure other than a navigation aid.

(ii) Drill through the seabed, and

(iii) Dredge or otherwise alter the seabed in any way other than by anchoring vessels or bottom trawling from a commercial fishing vessel, except for routine maintenance and navigation, ecological maintenance, mariculture, and the construction of docks and piers in Tomales Bay.

(4) *Operations of vessels.*

Except to transport persons or supplies to or from islands or mainland areas adjacent to sanctuary waters, within an area extending 2 nautical miles from the Farallon Islands, Bolinas Lagoon, or any Area of Special Biological Significance, no person shall operate any vessel engaged in the trade of carrying cargo, including but not limited to tankers and other bulk carriers and barges, or any vessel engaged in the trade of servicing offshore installations. In no event shall this section be construed to limit access for fishing, recreational or research vessels.

(5) *Disturbing marine mammals and birds.*

No person shall disturb seabirds or marine mammals by flying motorized aircraft at less than 1000 feet over the waters within one nautical mile of the Farallon Islands, Bolinas Lagoon, or any Area of Special Biological Significance except to transport persons or supplies to or from the islands or for enforcement purposes.

(6) *Removing or damaging historical or cultural resources.*

No person shall remove or damage any historical or cultural resource.

(b) All activities currently carried out by the Department of Defense within the Sanctuary are essential for the national defense and, therefore, not subject to these prohibitions. The exemption of additional activities having significant impacts shall be determined in consultation between the Assistant Administrator and the Department of Defense.

(c) The prohibitions in this section are not based on any claim of territoriality and will be applied to foreign persons and vessels only in accordance with recognized principles of international law, including treaties, conventions, and other international agreements to which the United States is signatory.

§ 936.7 Penalties for commission of prohibited acts.

(a) Section 303 of the Act authorizes the assessment of a civil penalty of not more than \$50,000 against any person subject to the jurisdiction of the United States for each violation of any regulation issued pursuant to the Act, and further authorizes a proceeding in rem against any vessel used in violation of any such regulation. Procedures are outlined in Subpart D of Part 922 (15 CFR Part 922) of this chapter. Subpart D is applicable to any instance of a violation of these regulations.

§ 936.8 Permit procedures and criteria.

(a) Any person in possession of a valid permit issued by the Assistant Administrator in accordance with this section may conduct any activity in the Sanctuary, prohibited under Section 936.6, if such an activity is (1) research related to the resources of the Sanctuary, (2) to further the educational value of the Sanctuary, or (3) for salvage or recovery operations.

(b) Permit applications shall be addressed to the Assistant Administrator for Coastal Zone Management, Attn: Office of Coastal Zone Management, Sanctuary Programs Office, National Oceanic and Atmospheric Administration, 3300 Whitehaven Street, N.W., Washington, D.C. 20235. An application shall provide sufficient information to enable the Assistant Administrator to make the determination called for in paragraph (c) below and shall include a description of all activities proposed, the equipment, methods, and personnel (particularly describing relevant experience) involved, and a timetable for completion of the proposed activity. Copies of all other required licenses or permits shall be attached.

(c) In considering whether to grant a permit, the Assistant Administrator shall evaluate (1) the general professional and financial responsibility of the applicant, (2) the appropriateness of the methods envisioned to the purpose(s) of the activity, (3) the extent to which the conduct of any permitted activity may diminish or enhance the value of the Sanctuary, (4) the end value of the activity, and (5) other matters as deemed appropriate.

(d) In considering any application submitted pursuant to this section, the Assistant Administrator may seek and consider the views of any person or entity, within or outside the Federal Government, and may hold a public hearing, as deemed appropriate.

(e) The Assistant Administrator may, at his or her discretion, grant a permit which has been applied for pursuant to

this section, in whole or in part, and subject to such condition(s) as deemed appropriate. The Assistant Administrator or a designated representative may observe any permitted activity and/or require the submission of one or more reports of the status or progress of such activity. Any information obtained will be made available to the public.

(f) The Assistant Administrator may amend, suspend or revoke a permit granted pursuant to this section, in whole or in part, temporarily or indefinitely if the permit holder (the Holder) has violated the terms of the permit or applicable regulations. Any such action will be provided in writing to the Holder, and will include the reason(s) for the action taken. The Holder may appeal the action as provided for in § 936.10.

§ 936.9 Certification of other permits.

(a) All permits, licenses, and other authorizations issued pursuant to any other authority are hereby certified and shall remain valid if they do not authorize any activity prohibited by § 936.8. Any interested person may request that the Assistant Administrator offer an opinion on whether an activity is prohibited by these regulations.

(b) A permit, license, or other authorization allowing the discharge of municipal sewage, the laying of any pipeline outside 2 nmi from the Farallon Islands, Bolinas Lagoon and Areas of Special Biological Significance, or the disposal of dredge material at the interim dumpsite now established approximately 10 nmi south of the Southeast Farallon Island prior to the selection of a permanent dumpsite shall be valid if certified by the Assistant Administrator as consistent with the purpose of the Sanctuary and having no significant effect on sanctuary resources. Such certification may impose terms and conditions as deemed appropriate to ensure consistency.

(c) In considering whether to make the certifications called for in this section, the Assistant Administrator may seek and consider the views of any other person or entity, within or outside the Federal Government, and may hold a public hearing as deemed appropriate.

(d) Any certification called for in this section shall be presumed unless the Assistant Administrator acts to deny or condition certification within 60 days from the date that the Assistant Administrator receives notice of the proposed permit and the necessary supporting data.

(e) The Assistant Administrator may amend, suspend, or revoke any certification made under this section

whenever continued operation would violate any terms or conditions of the certification. Any such action shall be forwarded in writing to both the holder of the certified permit and the issuing agency and shall set forth reason(s) for the action taken.

(f) Either the holder or the issuing agency may appeal any action conditioning, denying, amending, suspending, or revoking any certification in accordance with the procedure provided for in § 936.10.

§ 936.10 Appeals of administrative action.

(a) Any interested person (the Appellant) may appeal the granting, denial or conditioning of any permit under § 936.8 to the Administrator of NOAA. In order to be considered by the Administrator, such appeal must be in writing, must state the action(s) appealed, and the reason(s) therefore, and must be submitted within 30 days of the action(s) by the Assistant Administrator. The Appellant may request an informal hearing on the appeal.

(b) Upon receipt of an appeal authorized by this section, the Administrator will notify the permit applicant, if other than the Appellant, and may request such additional information and in such form as will allow action upon the appeal. Upon receipt of sufficient information, the Administrator will decide the appeal in accordance with the criteria defined in Section 936.8(c) as appropriate, based upon information relative to the application on file at OCMZ and any additional information, the summary record kept of any hearing, and the Hearing Officer's recommended decision, if any, as provided in paragraph (c) and such other considerations as deemed appropriate. The Administrator will notify all interested persons of the decision, and the reason(s) for the decision, in writing, within 30 days of receipt of sufficient information, unless additional time is needed for a hearing.

(c) If a hearing is requested or if the Administrator determines one is appropriate, the Administrator may grant an informal hearing before a designated Hearing Officer after first giving notice of the time, place, and subject matter of the hearing in the Federal Register. Such hearing must normally be held no later than 30 days following publication of the notice in the Federal Register unless the Hearing Officer extends the time for reasons deemed equitable. The Appellant, the Applicant (if different), and other interested persons (at the discretion of the Hearing Officer) may appear

personally or by counsel at the hearing, and submit material and present arguments as determined appropriate by the Hearing Officer. Within 30 days of the last day of the hearing, the Hearing Officer shall recommend in writing a decision to the Administrator.

(d) The Administrator may adopt the Hearing Officer's recommended decision, in whole or in part, or may reject or modify it. In any event, the Administrator shall notify interested persons of the decision, and the reason(s) for the decision, in writing, within 30 days of receipt of the recommended decision of the Hearing Officer. The Administrator's action will constitute final action for the agency for the purposes of the Administrative Procedures Act.

(e) Any time limit prescribed in this section may be extended for a period not to exceed 30 days by the Administrator for good cause upon written request from the Appellant or Applicant stating the reason(s) for the extension.

Appendix L—Point Reyes/Farallon Islands Proposed Marine Sanctuary, California, West Coast, United States

(Listing of "practical" rounded-off coordinates for the two boundary alternatives, coordinates have been rounded-off to whole values for seconds of latitude and longitude.)

Pt. No.	Latitude	Longitude
1	38°15'30"	123°10'48"
2	38°12'38"	123°07'05"
3	38°08'57"	123°05'27"
4	38°08'27"	123°04'53"
5	38°07'42"	123°05'11"
6	38°08'08"	123°05'48"
7	38°08'27"	123°06'10"
8	38°04'45"	123°06'29"
9	38°03'54"	123°06'58"
10	38°03'08"	123°07'38"
11	37°58'11"	123°08'44"
12	37°57'38"	123°11'25"
13	37°54'19"	123°17'41"
14	37°48'10"	123°21'20"
15	37°43'57"	123°21'16"
16	37°38'38"	123°18'05"
17	37°37'25"	123°18'30"
18	37°38'55"	123°15'58"
19	37°38'30"	123°13'31"
20	37°33'47"	123°11'51"
21	37°31'12"	123°07'40"
22	37°30'30"	123°05'42"
23	37°29'38"	123°00'24"
24	37°30'34"	122°54'18"
25	37°31'48"	122°51'32"
26	37°34'10"	122°48'10"
27	37°38'58"	122°48'08"
28	37°38'58"	122°45'00"
29	37°32'58"	122°37'38"
A-1	37°38'08"	123°14'30"
A-2	37°38'01"	123°18'37"
A-3	37°41'20"	123°23'30"
A-4	37°48'34"	123°23'33"
A-5	37°50'08"	123°25'28"
A-6	37°54'17"	123°23'18"
A-7	37°57'32"	123°18'18"
A-8	37°58'22"	123°14'08"
A-9	37°58'32"	123°08'25"

[FR Doc. 81-3483 Filed 1-23-81; 8:45 am] BILLS/REG CODE 3610-05-01

F.2.c.3. Alteration of or Construction on the Seabed

No person shall:

- (A) Construct any structure other than a navigational aid,
- (B) Drill through the seabed,
- (C) Dredge or otherwise alter the seabed in any way other than by anchoring vessels or bottom trawling from a commercial fishing vessel, except for routine maintenance, navigation, ecological maintenance, mariculture, the construction of piers and docks in Tomales Bay, and in connection with the construction of a municipal outfall or laying of pipeline if certified by the Assistant Administrator.

Dredging activities are not extensive within the preferred alternative proposed sanctuary boundary (see Section E.3.g); nevertheless, unrestricted alteration of or construction on the seabed represents a potential threat to particularly sensitive marine resources. Foremost among these adverse impacts would be increased turbidity levels, disruption or displacement of benthic and intertidal communities, and human intrusions near marine bird and marine mammal concentrations. The suggested regulatory restriction above will allow limited and ecologically sound dredging (particularly along the mainland) at levels fairly certain not to harm breeding grounds, haul out areas,

and foraging areas. Dredging for pipeline construction (i.e., for oil, water, and gas) is allowed subject to permitting by the California Coastal Commission, all other regulating agencies, and any sanctuary requirements on location and certification (see Section F.2.a).

This regulation will enhance resource protection by reducing the presence and operation of large, and often noisy, dredging machinery. Thus, both over the short- and long-term, human intrusion upon marine wildlife, along with potentially adverse impacts on their food supplies, e.g. benthic and pelagic fish resources, will be minimized. No severe economic impacts upon commercial firms are expected.

Dredging exceptions would allow for navigational projects, the maintenance of existing facilities, mariculture, and a possible U.S. Army Corps of Engineers project for selective dredging in Bolinas Lagoon to help restore its natural ecology, which may be threatened by increased sedimentation due to development further inland (Perry 1979, personal communication.) The regulation of projects for docks and piers in the nearshore area will remain the responsibility of the existing regulatory authorities. Activities for the construction in and placement of pipelines certified by the Assistant Administrator are allowed.

The activities exempted from this regulation will be monitored by the sanctuary manager, based on information supplied by the Corps and the Coastal Commission. If the data collected demonstrate that a greater degree of sanctuary oversight is appropriate, amendments to the regulations instituting sanctuary certification procedures could be proposed.

APPENDIX B

JURISDICTIONAL, PLANNING, AND REGULATORY FRAMEWORK**FEDERAL**

Gulf of the Farallones National Marine Sanctuary (GFNMS). The Gulf of the Farallones National Marine Sanctuary was designated on January 16, 1981, under the terms of Title III of the Marine Protection, Research and Sanctuaries Act of 1972, as amended. The Sanctuary, whose jurisdiction includes Bolinas Lagoon up to the mean high tide line, was established to protect and preserve the distinctive conservation, recreational, ecological, and aesthetic qualities of the ecosystems and habitats included within the Sanctuary boundaries. Certain activities are governed by the implementing Sanctuary regulations. The regulations, which apply to activities in Bolinas Lagoon, control: hydrocarbon operations; the discharge of substances; alteration of or construction on the seabed; certain operations of vessels; disturbing marine mammals or birds by aircraft overflights; and removing or damaging historical or cultural resources. The Draft Sanctuary Management Plan established three main program areas: resource protection, which includes enforcement and which is the program area of primary emphasis; education and interpretation; and research and monitoring. The National Marine Sanctuary Program, as a matter of management philosophy as well as budgetary constraints, seeks to achieve its management goals through a broad collaboration of participating federal, state, and local agencies and other interested organizations and persons. The Sanctuary does, however, have permit authority and enforcement jurisdiction over those activities controlled by federal Sanctuary regulations.

National Park Service (NPS)

The Point Reyes National Seashore was established in 1962 and ten years later, the Golden Gate National Recreation Area (GGNRA) was established. A current administrative agreement provides that the superintendent of Point Reyes has management authority over all of the National Seashore and Olema Valley portion of GGNRA north of the Bolinas-Fairfax Road. Point Reyes was granted concurrent jurisdiction enabling their rangers to enforce local, state, and federal legislation and rules. The superintendent of GGNRA, based at headquarters at Fort Mason, retains administrative and maintenance supervision over all National Park Service lands south of the Bolinas-Fairfax Road. The General Management Plan for Golden Gate and Point Reyes has designated the shoreline and streams around Bolinas Lagoon within GGNRA jurisdiction a Biotic Sensitivity - Special Protection Zone. This zone generally identifies those natural resources that are particularly sensitive to human use or are especially valuable from an ecological or scientific point of view. Use and development in these areas is discouraged. The remaining land under GGNRA jurisdiction around Bolinas Lagoon falls within a Natural Landscape Management Zone. In this zone natural resources and processes will remain as undisturbed as possible, given a relatively high level of natural park uses. Management activities will be directed primarily at protecting wildlife and vegetation from misuse and overuse and at maintaining a variety of landscape settings

1 conducive to recreational use. A Special Use Zone is designated for Audubon Canyon Ranch,
2 located within the authorized boundaries of GGNRA but not currently under the jurisdiction of the
3 National Park Service.

4
5 A district office at Stinson Beach serves rangers and district managers of Bolinas Lagoon.
6 GGNRA has proprietary jurisdiction over their lands. Their rangers are not yet deputized by the
7 County sheriff. Patrol of Bolinas Lagoon is a secondary priority for the GGNRA rangers, who
8 have primary responsibilities for Stinson Beach.

9 10 Corps of Engineers (COE)

11
12 The COE is a regulatory agency, issuing permits for obstructing, altering, and discharging into the
13 waters of the United States on the basis of public benefit under Section 10 (River and Harbors Act
14 of 1899) and under Section 404 of the Clean Water Act. (See EPA, below). In 1975, the U.S.
15 House of Representatives Committee on Public Works and Transportation requested that the COE
16 conduct a study to determine those measures which are desirable or necessary to preserve and
17 enhance the quality of the Bolinas Lagoon ecosystem. A Plan of Study was produced that outlined
18 the scope of work to include, but not be limited to, rehabilitative dredging and other means of
19 restricting deposition of sediments through investigation and evaluation of sedimentation
20 processes, aquatic and upland resources uses and impacts, ecology, water quality, hydrology, and
21 a monitoring program of the area. However, the study was not funded.

22 23 Environmental Protection Agency (EPA)

24
25 The Environmental Protection Agency is responsible for coordinating government action to protect
26 and enhance the environment. The EPA integrates research, monitoring, standard setting, and
27 enforcement activities. A major portion of the authority for establishing and enforcing air and water
28 quality standards in California has been delegated by EPA to the State Air Resources Board and
29 State Water Resources Control Board, respectively. EPA is responsible for establishing the
30 guidelines that must be met by COE permits under Section 404 of the Clean Water Act (Federal
31 Water Pollution Control Act). A Memorandum of Understanding between EPA and the COE
32 allows the Corps to determine jurisdiction. When major disputes arise, EPA has the authority to
33 declare the issue a special case, reserving the right to decide jurisdiction relating to the extent of
34 wetlands.

35 36 U.S. Coast Guard

37
38 The Coast Guard is responsible for law enforcement on federal waterways and for providing aids
39 to navigation (i.e., channel markers, lights, etc.) as needed. They are required to review Corps of
40 Engineers permits for the construction of piers or docks and issue permits for operations that
41 involve the transfer of fuel and refueling of boats. Their main responsibility is with oil pollution
42 and handling of hazardous substances and to oversee cleanup operations.

1
2 The Coast Guard is responsible for boating safety and marine mammal protection. The Coast
3 Guard does not patrol Bolinas Lagoon on a regular basis; however, calls for service are dispatched
4 to the Inverness field station or GGNRA Stinson Beach rangers for action.
5

6 U.S. Fish and Wildlife Service (USFWS)

7

8 The U.S. Fish and Wildlife Service is concerned with the management, conservation, and
9 development of the nation's water, wildlife, fish, mineral, forest, and park and recreational
10 resources. One of the principal goals of the service is to prevent piecemeal destruction of remaining
11 wetland areas, recognizing that estuaries must serve both human and wildlife purposes. USFWS
12 acts in an advisory role, reviewing and commenting on permit applications received by the Corps
13 of Engineers. Any action that requires a federal permit (such as dredging) that may affect listed or
14 proposed species would require a Section 7 consultation under the Endangered Species Act.
15

16 National Marine Fisheries Service (NMFS)

17

18 The National Marine Fisheries Service is primarily concerned with the preservation and
19 management of marine, estuarine, and anadromous resources. NMFS functions in an advisory role
20 (similar to USFWS), reviewing permit applications submitted to the Corps of Engineers. The
21 Service has federal agents in the San Francisco Bay area to investigate violations of the Endangered
22 Species Act and Marine Mammal Protection Act and to issue citations or press charges in federal
23 court. National Marine Fisheries Service supplied signs in the Bolinas Lagoon area prohibiting
24 human disturbance of the harbor seals.
25

26 STATE

27

28 State Lands Commission (SLC)

29

30 Chapter 787 of the Laws of 1969 grants to Marin County all lands, salt marsh, tidelands,
31 submerged lands, swamp, and overflowed lands in Bolinas Bay situated and lying within the
32 boundaries previously held by the Bolinas Harbor District. The terms of the grant required the
33 County to prepare and submit a plan for improvement, restoration, preservation, and/or
34 maintenance by the county without expense to the state. In addition, the lands must be used for
35 purposes in which there is a general statewide interest, such as public access and multiple use of
36 resources. The SLC approved the Bolinas Lagoon Plan in 1973. A five year report describing the
37 activities undertaken at the County's direction concludes that the County has substantially met the
38 objectives of the plan and the conditions of the land grant.
39

40 California Coastal Commission, North Central Coast Region

41

42 The Regional Coastal Commission and State Coastal Commission were established under 1976

1 legislation, succeeding the temporary California Coastal Zone Conservation Commission and
2 regional commission created by a 1972 statewide initiative. The 1976 law requires that all local
3 governments within the coastal zone prepare a coastal plan that is consistent with existing state
4 policies. As part of Marin County's LCP, the California Coastal Plan called for a management
5 study of Bolinas Lagoon to provide for resource protection and compatible recreation, as well as
6 possible restoration programs. This requirement has been satisfied.

7 8 California Coastal Conservancy

9
10 The Conservancy Act authorizes the California Coastal Conservancy to award grants to state and
11 local public agencies for the purpose of enhancing coastal areas which have suffered a loss of
12 natural and scenic values. The thrust of the Conservancy's involvement in wetlands is to assist
13 local governments in the rehabilitation, enhancement, and management of wetlands that are to be
14 owned and managed locally. These activities take place under one or more Conservancy programs:
15 resource enhancement, restoration, site preservation, and resource protection zones. Although
16 several other state and federal agencies are involved with wetlands, they are generally interested in
17 the acquisition of those resource areas that are the most pristine and productive.

18 19 State Health Services

20
21 In 1970, the State Health Services imposed a quarantine prohibiting the harvesting of shellfish and
22 water-contact sports in Bolinas Lagoon. The original cause for the quarantine has been corrected
23 (Bolinas' sewage discharge).

24 25 State Water Resources Control Board (SWRCB), and Regional Water Quality Control Board 26 (RWQCB)

27
28 The RWQCB works in close cooperation with the SWRCB to develop basin plans for the
29 maintenance of water quality in the region. The Regional Board reviews discharge permit
30 applications and establishes specific discharge requirements. The plan for the San Francisco Bay
31 Region prohibits the discharge of wastewater with particular constituents which conflict with
32 beneficial uses in Bolinas Lagoon. The RWQCB approved the effectiveness of the Stinson Beach
33 County Water District's septic system maintenance program for correcting failing systems. They
34 have prohibited the use of copper sulfate for controlling algal growth in Seadrift Lagoon and have
35 encouraged the use of physical controls (frequent tidal flushing) that are currently used by Seadrift.

36 37 Department of Fish and Game (CDFG)

38
39 The California Department of Fish and Game was established to administer and enforce the Fish
40 and Game Code. The Department is empowered to review EIR's on development projects and
41 recommend conditions for any activity proposed within inland waterways, and must be notified
42 prior to any such action. Department authority is generally restricted to below the mean high tidal

1 level in estuarine waters but may overlap the jurisdiction of other agencies, including the State
2 Lands Commission and the Corps of Engineers. The Commission establishes the regulations for
3 sport fishing and the CDFG issues permits for the commercial harvest of fish and invertebrates,
4 which enables them to manage aquatic resources.

5
6 CDFG has a squad of wardens in Marin County to enforce the Fish and Game Code. A CDFG
7 marine resource warden also patrols Bolinas Lagoon. The wardens respond to calls for service.
8 The NMFS and USFWS contract to CDFG patrol and enforcement responsibility for protecting
9 birds and marine mammals.

10 11 Department of Transportation (CALTRANS)

12
13 CALTRANS is responsible for maintaining State Highway 1 along the perimeter of Bolinas
14 Lagoon. Current maintenance consists of thin blanket resurfacing, rehabilitative maintenance, and
15 an occasional drainage project. Any major project that CALTRANS might propose in the Bolinas
16 Lagoon area would be subject to State Coastal Commission review.

17 18 Department of Boating and Waterways

19
20 The Department of Boating and Waterways terminated its activities in Bolinas Lagoon in 1978
21 when it became obvious that harbor and boating facilities were inconsistent with the plan to protect
22 the resources of the Lagoon. They are no longer represented on the Bolinas Lagoon Technical
23 Advisory Committee. The County Sheriff and MCOSD have assumed the Department's
24 responsibilities for boating safety and law enforcement on Bolinas Lagoon.

25 26 **LOCAL**

27 28 Marin County Open Space District

29
30 The MCOSD has primary responsibility for managing Bolinas Lagoon and protecting its natural
31 resources within the constraints of existing state law. When the State Lands Commission granted
32 the Lagoon to the County, the Marin County Parks and Recreation Department (which preceded the
33 MCOSD as the Lagoon's managing entity) developed the Bolinas Lagoon Plan. This plan
34 recommended that all tidal areas within the scope of the plan be incorporated into an ecological
35 reserve. This was accomplished in 1977, when Bolinas Lagoon was given County Nature
36 Preserve status. The plan encourages scientific and educational uses of the Lagoon, as well as
37 passive recreational activities compatible with management policies. The plan was approved by the
38 State Lands Commission in 1973. In 1978 the Parks and Recreation Department satisfied the
39 remaining conditions of the land grant by submitting a five-year report to the State Lands
40 Commission outlining the activities undertaken at the County's direction to implement the Bolinas
41 Lagoon Plan. In 1988 management responsibility for the Lagoon was transferred to MCOSD, and
42 the Bolinas Lagoon Nature Preserve became the Bolinas Lagoon Open Space Preserve. Public use

1 of the Lagoon is governed by the MCOSD Code and portions of the Marin County Code
2 (Appendix H).

3
4 Marin County Community Development Agency

5
6 The County Community Development Agency (formerly the Marin County Planning Department)
7 has responsibility for the preparation and implementation of a General Plan for the control of land
8 use and development in the unincorporated areas of the County. The Marin Countywide Plan,
9 adopted in 1973, designates Bolinas Lagoon as a Conservation Zone within the Coastal Recreation
10 Corridor. This zone would allow only limited development under strict controls. The agency
11 reviews actions under the Tidal Waterways Ordinance to insure that proposed actions will not
12 cause severe or irreparable damage to the environment, with the burden of proof falling on the
13 developer or agency wishing to take action. In addition, the criterion of finding of need applies to
14 conservation zones. This means that the applicant must demonstrate that the proposed use requires
15 a site within the Conservation Zone and that alternate sites outside the zone cannot be found.
16 Additional requirements for approval include a specific finding of safety, water quality protection,
17 and demonstration that the proposed action will not damage the land along the water's edge, fish
18 and aquatic habitats, navigation, or public use of the water.

19
20 Marin County Department of Environmental Health

21
22 The County Environmental Health Services relies heavily on the State Health Services for water
23 quality and shellfish sampling in connection with the imposition of quarantines. The County does
24 not have a routine program for sampling water quality in Bolinas Lagoon.

25
26 Marin County Public Works Department

27
28 The Public Works Department has responsibility for construction and maintenance of all public
29 works, and includes divisions relating to roads, building and inspection, flood control, and
30 engineering services.

31
32 Stinson Beach Community

33
34 The Stinson Beach Community Plan endorsed and supported the original Bolinas Lagoon Plan.
35 Additional policies regarding the Lagoon were suggested, including restoring the original channel
36 and flow of the Lagoon in the vicinity of the old fill between Calle del Arroyo and State Highway
37 1, preserving the alder grove east of Highway 1 at the juncture of Stinson Creek and the Lagoon,
38 preserving the unsubdivided and undeveloped land east of Dipsea Road in the Seadrift
39 neighborhood for Lagoon protection purposes, and a setback requirement of 15 feet (4.5 meters)
40 from the Lagoon to afford the possibility of creating a linear park. The removal of the causeway
41 fill and dump site was completed in December 1993, thereby restoring the Lagoon mudflats and
42 increasing tidal prism.

Town of Bolinas

1
2
3 It is the goal of the Bolinas Peninsula Community Plan to be responsive to all aspects of Bolinas
4 Lagoon, including the effects of human activity in its watershed and along its shoreline. The plan
5 emphasizes the protection of the Lagoon environment and urges the establishment of a self-
6 regulating body to protect the freshwater inflow to the Lagoon from Pine Gulch Creek. The plan
7 also recommends that no construction be permitted within 300 feet (91 meters) of the Lagoon and
8 that the *Salicornia* areas at the mouth of Pine Gulch Creek and south to the foot of Francisco Mesa
9 be protected from grading. The Community Plan supports the restriction of power boats to the
10 main channel and wharf area, but supports the use of the upper Lagoon channels by power boats in
11 transit to and from the Bolinas Marine Boatworks.

APPENDIX C

1
2
3 Conceptual models of lagoon mouth closure (e.g. Bruun 1978, Johnson 1973b) describe a
4 closure event occurring when littoral transport is high enough to fill significantly more of the
5 entrance channel on the flood tide than can be scoured by the succeeding ebb. Later, O'Brien
6 (1980) modified this model by suggesting that suspension and movement of sand onshore during
7 extreme wave events could have the same effect. Closure is therefore most likely to occur when
8 there is a coincidence of high wave energy and weak ebb velocity. Weak ebb velocities occur
9 during neap tides, when the tidal prism is small, and when streamflow (which adds to ebb
10 velocities) is low. In spite of significant reduction of tidal prism, the mouth of Bolinas Lagoon has
11 never closed in historic times.

12
13 O'Brien (1980) proposed an empirical closure relationship for Pacific Coast lagoons with
14 the ratio of wave power (which drives littoral transport (sand deposition) at the lagoon mouth) and
15 tidal power (which determines the scouring power of sediment removal on the ebb tide)
16 determining the probability of closure. Using O'Brien's relationship, the maximum O'Brien
17 criterion value of 18 at Bolinas Lagoon occurred during a neap tide on March 2, 1983 with 18-22 ft
18 waves offshore. This strong event (during an El Niño) caused extensive erosion of the barrier spit
19 at Stinson Beach but did not close the entrance channel. It is reasonable to assume that Bolinas
20 Lagoon, whose mouth is more protected from prevailing wave directions than that of Estero de San
21 Antonio, would be unlikely to close at values of less than about 120 (see Appendix B for
22 calculations). Assuming a repeat of the worst wave events such as those that occurred in 1983,
23 coinciding with the lowest neap tides and no runoff, this analysis indicates that the potential diurnal
24 tidal prism would have to be reduced to about 7% of its 1968 value; however, such analysis
25 ignores the difference between effective ebb tidal prism (volume of water actually moved out of the
26 lagoon) as compared to the potential tidal prism. The effective tidal prism will become a smaller
27 fraction of the potential tidal prism as the lagoon silts up due to friction losses within the lagoon. It
28 appears that based on measurements taken in 1967 in Bolinas Lagoon (Ritter, 1973), this fraction
29 is about 2/3 for typical neap tides. Assuming this factor to be 50% at the time of closure, and a
30 continued loss of potential diurnal tidal prism at a rate of 1.4 million ft³/yr, means that significant
31 risk of closure could occur in about 50 years when the potential diurnal tidal prism has declined to
32 about 27 million cubic feet. Obviously the margin of error in this kind of calculation is large.
33 However, the calculation is useful for guiding management decisions indicating that the time frame
34 for closure is more likely to be decades than within a few years.

35
36 O'Brien (1980) proposed an empirical closure relationship for Pacific Coast Lagoons as a
37 ratio C , between wave power, which drives the littoral transport, and tidal power, which
38 determines the scouring of the channel. C is used to define when lagoon mouths are fully tidal and
39 when they are closed.

$$C = \frac{\phi_w}{\phi_T}$$

O'Brien defined tidal power as ϕ'_T such that:

$$\phi'_T = \frac{\gamma P h_r}{T_t b} \text{ ftlb/ft/sec}$$

where

P	=	tidal prism (ft ³)
h_r	=	tidal range (ft)
T_t	=	tidal period (seconds)
b	=	width of entrance channel (ft)

For this analysis we have further defined these terms as

P	=	potential tidal prism (ft ³)
h_r	=	potential tidal range (ft)
T_t	=	ebb tide period (approx. = 6.25 hours)

Goodwin (Goodwin and Cuffe, 1993) has refined the definition of the closure criteria to take into account the additional role of stream flow to scouring on the ebb tide. The stream power is added to give the total tidal power ϕ_T :

$$\phi_T = \frac{\gamma h_r}{b} \left(\frac{P}{T_t} + Q \right)$$

where

Q	=	river flow (ft ³ /sec)
-----	---	-----------------------------------

Johnson (1973b) was the first to apply O'Brien's criterion to closure conditions of Pacific Coast inlets. Because of the lack of nearshore wave data, he used average annual deep water wave power as determined from hindcast analysis (National Marine Consultants 1960, Johnson *et al.* 1971) as a surrogate for the instantaneous shallow water wave power affecting the entrance channel. Shallow water wave power can be orders of magnitude less than deep water wave power during large storm events (Vincent 1983) as was shown in measurements in Bolinas Bay (Johnson 1969) and is greatly affected by the exposure of the entrance channel to the predominant wave direction. In his use of deep water wave power, Johnson therefore only used the power values from sectors directly exposed to wave approach.

Johnson's plot has proved useful as a first approximation in assessing closure conditions for California coastal lagoons and the approach has been expanded and updated with more precise tidal prism data (Williams 1984, Williams and Cuffe 1993). The most recent data with additional lagoons is shown in Table C1 and Figure C1. One important adjustment is to the data point for

1 Bolinas Lagoon whose entrance channel is protected by Duxbury Reef from westerly wave
2 approaches. Whereas Johnson included wave directions of W through SSE, directions of WSW
3 through SSW seem more appropriate and are consistent with how directions were selected for
4 other lagoons. With this adjustment it is clear from Figure 8 that with its 1988 tidal prism, Bolinas
5 Lagoon falls within the area of lagoons that are always open.

6
7 Fortunately, since 1981, continuous deep water wave data has been collected off
8 the California coast as part of NOAA's National Data Buoy Center program (Figure C2). In
9 addition, monitoring of closure events at nearby lagoons at the Russian River mouth and Estero de
10 San Antonio enables the ratio of wave power and tidal power that initiates closure to be defined.
11 Figure C3 shows the monitoring of Estero de San Antonio carried out by the authors during in the
12 spring of 1993.

Table C1

CLOSURE CHARACTERISTICS FOR UNJETTIED
CALIFORNIA COASTAL LAGOONS

SITE	LOCATION	DATE	POTENTIAL TIDAL PRISM ^A (10 ⁶ FT ³)		ANNUAL DEEP-WATER WAVE POWER ^B (10 ¹¹ FT-LB _F /FT/YR)	WAVE STATION ^B	SECTOR OF WAVE APPROACH ^C	CLOSURE FREQUENCY ^D
			DIURNAL	MEAN				
LE	Lake Earl	1966	(430)	(320)	329	CA-1	NNW-SW	Usual
FL	Freshwater Lagoon	1966	(35)	(25)	348	CA-1	NNW-SSW	Usual
RR	Russian River Estuary	1993	76.2	56.6	189	CA-3	WNW-S	Seasonal
EA	Estero Americano	1954	(22)	(15)	29	CA-3	WSW-SSW	Seasonal
ESb	Estero de San Antonio	1993	7.1	4.6	98	CA-3	W-SSW	Seasonal
TB	Tomales Bay	1954	(1580)	(1070)	209	CA-3	NW-WNW	Never
AL	Abbotts Lagoon	1953	(17)	(11)	311	CA-3	NNW-SW*	Usual
DE	Drakes Estero	1953	(490)	(340)	26	CA-3	SSW-SE*	Never
BOa	Bolinas Lagoon	1854	191	141.6	32	CA-3	SW-SE*	Never
BOb	Bolinas Lagoon	1968	150	107	32	CA-3	SW-SE*	Never
BOc	Bolinas Lagoon	1988	109	74	32	CA-3	SW-SE*	Never
PEb	Pescadero	1990	2.8	1.1	284	CA-3	NNW-S	Seasonal
SLRb	San Lorenzo River	1986	5.4	3.69	21	CA-3	SSW-S*	Seasonal
MB	Morro Bay	1884	435.6	156.8	265	CA-4	NW-SSW	Never
CA	Carpinteria	1983	(4.8)	(1.5)	17	CA-6	WSW-SE	Occasional
MUb	Mugu	1976	(27)	(19)	8	CA-7	WSW-ESE	Seasonal
BC	Bolsa Chica (Alamitos Bay)	1850	(113)	(80)	8	CA-7	WSW-SE*	Never
BAa	Bataquitos Lagoon	1850	90	60	28	CA-7	W-S	Never
BAb	Bataquitos Lagoon	1985	20	13.2	28	CA-7	W-S	Seasonal
SE	San Elijo	1990	NA	4.6	28	CA-7	W-S	Seasonal
SDa	San Dieguito	1889	37	24	28	CA-7	W-S	Never
SDb	San Dieguito, post-rest.	1982	8	N/A	28	CA-7	W-S	Seasonal
LPa	Los Penasquitos	1976	(2)	(0.75)	28	CA-7	W-S	Seasonal
LPb	Los Penasquitos	1987	3.1	N/A	28	CA-7	W-S	Seasonal
Tla	Tijuana	1852	67.5	47.9	28	CA-7	W-S	Never
Tlb	Tijuana	1928	34.4	20.0	28	CA-7	W-S	Never
Tlc	Tijuana	1986	(12.6)	(4.8)	28	CA-7	W-S	Occasional

Notes:

- a. Potential Tidal Prism values in parentheses indicate that tidal prism has been estimated based on a USGS 1:24000 scale topographic map.
b. Annual Deep Water Wave Power Data obtained from National Marine Consultants (1960).
c. Sector of Wave Approach determined by Johnson (1973^b), and where marked with * re-evaluated by PWA.
d. Usual indicates inlet remains closed under normal conditions and is only opened during extreme high-flow events; Seasonal indicates inlet may close during the low-flow season (commonly late spring and summer) and reopen during the high-flow season (commonly late fall or winter); Occasional indicates inlet normally remains open but may be closed for short periods.

Table C2

SUMMARY OF CLOSURE DATA

LAGOON OR ESTUARY	WAVE EXPOSURE	DATE	PHYSICAL CONDITIONS					WAVE POWER (ft.lbs /sec)	TIDAL POWER (ft.lbs /sec)	CLOSURE CRITERION (WP/TP)	INLET CONDITION
			Potential Tidal Range (ft)	Actual Tidal Range (ft)	Potential Diurnal Tidal Prism ($\times 10^6$ ft ³)	Wave Energy	Flow				
Estero de San Antonio	Partially Protected	3/24/93	4.7	1.9	6.8	high	high	85,667	768	112	no closure
		4/1/93	4.5	0.6	5.7	mod.	mod.	18,532	107	173	closure
		4/10/93	6.7	1.3	7.9	mod.	low	28,779	249	116	mouth opening
		4/14/93	3.8	0.2	4.2	low	low	3,759	14	269	closure
Russian River	Fully Exposed	7/26/92	7.0	0.7	96	low	low	4,976	205	24	begins closure
		8/18/92	3.8	1.5	56	low	mod.	4,735	969	5	no closure
		8/23-24/92	6.2	1.8	86	low	mod.	3,650	1044	3.5	no closure
		9/21/92	5.4	0.9	112.5	low	mod.	4,377	300	15	begins closure
Bolinas Lagoon	Protected	1/27/83	8.7	6.4	171.5	high	high	85,491	10,954	8	no closure
		3/2/83	4.9	3.6	99	high	high	97,155	4,934	20	no closure
Bolinas Lagoon Projection	Protected	worst case; assumed effective	4.9	1.8	27	peak	peak	100,000	833	120	closure

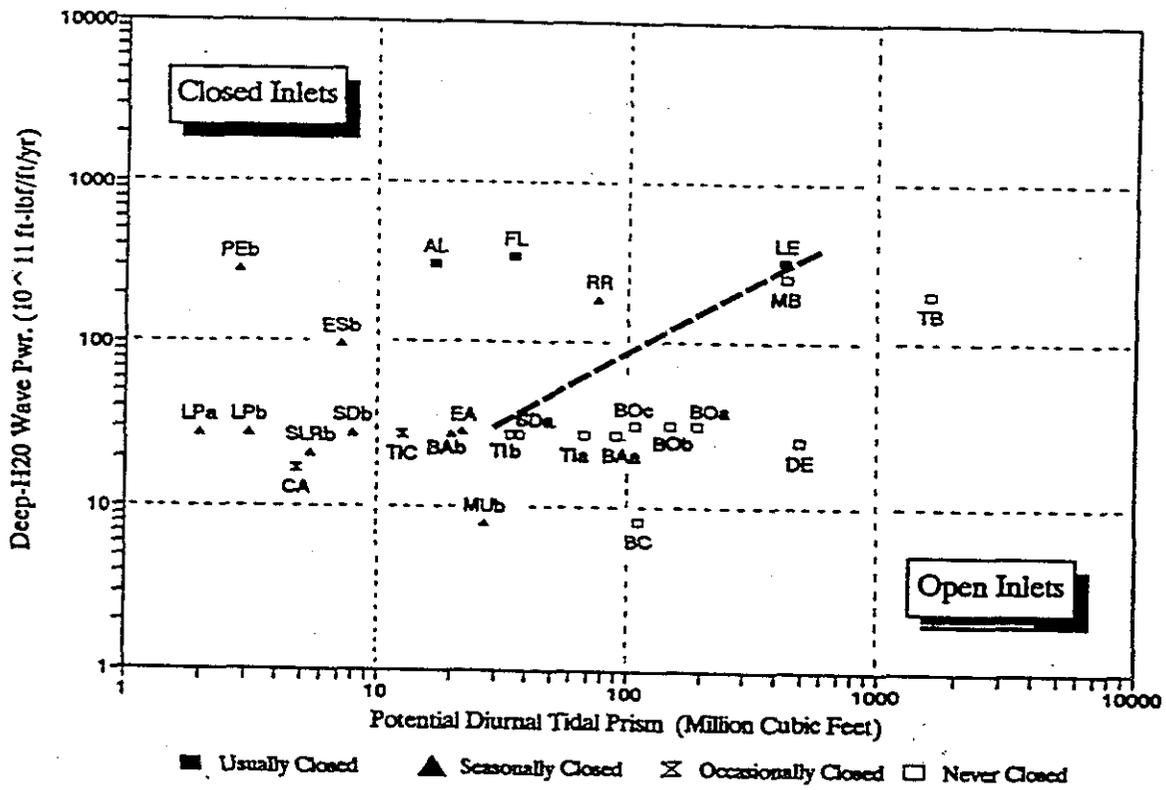


Figure C1. Annual deep-water power versus potential diurnal tidal prism for natural California lagoons.



Wetlands Research Associates, Inc.

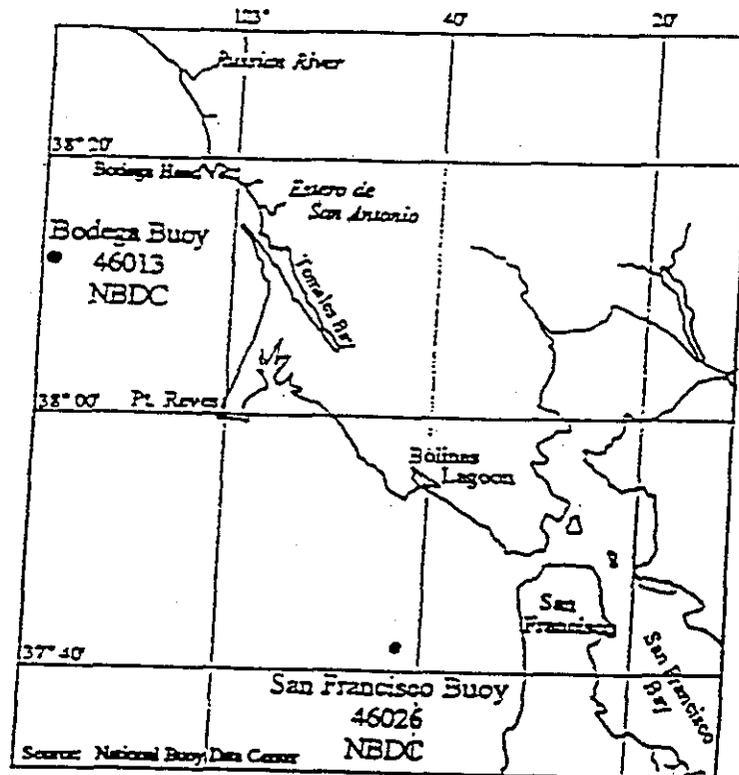
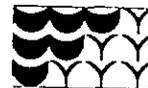


Figure C2. Wave Buoy Locations.



Wetlands Research Associates, Inc.

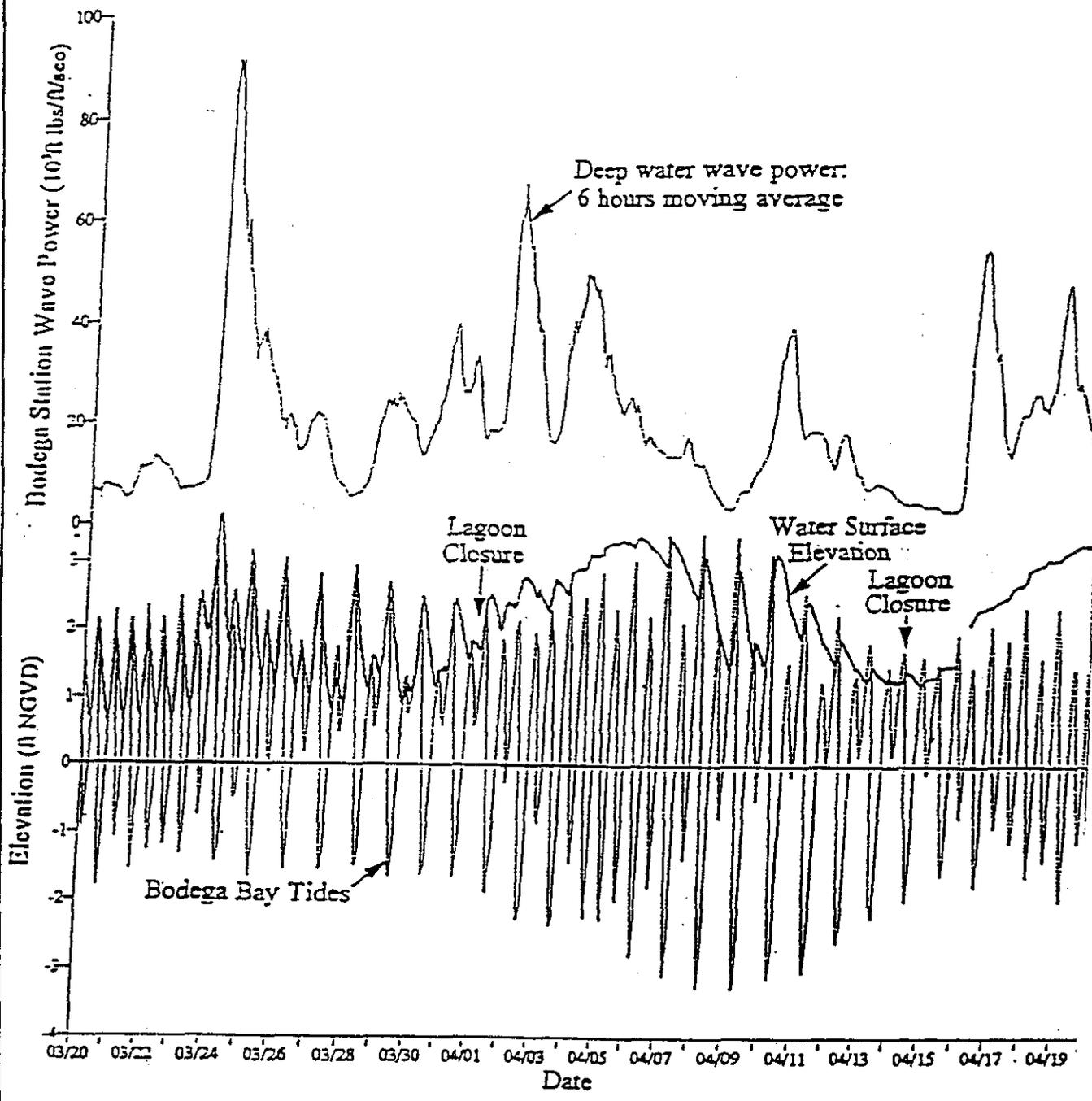
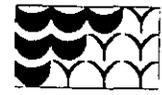


Figure C3. Closure events at Estero de San Antonio.



Wetlands Research Associates, Inc.

APPENDIX D

Rare, Threatened, and Endangered Species of the Bolinas Watershed [Incomplete]

= status: c = common; fc = fairly common; u = uncommon; r = rare; x = extirpated; ? = status unknown

- A. U.S. Fish and Wildlife 1989 (Federally threatened or endangered)
 B. U.S. Fish and Wildlife 1991 (Candidate species)
 C. Calif. Dept. Fish and Game 1991 a. (State threatened or endangered species)
 D. Calif. Dept. Fish and Game 1991 b (State species of special concern)

<u>Common Name</u>	<u>Scientific name</u>	<u>E</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
Dwarf peppergrass	<i>Lepidium latipes</i>					
Point Reyes bird's beak	<i>Cordylanthus maritimus pallustris</i>					
California red-legged frog	<i>Rana aurora draytonii</i>	R		✓		
Foothill yellow legged frog	<i>Rana boylei</i>	R		✓		
Northwestern pond turtle	<i>Clemmys marmorata marmorata</i>	R		✓		
Common Loon	<i>Gavia immer</i>	C				
California Brown Pelican	<i>Pelecanus occidentalis californicus</i>	C	✓		✓	
American White Pelican	<i>Pelecanus erythrorhynchos</i>	U				
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	C				✓
Harlequin duck	<i>Histrionicus histrionicus</i>	R				
Barrow's Goldeneye	<i>Bucephala islandica</i>	R				
Osprey	<i>Pandion haliaetus</i>	C				✓
Northern Harrier	<i>Circus cyaneus</i>	FC				✓
Sharp-shinned Hawk	<i>Accipiter striatus</i>	FC				✓
Cooper's Hawk	<i>Accipiter cooperi</i>	FC				✓
Bald Eagle	<i>Haliaeetus leucocephalus</i>	R	✓	✓		
Golden Eagle	<i>Aquila chrysaetos</i>	R				✓
Merlin	<i>Falco columbarius</i>	U				
American Peregrine Falcon	<i>Falco peregrinus anatum</i>	U	✓		✓	
California Clapper Rail	<i>Rallus longirostris obsolerus</i>	R	✓		✓	
California Black Rail	<i>Laterallus jamaicensis coturniculus</i>	R		✓	✓	
Western snowy plover	<i>Charadrius alexandrinus nivosus</i>	U		✓	✓	✓
Long-billed Curlew	<i>Numenius americanus</i>	FC		✓		
California Gull	<i>Larus californicus</i>	C				
Elegant tern	<i>Sterna elegans</i>	FC		✓		
Burrowing owl	<i>Ashene cucicularia</i>	R				✓
Northern Spotted Owl	<i>Strix occidentalis</i>	U	✓			
Long-eared owl	<i>Asio otus</i>	R				✓
Short-eared owl	<i>Asio flammeus</i>	R				✓
Willow Flycatcher	<i>Empidonax traillii</i>	R		✓		
Purple Martin	<i>Progne subis</i>	R				✓
Yellow Warbler	<i>Dendroica petechia</i>	U				✓
Saltmarsh Com. yellowthroat	<i>Geothlypis trichas sinuosa</i>	FC		✓		✓
Yellow-brested Chat	<i>Icteria virens</i>	R				✓
Tricolored Blackbird	<i>Agelaius tricolor</i>	U		✓		✓
Point Reyes Mountain Beaver	<i>Aplodonia rufa phaea</i>	?		✓		
Point Reyes Jumping Mouse	<i>Zapus trinotatus orarius</i>	?		✓		
Townsend's Big-eared Bat	<i>Plecotus townsendi townsendi</i>	R		✓		
River otter	<i>Lutra canadensis brevipilus</i>	R				
Mountain lion	<i>Felis concolor californicus</i>	R				

STATUS EQUITVOCAL

Bolinas manzanita	<i>Arctostaphylos virgata</i>		
Calif. bottle-brush grass	<i>Elymus californicus</i>	?	
San Francisco owl's clover	<i>Triphysaria floribundus</i>	?	
Sea rocket	<i>Cakile edentula californica</i>	?	
Swamp harebell	<i>Campanula californica</i>		
Calif. Freshwater shrimp	<i>Syncaris pacifica</i>	X	✓
Marbled Murrelet	<i>Brachyrampus marmoratus</i>	X	✓
California Condor	<i>Gymnogyps californianus</i>	X	✓
		X	
Sea otter		X	

APPENDIX E

MARIN COUNTY OPEN SPACE DISTRICT

NON-NATIVE PLANT SPECIES LIST

Location: Bolinas Lagoon

Compiled by Ron Paolini 07/23/90

Plant Categories: Current Management Practice

- D Desirable: Native species endemic to a specific site. Management practices geared towards their enhancement.
- A Acceptable: Plants acceptable to a specific site due to management goals. Management practices may be geared towards their culture, containment, control or ultimate failure.
- U Undesirable: Non-Natives or plants not endemic to a Specific Site. Management practices are geared away from their survival.

<u>Botanical Name</u>	<u>Common Name</u>	<u>CATEGORY</u>	<u>Origin</u>
Acacia spp.	Acacia	U	Australia
Ammophila arenaria	European Beachgrass	U	Europe
Anthemis cotula	Mayweed	U	Old World
Arundo donax	Arundo, Giant Reed	U	Europe
Brassica Spp.	Mustard	U	Old World
Carduus pycnocephalus	Italian Thistle	U	Medit.
Centaurea solstitialis	Yellow Star Thistle	U	Medit.
Cyperus alternifolius	Umbrella Plant	U	Madag.
Cirsium vulgare	Bull Thistle	U	Old World
Conium maculatum	Poison Hemlock	U	Old World
Cortaderia jubata	Jubata, Pampas	U	Argentina
Cottoneaster pannosa	Cottoneaster	U	China
Cupressus macrocarpa	Monterey Cypress	A	Monterey
Cytisus monspessulanus	French Broom	U	S. Europe
Datura stramonium	Jimson Weed	U	Trop.Amer.
Dipsacus sativus	Fuller's Teasel	U	Europe
Eucalyptus globulus	Blue Gum	A	Australia
Foeniculum vulgare	Anise, Fennel	U	Medit.
Hedera helix	English Ivy	U	Europe
Hydrangea sp.	Hydrangea	U	
Myoporum laetum	Myoporum	U	
Picris echioides	Bristly Ox-Tongue	U	Medit.
Pinus radiata	Monterey Pine	A	Monterey
Pittosporum sp.	Pittosporum	U	
Rubus procerus	Hymalaya Blackberry	U	Europe
Senecio mikanioides	German Ivy	U	S. Africa
Senecio vulgaris	Groundsel	U	
Silybum marianum	Milk Thistle	U	Old World
Solanum sp.	Nightshade	U	

BL - Non-Native Plant List Continued

Sonchus sp.	Sow Thistle	U	Old World
Tradescantia fluminensis	Wandering Jew	U	S. America
Tropaeolum majus	Nasturtium	U	S. America
Xanthium spinosum	Spiny Clotbur	U	Europe
Vinca Major	Vinca, Periwinkle	U	
Zantedeschia aethiopica	Common Calla	U	S. Africa

To be determined:

Carpobrotus edule (African) or chilense (Native or ?), Ice Plant
 Crocosmia, Montbretia; Sporaxis; Ixia; Freesia

1

Warren Weber (Agriculture)

APPENDIX G

GLOSSARY

- 1
2
3
4 **Anaerobic:** Without oxygen
- 5 **Barrier Spit:** A sandy offshore island formed by erosion and elongation of a headland,
6 followed by marsh development and detachment from the shore
- 7 **Bathymetry:** Measurement of the depth of large bodies of water
- 8 **Benthos:** Organisms living on sea or lake bottoms
- 9 **Benthic diatoms:** Diatoms that live on the ocean bottom
- 10 **CEQA:** California Environmental Quality Act
- 11 **Diversity:** The number of different species present in an area
- 12 **Ebb current:** The period of a tide between high water and a succeeding low water
- 13 **EIR:** Environmental Impact Report
- 14 **EIS:** Environmental Impact Statement
- 15 **Epibenthic diatoms:** Diatoms of the sea bottom between the low water mark and 100 fathoms
- 16 **Epifaunal:** Benthic organisms that live on or move over the surface of bottom material
- 17 **Estuarine:** Belonging or having to do with an estuary
- 18 **Graben:** Elongated depression of the earth's crust between two parallel faults
- 19 **Halophytes:** Plants of salty or alkaline soils
- 20 **Intertidal:** Occurs between mean lower low water and mean high water
- 21 **Littoral drift:** Movement of sediments in the littoral (shore of a coastal region) zone
- 22 **Macroinvertebrates:** An animal lacking a backbone that can be seen without a microscope
- 23 **Mean high water:** Average height of all high tides
- 24 **Mean higher high water:** Average height of the higher of the daily high tides
- 25 **Mean low water:** Average height of all low tides
- 26 **Mean lower low water:** Average height of the lower of the daily low tides
- 27 **Mean sea level:** Average height of the water surface for all stages of the tide
- 28 **Morphologic:** Pertaining to form and structure of an organism or parts of an organism
- 29 **Nektonic:** Pelagic animals powerful enough to swim and move in the water column
- 30 **NEPA:** National Environmental Policy Act
- 31 **Pelagic:** Of or pertaining to the open sea
- 32 **Phytoplankton:** Plants that float or drift in open water
- 33 **Piscivorous:** Fish eating
- 34 **Planktivorous:** Plankton eating
- 35 **Primary production:** Plant assimilation of energy of light to synthesize organic compounds
- 36 **Taxa:** In classification, a group of organisms at any rank
- 37 **Tidal prism:** The volume of water that moves into or out of the system on a tidal cycle
- 38 **Tectonic subsidence:** Lowering of the earth's crust due to earthquake activity
- 39 **Tidal scouring:** Removal of sediments resulting from tidal currents
- 40 **Trophic interactions:** Feeding (energy transfer) relationships within a ecological community
- 41 **Vascular:** Pertaining to plant veins or to plants with veins

MARIN COUNTY OPEN SPACE DISTRICT CODE**Titles:**

Title 1 General Provisions
Title 2 Land Use Regulations

Title 1 General Provisions

Chapters: 1.01 General

Chapter 1.01 General

Sections: 1.01.010 Scope of This Code
 1.01.020 Purpose
 1.01.030 Authority
 1.01.040 Definitions
 1.01.050 General Regulations
 1.01.060 Severability
 1.01.070 Abatement of Public Nuisances
 1.01.080 Public Roadway Easement

1.01.010 **Scope of This Code.** This document shall be known as "Marin County Open Space District Code" and may be referred to as such. This code shall apply to management and administration of Marin County Open Space District, including use and protection of lands owned, maintained or otherwise managed by the District.

1.01.020 **Purpose.** This code is adopted to assure appropriate management and administration of Marin County Open Space District, as well as to assure stewardship and protection of lands owned or managed by Marin County Open Space District in a form consistent with criteria set forth in the District's "Open Space Land Management Policy" and "Open Space Acquisition and Preservation Policy."

1.01.030 **Authority.** The rules and regulations enacted in this code are authorized by Article 3, Division 5, Section 5500 et seq. of the Public Resources Code of the State of California.

1.01.040 **Definitions.**

- (a) **District** as referred to in this code means the Marin County Open Space District, and includes all lands, waters and other facilities owned, maintained or otherwise managed by the Marin County Open Space District.
- (b) **Open Space** as referred to in this code means an area of natural landscape essentially undeveloped, such as ridges, streams, hillsides, canyons, natural shorelines, marshes, scenic buffer areas and areas of agricultural land owned, maintained or otherwise managed by the Marin County Open Space District.
- (c) **Board** means the Board of Directors of Marin County Open Space District.
- (d) **General Manager** means the General Manager of Marin County Open Space District.

- (e) Permission as referred to in this code means written permission granted by an authorized representative of the Marin County Open Space District.
- (f) Person as referred to in this code means any natural person, firm, corporation, club, municipality, district or public agency, and all associations or combinations of persons whenever acting for themselves or any agent, servant or employee.

1.01.050 **General Regulations.** From time-to-time, the Board may promulgate rules and regulations pertaining to the District and, by resolution, adopt an "Open Space Land Management Policy." All persons entering upon District lands shall comply with applicable Federal, State, County, District and local laws and regulations. It shall be the duty of the General Manager to publish, post and enforce all such regularly adopted rules and regulations.

1.01.060 **Severability.** The provisions of the ordinance are hereby declared to be severable. If any chapter, section, sub-section, paragraph, subparagraph, sentence, or clause of this code is for any reason held to be invalid or unconstitutional, the Board of Directors declares that this code, including each chapter, section, sub-section, paragraph, sentence and clause, would have been adopted regardless of any findings of invalidity or unconstitutionality.

1.01.070 **Abatement of Public Nuisances.** The Board hereby establishes the following procedures for abatement of public nuisances on public open space lands:

- (a) Upon determination that a public nuisance exists upon lands owned, maintained or otherwise managed by the Marin County Open Space District within the County of Marin, the Board of Directors shall request that the Board of Supervisors of the County of Marin abate the nuisance pursuant to the Marin County Code.

The provisions of this Section shall be applicable to any nuisance existing on District lands as defined by any ordinance of the District, resolution of the Board or statutes of the State of California. A public nuisance shall further include any unauthorized obstruction, structure, monument, facility, physical improvement or encroachment for which the owners are known and identified. Any unauthorized obstruction, structure, monument, facility, physical improvement or encroachment which is in the process of being installed or for which the owners are unknown shall be treated as outlined in section 2.02.140 of this code and shall be subject to removal without abatement proceedings.

1.01.080 **Public Roadway Establishment.** No public roadways shall be established for regular and continuous vehicle use across District lands. If roadways are deemed necessary, their establishment shall require transfer of the District's interest in roadway-related lands from open space purposes. Such transfer is subject to the provisions of the California Public Resources Code.

Title 2 **Land Use Regulations**

Chapters:	2.01	General
	2.02	Visitor Conduct
	2.03	Resource Protection
	2.04	Vehicle and Traffic Regulations

- 2.05 Domestic Animal Regulations
- 2.06 Fire Regulations

Chapter 2.01 General

- Sections:
- 2.01.010 Scope of This Title
 - 2.01.020 Enforcement
 - 2.01.030 Lands Open to the Public
 - 2.01.040 Closure of District Lands
 - 2.01.050 Permits and Fees
 - 2.01.060 Misdemeanors and Infractions
 - 2.01.070 Separate Offenses
 - 2.01.080 Impoundment
 - 2.01.090 Exemptions

2.01.010 **Scope of This Title.** The rules and regulations contained herein shall be known as "Regulations for Use of Marin County Open Space District Lands" or as "land use regulations" and may be referred to as such. Except as otherwise provided, this title shall apply to all lands owned, maintained or otherwise managed by the Marin County Open Space District.

2.01.020 **Enforcement.** Any District employee or designee shall have the authority to enforce these regulations and to eject any person acting in violation of these regulations from District lands or otherwise revoke their permit to use District lands.

2.01.030 **Lands Open to the Public.** District lands are open to the public for use in accordance with the provisions of these regulations. Persons using District lands shall comply with all applicable Federal, State, County, District and local laws and regulations.

2.01.040 **Closure of District Lands.** All or any portion of District lands may be closed to the public or have public uses restricted during an emergency or for health, safety, maintenance or open space management purposes.

2.01.050 **Permits and Fees.** The District may issue permits and may charge fees for special use of District lands. Charges for permits shall be determined by the Board from time-to-time, and may include land use fees and charges for expenses incurred by the District, such as labor, equipment costs, overhead, etc. Permits are not transferable and may be revoked for failure to comply with any provision of the permit or applicable portions of these regulations. Permits must be carried while on District lands and shown upon request to District personnel or otherwise displayed as directed.

2.01.060 **Misdemeanors and Infractions.** Violation of the following regulations is a misdemeanor:

- (a) Section 2.02.020, remaining on or reentering District lands after consent has been withdrawn;
- (b) Section 2.02.030, damaging District property;
- (c) Section 2.02.050, misconduct of minor children;
- (d) Section 2.02.060, camping without a permit;
- (e) Sections 2.02.080(e), 2.02.080(f) and 2.02.080(g), games and miscellaneous activities;
- (f) Section 2.02.090, use, possession or discharge of firearms, traps and other weapons;
- (g) Section 2.02.100, noise disturbance;

- (h) Section 2.02.110(d), depositing waste water, sewage or effluent;
- (i) Section 2.02.130, dumping of garbage, refuse and trash;
- (j) Section 2.02.140, structures and encroachments;
- (k) Section 2.02.160, commercial activities;
- (l) Section 2.02.170, disorderly conduct;
- (m) Section 2.02.180, introduction of organisms;
- (n) Sections 2.03.010, 2.03.020, 2.03.030, 2.03.040, and 2.03.050, damaging District resources;
- (o) Section 2.04.010, use of motor vehicles;
- (p) Section 2.06.010, creation of fire hazards, and Section 2.06.020, use, possession or discharge of fireworks;
- (q) continuing to use District lands in an illegal manner once a District employee, designee or law enforcement official has directed that such activity be stopped.

Violation of any land use regulation not mentioned in this section is an infraction.

- 2.01.070 **Separate Offenses.** Any violation of these regulations occurring on more than one calendar day shall constitute a separate offense.
- 2.01.080 **Impoundment.** The District may impound any animal, property or equipment found to be in violation of these regulations. Items shall be disposed of in accordance with Section 5561.5 of the California Public Resources Code and adopted procedures.
- 2.01.090 **Exemptions.** These regulations shall not apply to employees and agents of the District or the County of Marin engaged in and acting within the scope of their authorized duties and responsibilities. The District, at its sole discretion, may grant written exemption to all or any portion of these land use regulations by temporary or special permit, contract or lease; however, exemptions shall be limited to uses consistent with the District's "Open Space Land Management Policy" and the purpose of this code and shall not violate any Federal, State or County law.

- Chapter 2.02 Visitor Conduct
- Sections: 2.02.010 Compliance with All Laws, Regulations and Signs
2.02.020 Use Restrictions
2.02.030 Care of Property and Facilities
2.02.040 Group Use
2.02.050 Responsibility for Misconduct of Minors
2.02.060 Camping
2.02.070 Running and Jogging
2.02.080 Games and Miscellaneous Activities
2.02.090 Firearms, Traps and Other Weapons
2.02.100 Noise and Audio Devices
2.02.110 Sanitation
2.02.120 Littering
2.02.130 Garbage, Refuse and Trash
2.02.140 Unauthorized Structures, Encroachments and Signs
2.02.150 Abandoned and Unattended Property
2.02.160 Commercial Activity
2.02.170 Disorderly Conduct
2.02.180 Introduction of Organisms
- 2.02.010 **Compliance with All Laws, Regulations and Signs.** No person while on District lands shall violate or fail to comply with any provision of Federal, State, County or District laws, regulations or posted signs.
- 2.02.020 **Use Restrictions.** No person shall enter any area of District lands closed to the public, nor use any area of District lands for an unauthorized purpose. No person shall remain on or reenter District lands after a District employee or law enforcement official has specifically withdrawn consent to use such lands.
- 2.02.030 **Care of Property and Facilities.** No person shall damage, deface, tamper with or remove any District property or facilities, including buildings, signs, gates, fences, equipment, markers, trash receptacles, paving material, utilities or water lines.
- 2.02.040 **Group Use.** No group, school, club or similar organization, whether formally organized or not, shall hold or conduct any activity on District lands with 20 or more participants without prior written approval of the District. Group use of District lands is subject to prior reservations, conditions and charges.
- 2.02.050 **Responsibility for Conduct of Minors.** Parents and guardians shall be responsible for the conduct of their minor children and shall not permit such minor children to do any act on District lands prohibited by these regulations.
- 2.02.060 **Camping.** No person shall camp overnight or shall possess camping gear within District lands except by written permission from the District. Camping gear includes sleeping bags, tents, or other articles associated with overnight camping.
- 2.02.070 **Running and Jogging.** No school, club or other organization shall hold running, jogging or cross-country meets, events or practice sessions on District lands without prior written approval of the District. No person shall run or jog in such a way as to endanger hikers, equestrians, bicyclists or others using District lands.

- 2.02.080 **Games and Miscellaneous Activities.** No person shall engage in games or other activities which interfere with others using District lands or which endanger property, public safety or environmental resources. Non-permitted activities include:
- (a) participating in volleyball, baseball, softball, soccer, football and other similar organized sports;
 - (b) participating in bicycle races;
 - (c) hitting golf balls;
 - (d) operating self-propelled model airplanes, boats, automobiles or other model craft;
 - (e) throwing, releasing or discharging missiles, rockets, stones, paintballs or other similar projectiles;
 - (f) Hang-gliding, paragliding or parachuting;
 - (g) operating or landing aircraft of any nature;
 - (h) participating in any activity or operating any device in such fashion which interferes with others using District lands or endangers property, public safety or environmental resources.
- 2.02.090 **Firearms, Traps and Other Weapons.** No person shall possess, use, carry, discharge or cause to be discharged any gun, firearm or weapon while on District lands, including any air or gas weapon, spring gun, spear, bow and arrow, crossbow, sling shot, animal trap, knife with blade over 5 inches long, explosive or any other form of weapon potentially dangerous to wildlife or human safety. No person shall discharge or cause to be discharged any firearm or weapon onto or across District lands from outside the boundary of District lands.
- 2.02.100 **Noise and Audio Devices.** No person while on District lands shall make or cause to be made any loud, unnecessary or unusual noise which disturbs the peace and quiet within any area within the District or which causes discomfort or annoyance to any reasonable person of normal sensitivity utilizing any facility of the District. No person shall operate or possess any public address system, amplified musical instrument or other noise-producing or transmitting device on District lands.
- 2.02.110 **Sanitation.** No person using District lands shall do any of the following:
- (a) urinate or defecate, or permit dogs or other domestic animals, including horses, to urinate or defecate, within 50 feet of any entrance to District lands, nor within 100 feet of any water source, including wells, creeks and streams;
 - (b) urinate or defecate in public view;
 - (c) fail to bury human waste to a minimum depth of six inches;
 - (d) deposit waste water, sewage or effluent from sinks, portable toilets or other fixtures onto District lands or within reservoirs, lakes, streams, waterways or other bodies of water owned, maintained or otherwise managed by the District.
- 2.02.120 **Littering.** No person shall throw, drop, place, deposit or sweep any object, including, but not limited to, paper, food scraps, bottles, bottle caps, cans, fish or fish parts, soil or rocks onto District lands or into District reservoirs, lakes, streams and waterways, except in trash receptacles. Where trash receptacles are not provided or are full, all such matter shall be carried away from District lands by the person responsible for its presence and properly disposed of elsewhere.

- 2.02.130 **Garbage, Refuse and Trash.** No person shall bring garbage, refuse, trash or yard clippings onto District lands, nor dump or deposit such garbage, refuse, trash or yard clippings on District lands.
- 2.02.140 **Unauthorized Structures, Encroachments and Signs.** No person shall erect any temporary or permanent obstruction, structure, monument, facility, physical improvement or encroachment on District lands. With the exception of those structures deemed to be public nuisances and addressed in section 1.01.070 of this code, any such structure may be demolished by the District and its contents impounded.
- 2.02.150 **Abandoned and Unattended Property.** No person shall abandon or leave unattended or without permission any personal property or device on District lands for a period longer than 12 hours. Any property or device so abandoned or unattended may be impounded and disposed of in accordance with Section 5561.5 of the California Public Resources Code and adopted procedures.
- 2.02.160 **Commercial Activities.** No person shall do any of the following on District lands:
(a) sell, hawk, or otherwise peddle any goods, merchandise or services;
(b) station or place any stand, cart or vehicle for display of goods, merchandise or services;
(c) distribute, circulate or post any handbill, pamphlet or other advertisement regarding sale of goods, merchandise or services;
(d) conduct any commercial photography or activity related to commercial photography except by written permission from the District;
(e) conduct any activity of a commercial nature except by written permission from the District.
- 2.02.170 **Disorderly Conduct.** No person shall do any of the following on District lands:
(a) harass or otherwise disturb others using District land;
(b) accost another person for the purpose of begging or soliciting;
(c) be under the influence of intoxicating liquor or dangerous drugs in such a condition that the individual is unable to exercise care for their own safety or the safety of others;
(d) engage in loud or disturbing conduct or any act tending to a breach of the peace.
In addition, no person shall do any thing defined as "Disorderly Conduct" as outlined in Section 647 of the California Penal Code.
- 2.02.180 **Introduction of Organisms.** No person shall introduce, cause to be introduced or otherwise disperse on District lands any organism, living or dead, including native or non-native plants, animals, fish, insects or bacteria.

Chapter	2.03	Resource Protection
Sections:	2.03.010	Water Resources
	2.03.020	Botanical Resources
	2.03.030	Wildlife and Animal Resources
	2.03.040	Geological Resources
	2.03.050	Archeological and Historical Resources

- 2.03.010 **Water Resources.** No person shall do any of the following while on District lands:
 - (a) pollute or in any manner contaminate any reservoir, lake, stream, waterway or other body of water;
 - (b) possess or apply any pesticide, herbicide, fungicide or other poison.
- 2.03.020 **Botanical Resources.** No person shall damage, injure, collect, eat or remove any plant, tree or other type of vegetation, whether living or dead, including, but not limited to, flowers, mushrooms, bushes, vines, grass, turf, cones, or wood located on District lands, except as follows:
 - (a) persons may take up to two quarts of edible berries per day for personal consumption.
- 2.03.030 **Wildlife and Animal Resources.** No person shall hunt, molest, disturb, injure, trap, take, net, poison, harm or kill any kind of animal or the eggs of any animal, whether living or dead, nor remove, destroy or in any manner disturb the natural habitat of any animal on District lands. Fishing or taking of fish is permitted as regulated by the California Fish and Game Code.
- 2.03.040 **Geological Resources.** No person shall damage, injure, collect, remove or disturb soil, earth, rocks, sand, gravel, fossils, minerals, features in caves, or any articles or artifact of geological interest or value located on District lands.
- 2.03.050 **Archeological and Historical Resources.** No person shall damage, injure, collect, remove or disturb any object of paleontological, archaeological or historical interest or value located on District lands.

Chapter 2.04 Vehicle and Traffic Regulations

- Sections:
- 2.04.010 Motor Vehicles
 - 2.04.020 Bicycles
 - 2.04.030 Boats
 - 2.04.040 Speed Limits
 - 2.04.050 Right-of-Way
 - 2.04.060 Parking and Vehicle Removal
 - 2.04.070 California Vehicle Code

2.04.010 **Motor Vehicles.** No person shall operate or possess any motor vehicle or motor driven vehicle, including, but not limited to cars, trucks, motorcycles, motorbikes or similar vehicles on District lands. For the purposes of this section, battery-powered wheelchairs, emergency vehicles and County or District maintenance vehicles are exempted.

2.04.020 **Bicycles.** No person shall operate any bicycle or similar vehicle on District lands except upon fire protection roads, designated bicycle pathways or public roads not signed against such use. Furthermore, no person shall operate or possess any bicycle or similar vehicle elsewhere on District lands, including trails, unless signed specifically to permit such possession.

All persons operating a bicycle on District lands during hours of darkness shall carry and use a lamp which emits a white light visible from a distance of 300 feet.

- 2.04.030 **Boats.** No person shall place, operate or possess any motorized vessels, including boats, rafts, or similar watercraft, in reservoirs, lakes, streams, waterways or other bodies of water owned, maintained or otherwise managed by the District, except on bay and tidal waterways, subject to applicable State and local laws. Personal watercraft (jet skis, wave runners, etc.) are not permitted in any bodies of water owned, maintained or otherwise managed by the District.
- 2.04.040 **Speed Limits.** No person shall operate any land vehicle, including bicycles, at speeds in excess of 15 miles per hour unless otherwise posted. Bicycles and similar vehicles shall slow to 5 miles per hour when passing others or approaching blind turns. No person shall operate any watercraft or other vessel in excess of 5 miles per hour. No vehicle, including bicycles, shall be operated at a speed greater than is reasonable for safe operation, nor in any manner which may endanger the safety of others or the protection of environmental resources.
- 2.04.050 **Right-of-Way.** All persons operating vehicles on District lands, including bicycles, shall yield the right-of-way to hikers and equestrians. Hikers shall yield the right-of-way to equestrians. District and emergency vehicles have the right-of-way on District lands at all times.
- 2.04.060 **Parking and Vehicle Removal.** No person shall park, leave, abandon, possess or otherwise store any vehicle on District lands, except in locations designated by the District. Vehicles used in violation of any provision of this code may be impounded and stored at the owners expense.
- 2.04.070 **California Vehicle Code.** Except as otherwise provided in these regulations, the provisions of the California Vehicle Code shall be applicable to the operation of vehicles on District lands.

Chapter 2.05 Domestic Animal Regulations

- Sections: 2.05.010 Dogs and Other Animals
2.05.020 Horses and Saddle Animals
2.05.030 Animals at Large
2.05.040 Gates

- 2.05.010 **Dogs and Other Animals.** Dogs and other domestic animals are allowed on District lands when under the direct and immediate control of a responsible person. Except on protection roads or areas designated otherwise, dogs and other domestic animals must be fastened to and restrained by a chain or leash not exceeding six feet in length. No person shall do any of the following on District lands:
- (a) allow any dog or other domestic animal to enter environmentally sensitive or restricted areas of District lands;
 - (b) allow any dog or other domestic animal to interfere with, bother or disturb others using District lands;
 - (c) allow any dog or other domestic animal to hunt, pursue or harass other animals or wildlife;
 - (d) bring or keep a noisy, vicious or dangerous dog or other animal;
 - (e) bring or keep a dog 4 months of age or more without proof that the dog has a valid rabies inoculation or a valid license;
 - (f) fail to promptly remove from District lands any dog or other domestic animal after being ordered by District personnel to do so.

Persons bringing dogs or other domestic animals onto District lands shall carry a chain or leash not exceeding 6 feet in length and shall be prepared to restrain their animals, if necessary.

2.05.020 **Horses and Saddle Animals.** Horses and saddle animals are permitted on District lands only on trails, fire protection roads and other areas not signed against such use. No person shall do any of the following on District lands:

- (a) ride, drive, lead or keep any horse or saddle animal at such speed or in such manner which may endanger the safety of others using District lands, other animals or the protection of environmental resources;
- (b) allow any horse or saddle animal to stand unattended or insecurely tied;
- (c) permit any horse or saddle animal to swim in any reservoir, lake, stream or waterway.

2.05.030 **Animals at Large.** No person shall do any of the following on District lands:

- (a) permit any cattle, sheep, goat, horse, dog, cat or other animal to graze or run at large;
 - (b) abandon a dog, cat, fish, fowl or other animal on District lands.
- Any domestic animal found at large on District lands may be turned over to the County poundkeeper for disposition as outlined in the Marin County Code.

2.05.040 **Gates.** All persons opening a gate shall securely close the same after passing through it.

Chapter 2.06 Fire Regulations

Sections: 2.06.010 Fires
2.06.020 Fireworks
2.06.030 Smoking

2.06.010 **Fires.** No person shall build, light or maintain any open or outdoor fires, including barbecues, camp stoves, gas lanterns, etc., within District lands. In addition, no person shall possess such items, nor similar items, while on District lands.

2.06.020 **Fireworks.** No person shall possess, bring onto, set off or otherwise cause to explode on District lands any firecrackers, skyrockets or other fireworks or explosives.

2.06.030 **Smoking.** No person shall smoke on District lands from April 1 through November 30 of each calendar year, nor during periods of high fire danger, as determined by the District.

11.32.010-11.32.040 HARBORS AND WATERWAYS

Chapter 11.32

BOLINAS LAGOON NATURE PRESERVE
MOORING AND USAGE

Sections:

- 11.32.010 Purposes.
- 11.32.020 Definitions.
- 11.32.030 Speed limit.
- 11.32.040 Mooring on Bolinas Lagoon.

11.32.010 Purposes. The provisions of this chapter are enacted to protect and promote the public health, safety and general welfare, to preserve environmental qualities, and to protect the value, worth and enjoyment of the Bolinas Lagoon Nature Preserve and the waters and tidelands therein through regulation of the uses and activities within Bolinas Lagoon. (Ord. 2657 § 1 (part), 1981).

11.32.020 Definitions. For the purposes of this chapter:

A. "Vessel" means any boat, raft or watercraft of any type or size, whether motor powered or not.

B. "Moor" means the fixing of a vessel in one location, temporarily or permanently, by mooring, anchoring, grounding or any other means. (Ord. 2657 § 1 (part), 1981).

11.32.030 Speed limit. No person shall operate any vessel on any part of the Bolinas Lagoon or the Bolinas Lagoon Nature Preserve at a speed in excess of five miles per hour. (Ord. 2657 § 1 (part), 1981).

11.32.040 Mooring on Bolinas Lagoon. No person shall moor any vessel in Bolinas Lagoon except as hereinafter provided:

A. Within the county-owned or controlled areas of the lagoon, continuous mooring over seventy-two hours and all placement of mooring are subject to written permission from the county parks and recreation department;

B. Living aboard any vessel within Bolinas Lagoon is prohibited except as provided in Chapters 11.20 and 11.21 of this code. (Ord. 2657 § 1 (part), 1981).

1 APPENDIX I -- SITE SUMMARY SHEET RELATED TO EMERGENCY OR SPILL
2 PROTECTION

3
4 Excerpt from:

5 North Coast Area Contingency Plan prepared by the California Department of Fish and Game,
6 Office of Oil Spill Prevention and Response. The Plan serves as a regional guidebook for
7 responding to oil spills

SITE: A-2-044 Bolinas Lagoon

Marin County

USGS 7.5" Quad: Bolinas, CA

OSPR Map No. 052

Lat. 37° 55' N

Long. 122° 40' W

rev. 6/14/95

SITE DESCRIPTION:

A large natural lagoon with extensive tidal mud flats, low saltmarsh, and riparian habitat along freshwater inflows. The lagoon mouth is open all year.

SEASONAL CONCERNS:

The lagoon is an A priority all year because of its extensive marshes and mud flats that are used by harbor seals, shorebirds, wading birds, and waterfowl.

RESOURCES OF PRIMARY CONCERN:

Endangered Brown Pelican from April to January, threatened Snowy Plover on sand spit at mouth of the lagoon, merlin (Species of Special Concern). Large numbers of egrets, great blue heron, dabbling and diving ducks, and shorebirds, particularly during fall and winter and during migration periods. Approximately 200 Harbor seals haul out regularly in the lagoon, with about 50 pups in spring. Ghost shrimp, gaper clam, littleneck clam, washington clam. Pacific herring in winter.

TRUSTEE AGENCY/MANAGER/LOCAL EXPERT:

Marin County Open Space District, Bob Stewart	(415) 499-6405
Audubon Canyon Ranch, Skip Schwartz	(415) 868-9244
Golden Gate National Recreation Area, Natural Resources	(415) 556-9507
Gulf of the Farallones National Marine Sanctuary	(415) 556-3509
PRBO	(415) 868-1221
National Park Service - Sarah Allen	Office (415) 663-8525
(Harbor Seals)	Home (415) 456-0187
The Marine Mammal Center	(415) 289-7325
Calif. Dept. Fish & Game - Tom Moore	(707) 875-2521

Site Response Strategy

Bolinas Lagoon: A-2-044

PROPOSED PROTECTION STRATEGY: In addition to on-water containment and recovery efforts, the following site-specific protection measures should also be carried out:

This large natural inlet cannot be closed. Length and specific placement of booms may vary due to changing currents and bottom topography.

- 1) As much oil as possible should be stranded outside the lagoon on Stinson Beach. If conditions allow, deploy deflection booms along shore to divert oil onto hard-packed fine-grained sand beach.
- 2) Deploy a series of deflection 18" curtain booms along the western side of the channel along house pilings to divert oil heading up northwest channel onto the high tide sand beach of Kent Island. Back curtain boom with sorbent boom.
- 3) Deploy a hinged set of cascading deflection booms in the eastern channel. Angle boom to deflect oil either onto the high-tide sand beach on Kent Island or to the fine-grained sand beach on the northwestern end of the sand spit. Back curtain boom with sorbent boom.
- 4) Deploy a series of cascading-18" curtain boom from sand spit across mouth of lagoon to concrete wall on the west side of the channel. Create a skim pocket against wall and position a skimmer here.
- 5) Position vessel operated skimmers in the east and west tidal channels.
- 6) Alternative: if conditions allow and inlet mouth is relatively narrow; place a "V shaped" boom configuration beginning several yards from up- and down-coast from the mouth and pointing out from the mouth and into the bay.

OIL COLLECTION AREAS: Stinson Beach, Kent Island. Landward side of sand spit. Mid-channel skimmers.

POTENTIAL IMPACTS FROM OIL: Contamination and injury to harbor seals, shorebirds, waterfowl, mudflat organisms, and marshes. Long-term persistence of oil in the lagoon.

RECOMMENDED RESOURCES:

- 1) Boom (amount/type): 8,000 ft of 18" curtain boom; may need 2000 ft of ocean boom at lagoon mouth. Sorbent boom.
- 2) Anchor Systems (#/weight/type): 30-40 / 25-40lb. / Danforth with chain and line.
- 3) Boats (#/type): 4 shallow draft fast response boom boats capable of carrying and pulling large amounts of boom, and grounding without sustaining damage.
- 4) Skimmers (#/type): Two vessel deployed skimmers, one shore deployed skimmers with storage (vacuum truck, barge, oil bladder, portable tank). See ACP Annex E-IV and Annex F, Tab B.
- 5) Personnel: 25-30

Site Response Strategy

Bolinas Lagoon: A-2-044 (cont.)

COMMENTS: 1) Small staging area and access through town of Bolinas at end of road out to mouth of lagoon. Access from east side along Stinson Beach. 2) Heavy surf and strong currents common at this site. 3) Can launch vessels at Sea Drift ramp, on Stinson Beach spit, only during high tide.

STRATEGY TESTING: Date Developed: March 1995
Date Tested: Strategy has not been deployed or tested.

INLET SKETCH MAP

Inlet Name INLET, CA.
 BOLLINAS LAGOON

Recorder(s) MOH / SIRS (3/95)
 OS-200006 on seaward

Date/Time 05-25-95

Tide Stage

Inlet Classification A
 Modify by J. Tierney - OSR

CHECKLIST (6/95)

- ✓ North Arrow
- ✓ Scale
- ✓ High-Tide Line
- ✓ Low-Tide Line
- ✓ Substrate Type

LEGEND
 - - - - - xxxxxxxx - - - - -

Recommended
 Catchment Area

g V V V

Salt-Water Marsh

Fresh-Water Marsh

High-Tide
 Overwash Zone

Last High-Tide
 Swash Line

SITE A-2-044

POTENTIAL PROTECTION STRATEGY (FLOOD TIDE)

- ↑ Path Of Oil
- Deflection Boom
- Oil On Shoreline
- ⌋ Skimmer Placement
- + Anchor Point / Hinge Line

