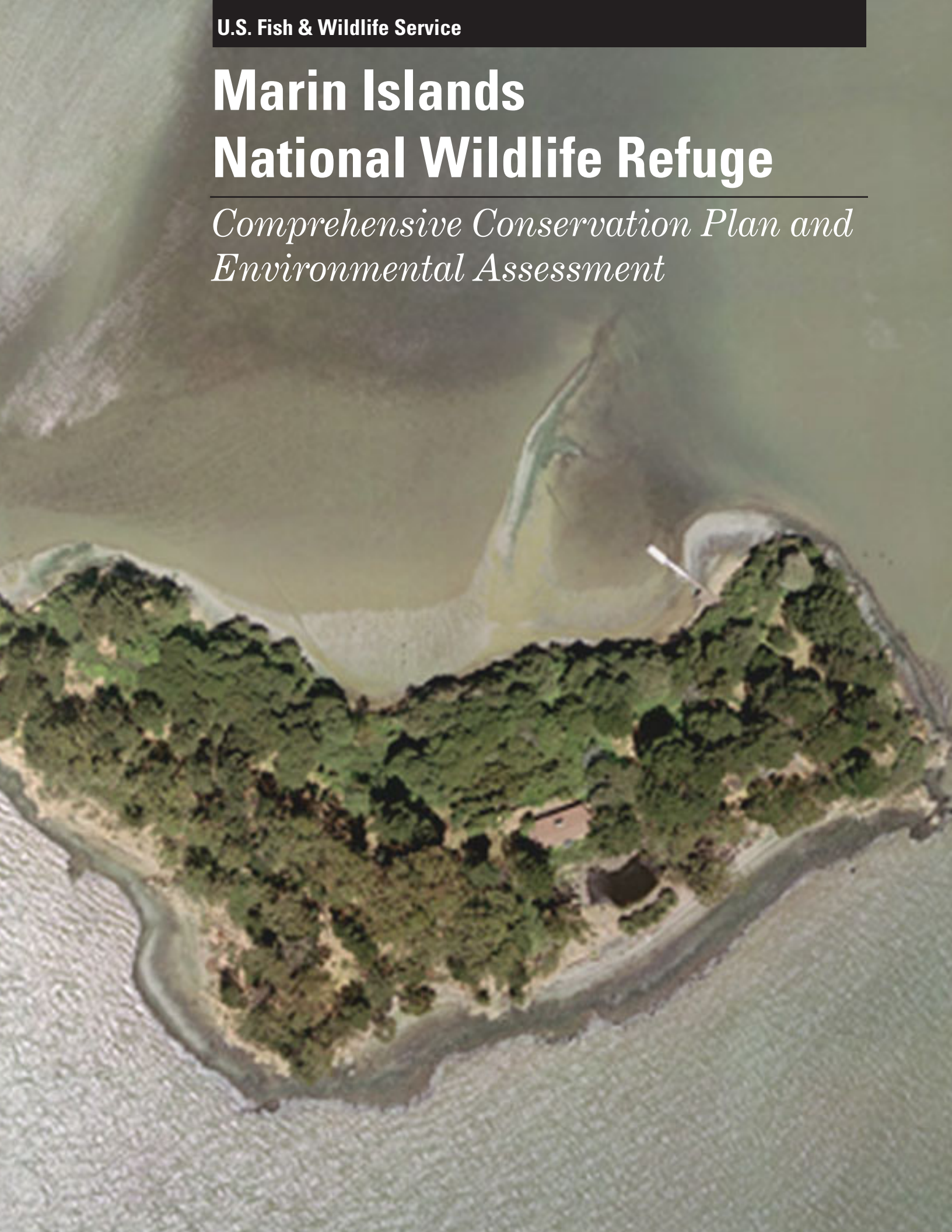


U.S. Fish & Wildlife Service

Marin Islands National Wildlife Refuge

*Comprehensive Conservation Plan and
Environmental Assessment*



Comprehensive Conservation Plans provide long term guidance for management decisions and set forth goals, objectives, and strategies needed to accomplish refuge purposes and identify the Service's best estimate of future needs. These plans detail program planning levels that are substantially above current budget allocations and, as such, are primarily for Service strategic planning and program prioritization purposes. The plans do not constitute a commitment for staffing increases, operational and maintenance increases, or funding for future land acquisition.

Cover photo USFWS



U.S. Fish & Wildlife Service

Marin Islands National Wildlife Refuge

Comprehensive Conservation Plan

Vision Statement

“The Marin Islands National Wildlife Refuge will provide one of the few protected sanctuaries of native San Francisco Bay habitat to local and migratory birds in the heavily urbanized San Francisco Bay area. West Marin Island will provide nesting habitat for great egrets, black-crowned night herons, snowy egrets, great blue herons, black oystercatchers, and other colonial nesting waterbirds free from human disturbance. East Marin Island will, over time, be reverted to native coastal scrub and oak woodland habitat that may be colonized by the herons and egrets.”

Visitors and the community will develop an understanding of the importance of migratory bird habitat and cultural history in the San Francisco Bay area. A public use program will provide the local community and visitors with opportunities to experience the unique resources of the Refuge. The Refuge will be a classroom where visitors will learn about the wildlife, habitat, and cultural history of San Francisco Bay through compatible wildlife-dependent recreation delivered by high quality interpretive materials, staff-led tours, and partnerships. Lastly, the Refuge will have an active and diverse volunteer group to support the purpose and continued preservation of the Marin Islands.”

U.S. Fish & Wildlife Service
California/Nevada Refuge Planning Office
2800 Cottage Way, Room W-1832
Sacramento, CA 95825

San Francisco Bay National Wildlife Refuge Complex
9500 Thornton Avenue
Newark, CA 94560

April 2007

U.S. Department of the Interior
Fish and Wildlife Service
California/Nevada Refuge Planning Office

FINDING OF NO SIGNIFICANT IMPACT

**Environmental Assessment for Management of Marin Islands National Wildlife Refuge
Marin County, California**

The U.S. Fish and Wildlife Service (Service) has completed the Comprehensive Conservation Plan (CCP) and the Environmental Assessment (EA) for the Marin Islands National Wildlife Refuge (Refuge). The CCP will guide Refuge management for the next 15 years. The CCP and EA (herein incorporated by reference) describe the Service's proposals for managing the Refuge and their associated effects on the human environment under three alternatives, including the no action alternative.

Decision

Following comprehensive review and analysis, the Service selected Alternative C for implementation because it is the alternative that best meets the following criteria:

- Achieves the mission of the National Wildlife Refuge System;
- Achieves the purposes of the Marin Islands National Wildlife Refuge;
- Achieves the Service's vision and goals for the Refuge;
- Maintains and restores the ecological integrity of the habitats and populations of the Refuge;
- Addresses important issues identified during the scoping process;
- Address the legal mandates of the Service and the Refuge;
- Consistent with scientific principles of sound fish and wildlife management; and
- Incorporates priority public uses which are compatible with the Refuge purposes and the Refuge System mission.

Alternatives Considered

The following is a brief description of the alternatives for managing Marin Islands Refuge, including the selected plan (Alternative C). For a complete description of each alternative, see the draft EA.

Alternative A

Under the No Action Alternative, the Service would continue current management activities on the Refuge. The Refuge currently has no comprehensive management plan. Current management activities include egret and heron colony surveys, limited non-native vegetation control, limited native plantings, and volunteer plant restoration opportunities. The Refuge would remain closed to visitors other than the limited supervised volunteer opportunities. This alternative was not selected because it lacks consideration for habitat restoration needs, management of the migratory birds that use the Refuge, and accommodation of local needs for wildlife-dependent recreation.

Alternative B

Under Alternative B, the Service would restore the Refuge to natural conditions to the extent possible. Prior to human occupation, the Refuge was primarily described as a coastal sage scrub, coastal sea-bluff scrub, coastal grassland, and oak-buckeye woodland habitat. The Refuge was exposed to various invasive and ornamental plants during private ownership that resulted in significant colonies of non-native vegetation. The Service would undertake a vegetation mapping project to determine the location and extent of non-native and native plants on the East and West Island. From this mapping, a coordinated plan would be developed to reduce non-native colonies and replace those areas with native plantings. The vegetation management objective is intended to restore the natural landscape of the islands in support of the wildlife on the Refuge. Native vegetation is used for nesting by the egret and heron colony. Building structures would also be removed to expand migratory bird habitat. This alternative was not selected because it does not include any wildlife-dependent opportunities for the public.

Alternative C (selected alternative)

Under Alternative C, the Service will implement habitat restoration activities as described under Alternative B. In addition, the Service will provide guided tours to East Marin Island at a frequency no greater than once per month. A walking trail and interpretive panels will be constructed to facilitate the tour. A cultural resources assessment will also be conducted under this alternative. The assessment will produce an inventory of the important cultural elements on the Refuge, as well as, provide a cultural element to the guided tours.

Effects of management of the Refuge on the human environment

As described in the EA, implementing the selected alternative will have no significant impacts on any of the environmental resources identified in the EA. A summary of the impacts analysis and conclusions follows:

Soils

Removal of structures on East Marin Island could result in large areas of bare soil that could be subject to erosion, especially in the marine environment. However, these removal activities will take place on flat terrain in the middle of the island where the soil would be protected from marine weather by vegetation that surrounds the island. Moreover, removal activities would take place during the dry season to further reduce erosion impacts. These bare areas will also be replaced by native vegetation which would offset erosion potential.

Water Quality

Under the selected plan, the Service plans to remove non-native vegetation through manual and chemical means. Herbicides would be used on a limited basis and are not expected to negatively impact the water quality of San Pablo Bay. Soil that is disturbed from manual removal will be replanted with native vegetation to counteract any long-term impacts to the water quality of the Bay. Activities under the plan are not expected to result in significant impact to the water quality.

Air Quality

Management activities under the selected plan are expected to increase air particulates in the immediate area. However, these particulates should dissipate given the windy condition on the Bay. Vessel emissions from increased management activities, and possibly public visitation,

would result in a long-term minor increase in particulates, reactive organic gasses, and carbon monoxide in the area. Given the current air quality conditions of the San Francisco Bay area and the mitigation measures described in the EA, the minor emission increases are not considered significant.

Vegetation

Management under the selected plan will result in widespread removal of non-native vegetation on East Marin Island. This vegetation will be replaced by native vegetation which is beneficial to the heron and egret colony on the Refuge. Herbicides will be used to reduce non-native vegetation. Herbicides are not likely to impact non-target plants because spraying will be done by hand to individual plants. This restoration activity will support regional biodiversity goals by expanding native coast live oak and coastal scrub plant communities that have been lost to development in the surrounding San Francisco Bay area.

Wildlife

The selected plan will result in both beneficial and adverse impacts on wildlife. Increased public access to the Refuge may result in disturbance to the wildlife. Even with proper boating instruction and supervised tours as prescribed under the CCP, the public could still disturb wildlife. Guided tours will be limited to East Marin Island, where no heron and egret nesting occurs. Furthermore, these guided tours will not take place while breeding and nesting is occurring on West Marin Island. Should wildlife begin to nest on East Marin Island, tours will be further limited to non-sensitive periods. West Marin Island will continue to be closed to access to protect the heron and egret colony.

Removal of structures and restoration of vegetation on the Refuge could also result in temporary disturbance of wildlife. Activities will be limited to non-breeding season of the colony to reduce possible impacts to young. These management activities would have the long-term benefit of providing further habitat and native vegetation appropriate for the migratory birds on the Refuge.

Wildlife-dependent Recreation

Under the selected plan, wildlife-dependent recreation will be expanded to include guided tours on the Refuge. Interpretive panels, brochures and a designated walking trail will be created for public safety as well as to enhance the tours and prevent trampling of restored vegetation. Fishing and wildlife viewing will continue to be allowed in the Refuge waters, but boats will not be allowed to dock at the islands. Fishing brochures and information will be created to communicate appropriate wildlife-dependent recreational opportunities at the Refuge.

Public Review

The planning process incorporated public involvement in developing and reviewing the CCP. This included a public scoping meeting, four planning updates, and public review and comment on the planning documents. The details of the Service's public involvement process are described in the CCP and EA.

Conclusions

Based on review and evaluation of the information contained in the supporting references, I have determined that implementing Alternative C as the CCP for management of Marin Islands


National Wildlife Refuge is not a major Federal action that would significantly affect the quality of the human environment, within the meaning of section 102(2)(c) of the National Environmental Policy Act of 1969, as amended. Accordingly, the Service is not required to prepare an environmental impact statement.

This Finding of No Significant Impact and supporting references are on file at the U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex, 1 Marshlands Road, Fremont, California, 94536 (telephone 510/ 792 0222) and the U.S. Fish and Wildlife Service, California/Nevada Refuge Planning Office, 2800 Cottage Way, Sacramento, California, 95825 (telephone 916/ 414 6500). These documents can also be found on the Internet at <http://www.fws.gov/cno/refuges/planning.html>. These documents are available for public inspection. Interested and affected parties are being notified of this decision.

Supporting References

U.S. Fish and Wildlife Service. 2006. Draft Comprehensive Conservation Plan Marin Islands National Wildlife Refuge.

U.S. Fish and Wildlife Service. 2006. Draft Marin Islands National Wildlife Refuge Environmental Assessment.




Manager, California/Nevada Operations
Sacramento, California

SEP 26 2006

Date

Marin Islands National Wildlife Refuge and State of California Ecological Reserve Comprehensive Conservation Plan

Prepared By
U.S. Fish and Wildlife Service
San Francisco Bay National Wildlife Refuge Complex
P.O. Box 524
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Approved:  Date: SEP 26 2006
California Nevada Operations Manager

Implementation of this Comprehensive Conservation Plan and alternative management actions/programs have been assessed consistent with the requirements of the National Environmental Policy Act (42 USC 4321 et seq.).

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- U. Response to Comments

Chapter 1. Introduction and Background

Introduction

The Marin Islands are a joint National Wildlife Refuge and State Ecological Reserve (Refuge) located in San Francisco Bay in northern California. The Refuge is composed of two small islands and adjacent tidelands set in the San Rafael Bay portion of the San Francisco Bay estuary. Day-to-day management is provided by the U.S. Fish and Wildlife Service (Service) under a memorandum of understanding with the California Department of Fish and Game. The Refuge is unique because it provides increasingly limited wildlife habitat in the heart of the heavily populated San Francisco Bay area.

The Service prepared this Draft Comprehensive Conservation Plan (CCP) to guide wildlife and other natural resource management with consideration for compatible public use on the Refuge for the lifetime of this 15-year plan. The CCP is flexible; it will be revised periodically to ensure that its goals, objectives, implementation strategies, and timetables remain valid and appropriate. Major revisions will require public involvement and appropriate National Environmental Policy Act (NEPA) documentation. The Service's management planning process for National Wildlife Refuges (NWRs) involves two phases: 1) the development of a broad CCP that articulates a vision and specific goals for a refuge; and 2) the formulation of more detailed "step-down" management plans that enable the implementation of the CCP's vision. The purposes of this CCP are to:

- Provide a clear statement of direction for the management of the Refuge during the lifetime of this plan;
- Provide long-term continuity in Refuge management;
- Communicate the Service's management priorities for the Marin Islands Refuge to its neighbors and the public;
- Provide an opportunity for the public to help shape the future management of the Marin Islands Refuge;
- Ensure that management programs on the Marin Islands Refuge are consistent with the legal and policy mandates for the National Wildlife Refuge System (Refuge System) and the purpose of the Refuge as stated in establishing documentation;
- Ensure that the management of the Marin Islands Refuge is, to the extent practicable, consistent with Federal, State, and local plans; and
- Provide a basis for budget requests to support the Marin Islands Refuge's needs for staffing, operations, maintenance, and capital improvements.

Environmental Assessment

This document also includes an environmental assessment (EA) as required under NEPA (42 USC 4321), the basic national policy for consideration of environmental values in federal decision making. This document was prepared as a concurrent CCP/EA because

regulations of the President's Council on Environmental Quality require the Service to integrate the NEPA review and compliance process with CCP development and implementation as early as possible, in order to ensure a systematic and interdisciplinary approach. The purpose of the EA is to evaluate the environmental effects of the CCP on the quality of the human environment, as required by NEPA. The EA includes:

- Description of the alternatives to the proposed CCP;
- Identification and analysis of the environmental effects of the proposed management program and the management alternatives; and
- Involvement of affected State and Federal agencies, Native American Tribes, and members of the public in the CCP process.

The CCP is also accompanied by the following step-down management plans:

- Recreational Sport Fishing Plan and Environmental Assessment for the Marin Islands NWR (Appendix I); and
- Marin Islands NWR Wildland Fire Management Plan (Appendix J)

Need for this CCP

No formal management plan currently exists for this Refuge; therefore, a CCP is needed to provide guidance in conducting general refuge operations, wildlife and habitat management, cultural resource protection, environmental education and wildlife observation. The National Wildlife Refuge System Improvement Act of 1997 (16 USC 668dd-668ee) (1997 Improvement Act) requires that all refuges be managed in accordance with an approved CCP by 2012. Under this Act, the refuges are to be consistently directed and managed to fulfill the Refuge System Mission as well as the specific purpose(s) for which the refuge was established.

The planning process is an additional directive for refuge managers to follow while achieving the specific refuge purpose(s) and Refuge System mission. It provides for the consideration and protection of the broad spectrum of fish, wildlife, and habitat resources found on refuges and associated ecosystems. Further, it provides refuge managers with an evaluation process to analyze their refuge and recommend the best management direction to prevent degradation of environmental conditions and restore lost or severely degraded portions of the refuge, when such restoration is appropriate and in concert with refuge purposes and Refuge System mission. When evaluating the appropriate management direction for refuges, refuge managers will use sound professional judgment to determine their refuges' contribution to biological integrity, diversity, and environmental health at multiple landscape scales. Moreover, the 1997 Improvement Act requires effective coordination with other Federal agencies, state fish and wildlife or conservation agencies, and local stakeholders.

Legal and Policy Guidance

National Wildlife Refuges are guided by the mission and goals of the Refuge System,

purposes of the Refuge, Service policy, laws, and international treaties. Relevant guidance includes the Refuge Recreation Act of 1962, the National Wildlife Refuge System Administration Act of 1966, as amended by the 1997 Improvement Act, and selected portions of the Code of Federal Regulations and Fish and Wildlife Service Manual. The Refuge Recreation Act of 1962, as amended, authorized the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use when such uses do not interfere with the area's primary purpose.

The 1997 Improvement Act:

- Identified a new mission statement for the Refuge System;
- Established six priority public uses (hunting, fishing, wildlife observation and photography, environmental education and interpretation);
- Emphasized conservation and enhancement of the quality and diversity of fish and wildlife habitat;
- Stressed the importance of partnerships with Federal and State agencies, Tribes, non-governmental organizations, industry, and the general public;
- Mandated public involvement in decisions on the acquisition and management of refuges; and
- Required, prior to acquisition of new refuge lands, identification of existing compatible wildlife-dependent uses that would be permitted to continue on an interim basis pending completion of comprehensive conservation planning.

The 1997 Improvement Act establishes the responsibilities of the Secretary of the Interior for managing and protecting the Refuge System; requires a CCP for each refuge by the year 2012; and provides guidelines and directives for the administration and management of all areas in the Refuge System, including wildlife refuges, areas for the protection and conservation of fish and wildlife threatened with extinction, wildlife ranges, game ranges, wildlife management areas, or waterfowl production areas.

The 1997 Improvement Act also establishes a formal process for determining compatibility of uses. A compatibility determination is required for a wildlife-dependent recreational use or any other public use of a refuge. A compatible use is one which, in the sound professional judgment of the refuge manager, will not materially interfere with or detract from the fulfillment of the Refuge System Mission or refuge purpose(s). The Service strives to provide wildlife-dependent public uses when compatible. If financial resources are not available to design, operate, and maintain a priority use, the refuge manager will take reasonable steps to obtain outside assistance from the State and other conservation interests.

This draft CCP contains several draft compatibility determinations for proposed uses on the Refuge. These documents are located in Appendix N-Q. These will be finalized along with the CCP.

While the Refuge System mission and the purposes by which the Refuges are established provide the foundation for management, National Wildlife Refuges are also governed by other Federal laws, Executive Orders (EO), treaties, interstate compacts, regulations, policies and conservation initiatives pertaining to the conservation and protection of natural and cultural resources. Some of these include: Floodplain Management (EO 11988), Intergovernmental Review of Federal Programs (EO 12372), National Environmental Policy Act of 1969, Protection of Historical Archaeological, and Scientific Properties (EO 11593), Protection of Wetlands (EO 11990), Environmental Justice in Minority Populations and Low-Income Populations (EO 12898), Endangered Species Act of 1973, as amended, Emergency Wetlands Resources Act of 1986, Fish and Wildlife Act of 1956, National Historic Preservation Act of 1966, as amended, Coastal Zone Management Act of 1972, as amended, Responsibilities of Federal Agencies to Protect Migratory Birds (EO 13186), Migratory Bird Treaty Act of 1918, the Fish and Wildlife Conservation Act of 1980, as amended, Neotropical Migratory Bird Conservation Act of 2000, North American Waterfowl Management Plan, U.S. Shorebird Conservation Plan, Riparian Bird Conservation Plan (Riparian Habitat Joint Venture / California Partners in Flight), North American Bird Conservation Initiative, and the North American Waterbird Conservation Plan.

The U.S. Fish and Wildlife Service and the National Wildlife Refuge System

U.S. Fish and Wildlife Service

The Service is the primary Federal agency responsible for conserving, protecting and enhancing the Nation's fish and wildlife populations and their habitats for the continuing benefit of the American people. Although the Service shares this responsibility with other Federal, State, Tribal, local, and private entities, the Service has specific responsibilities for migratory birds, threatened and endangered species, inter-jurisdictional fish, and certain marine mammals. These are referred to as Federal trust species. The Service also manages the National Wildlife Refuge System and National Fish Hatcheries; enforces Federal wildlife laws and international treaties related to importing and exporting wildlife; assists State fish and wildlife programs; and helps other countries develop wildlife conservation programs. The Service has similar responsibilities for the lands and waters it administers to support the conservation and enhancement of fish and wildlife.

The National Wildlife Refuge System

The National Wildlife Refuge System is the world's largest collection of lands specifically managed for fish and wildlife conservation. Unlike other Federal lands that are managed under a multiple-use mandate (e.g., National Forests and lands administered by the U.S. Bureau of Land Management), the Refuge System is managed primarily for the benefit of fish, wildlife, and plant resources and their habitats. The Refuge System consists of over 545 units that provide nearly 95 million acres of important habitat for native plants and many species of mammals, birds, fish and threatened and endangered species.

National Wildlife Refuge System Mission and Goals

The mission of the National Wildlife Refuge System is “to administer a national network of lands and waters for the conservation, management and, where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans” (1997 Improvement Act).

The goals of the National Wildlife Refuge System are to:

- a. *Fulfill our statutory duty to achieve refuge purposes(s) and further the System mission;*
- b. *Conserve, restore where appropriate, and enhance all species of fish, wildlife, and plants that are endangered or threatened with becoming endangered;*
- c. *Perpetuate migratory bird, interjurisdictional fish, and marine mammal populations;*
- d. *Conserve a diversity of fish, wildlife, and plants;*
- e. *Conserve and restore, where appropriate, representative ecosystem of the United States, including the ecological processes characteristic of those systems; and*
- f. *Foster understanding and instill appreciation of fish, wildlife, and plants, and their conservation, by providing the public with safe, high-quality, and compatible wildlife-dependent public use. Such use includes hunting, fishing, wildlife observation and photography, and environmental education and interpretation.*

San Francisco Bay National Wildlife Refuge Complex

The San Francisco Bay area has had a significant human presence stretching back thousands of years. A number of Native American tribes have inhabited the area, including the earliest residents, the Ohlone. Later, Spanish settlers immigrated to the area in the late 1700s. The years following the California gold rush in 1849 caused explosive growth and development that placed greater demands on the sensitive lands surrounding the Bay. For example, the salt industry converted tens of thousands of acres of salt marsh into commercial salt ponds.

Conversion of wetlands to support development continued well into the 20th century and today, nearly 85 percent of the Bay’s original marshes and shorelines have been altered. With the support of citizens and public officials, seven refuges have been created in the San Francisco Bay Area: Farallon NWR (1909), Salinas River NWR (1973), San Pablo Bay NWR (1974), San Francisco Bay NWR (1974), Ellicott Slough NWR (1975), Antioch Dunes NWR (1980), and Marin Islands NWR (1992). These seven refuges, spanning Monterey Bay to the San Francisco Bay Delta, were combined to create the Refuge Complex. These refuges provide a variety of critical nesting habitat, traditional grounds, and resting areas for Pacific shorebirds, waterfowl, species of concern, and endangered species. Unlike other refuges located in remote locations, each of the seven refuges shares the task of pursuing wildlife conservation objectives while addressing human needs

in a highly urbanized environment. Specifically, Congressman Don Edwards worked with Congress to approve the purchase of lands for the San Francisco Bay National Wildlife Refuge, which was officially established in 1974 (Public Law 92-330). This Refuge was officially renamed Don Edwards San Francisco Bay NWR in 1995 and serves as the Complex's headquarters.

The Marin Islands National Wildlife Refuge and State of California Ecological Reserve

Introduction

The Marin Islands Refuge was established as the 479th National Wildlife Refuge and added to the San Francisco Bay NWR Complex in April of 1992. The Refuge was established to provide wintering habitat for migratory birds and nesting habitat for waterbirds. It was established as a joint NWR and State Ecological Reserve (SER) with day-to-day management provided by the Service under a memorandum of understanding with the California Department Fish and Game. The Refuge is located in the San Rafael Bay, within the city limits of San Rafael, Marin County, California (See Figure 1). It encompasses 339.29 acres of submerged tidelands and two islands. East Marin Island is approximately 10.28 acres and West Marin Island is approximately 2.8 acres. West Marin Island is home to one of the largest heron and egret colonies in northern California.

Figure 1. Location Map



San Francisco Bay National Wildlife Refuge Complex

LEGEND

— Approved Refuge Boundary


 Prepared by: Branch of GIS & Cartography
 Region 1, Division of Refuge Planning
 911 NE 11th Avenue
 Portland, OR 97232-4161
 503.251.6221 7/18/04


 UTM ZONE 10 N
 NAD 83

0 10 20 40 Miles
 0 12.5 25 50 Kilometers

Refuge Setting

The Refuge's two islands (See Figure 2) and surrounding tideland are located in San Rafael Bay near the city of San Rafael, which is the closest mainland location. The Refuge is also within the coastal California North American Bird Conservation Region. The area surrounding the Refuge is heavily urbanized and the nearby waters attract recreational and commercial boating. The islands of the Refuge are officially closed to the public, though occasional illegal trespassing occurs by some recreational boaters.



East Marin Island
USFWS

There is no available historic data on the specific natural conditions of the Marin Islands. In pre-settlement times, the Refuge habitat was thought to primarily consist of coast live oak woodlands, coastal sage scrub, and coastal grasslands (Baye 2005). The islands were isolated by a rise in sea level during the late Holocene period, approximately 3000 years B.C. (Atwater et al. 1979). Given this separation from the mainland, the historic flora on Marin Islands represents a limited sample of the common widespread species of the flora found along northeastern San Francisco Bay. The soil on Marin Islands is categorized as the Tocaloma-McMullin complex of gravelly loams, loams, and Saurin clay loams. However, the soils on East Marin Island have been modified by human activities, including the addition of a high content of fine shell fragments (USDA 1979, Kroll 1991).

The Refuge vegetation currently consists of mixed evergreen forest, coastal prairie, coastal salt marsh, and northern coastal scrub. The majority of Refuge land is submerged tideland. Of the two islands, the larger East Marin Island harbors many non-native and invasive plant species due, in part, to earlier planting by previous owners of the island. Previous owners built two residential structures, a pumphouse and water storage tank on East Marin Island. West Marin Island is surrounded by cliffs, providing little opportunity for access. Limited by accessibility, there is no visible human disturbance on this island today, except for some signage. While there are no known endangered species or mammals that breed on the Refuge, California brown pelicans were observed roosting at West Marin Island during low tide and foraged in the surrounding waters continuously throughout the summer season in 2005 (pers. comm., Block). The islands, however, provide nesting habitat to one of the largest heron and egret colonies in northern California.

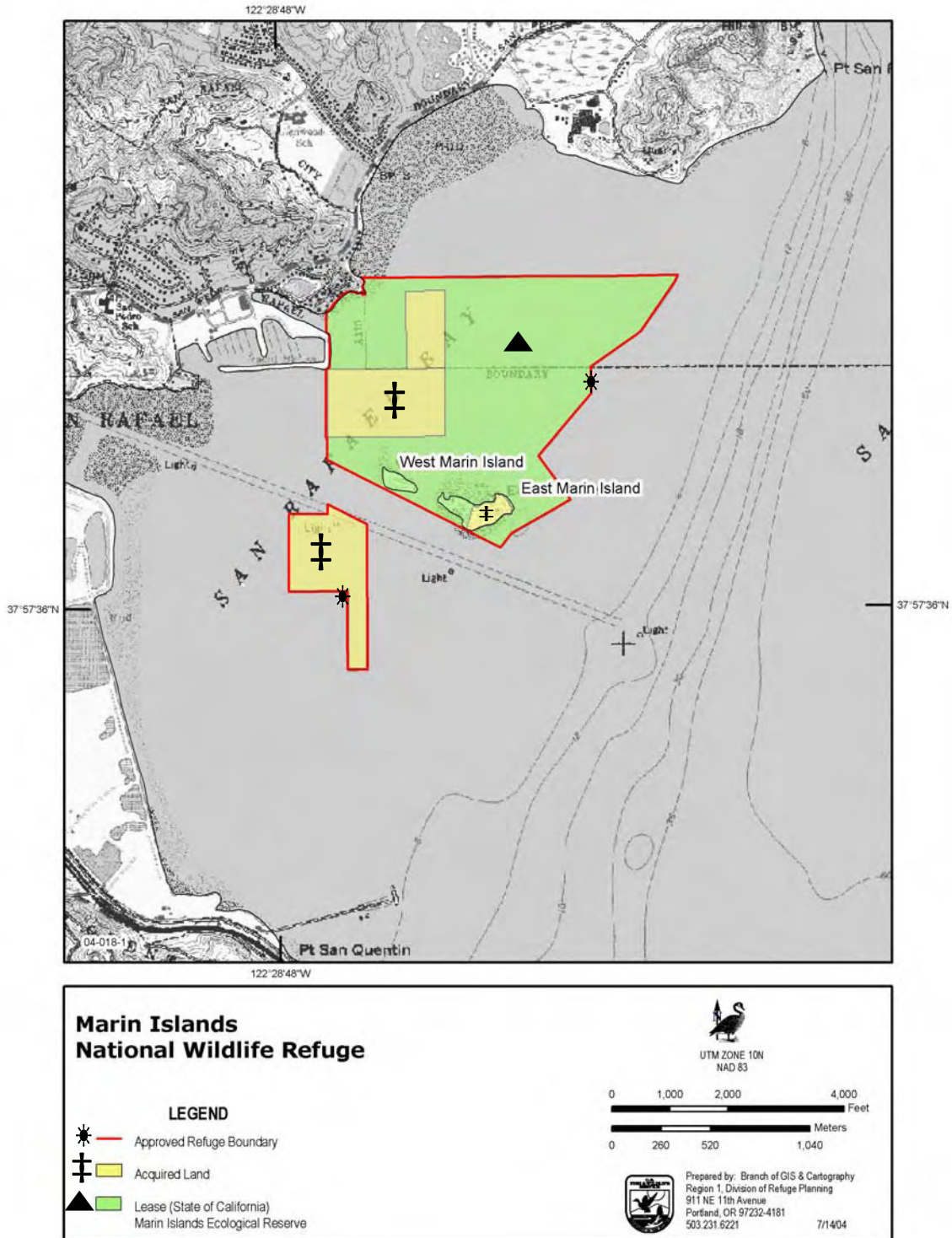
Refuge History

The earliest available written records indicate that Spain claimed ownership of California beginning in 1542 and therefore, ownership of the Marin Islands. However, there is significant historical knowledge and evidence that Native Americans in Marin County occupied the islands at one time. Mexico's independence from Spain in 1822 resulted in the transfer of ownership of the islands to Mexico. Chief Marin of the Hukueko tribe, for which the area and islands were named, used the islands as a hideout to elude Mexican soldiers in 1824 (Teather 1986). The islands were ceded to the United States in 1846 as a result of the Mexican-American War.



West Marin Island
USFWS

Figure 2. Refuge Map



The islands became property of the United States when California was admitted into statehood in 1850. The history of the property's ownership is unclear from 1850 to the late 1920s. The Federal government likely retained ownership of the property until about 1929, but research indicates it may have intermittently changed hands among an unknown number of owners until that time. The last private owner was the Harbor Tug and Barge Company, a subsidiary of Crowley Maritime Corporation, which ran a local tugboat company. Shipping magnate Thomas Crowley charged his brother with the duty of purchasing the islands around 1929 at a government auction for \$45,000. The purchase was envisioned as an investment; Crowley thought the island would be naturally used as footings for the Richmond Bridge, which was under construction at that time (Peabody 2004). However, the islands were never used in the construction of the Richmond Bridge, but did serve as a retreat for the Crowley family. An arc and pilot house sat on pilings on the shore of East Marin Island, serving as temporary residences for the family. While the Crowley family used the island primarily as a day retreat, two houses were eventually built on the island. The main house was constructed around 1945-1946 by architect, Mario Corbett. The second smaller guest house was constructed 20 years later by architect Clarence Mayhew. Rocks from the island's beach were used in the foundation of the main house (Peabody 2004). Beach rocks were also used to build the San Quentin prison located in Marin County, California (Peabody 2004).

West Marin Island attracted fewer inhabitants than East Marin Island. After World War II, the Sea Scouts, a youth seamanship program, used West Marin Island as a campground and recreational area (pers. comm., French). However, by the late 1950s through early 1960s, use of West Marin Island slowed or stopped in favor of other islands offering facilities. For the most part, West Marin Island was untouched while privately owned by the Crowley family. The islands were marketed in the 1980s as a \$4.5 million private retreat, but there was no interest (Thurman 1990). In the 1980s, a small flock of Barbary sheep (*Ammotragus lervia*) was introduced to East Marin Island to reduce fire hazard and control vegetation (Schoenherr 1999).

During the period that the Harbor Tug and Barge Company sought to sell the Marin Islands, local citizens were concerned with the potential conversion of the Marin Islands from a single-family retreat to high intensity recreation or development. The Friends of the Marin Islands group formed to successfully lobby and raise funds to protect the valuable natural resources of the islands. The Friends and the California Coastal Conservancy purchased an option to buy the islands and surrounding tidelands. With the expiration of that option, the Trust for Public Land later purchased another option to buy the islands. Numerous agencies, organizations and citizens participated in the purchase of this area to establish a National Wildlife Refuge and State Ecological Reserve including:

- U.S. Fish and Wildlife Service
- Marin County Open Space District

- California State Lands Commission
- Wildlife Conservation Board
- California Department of Fish and Game
- The Richard and Rhoda Goldman Fund
- Crowley Maritime Corporation
- Friends of Marin Islands
- Marin Audubon Society
- Golden Gate Audubon Society
- Thomas B. Crowley
- Constance Crowley Bowles
- Richard D. Spight
- GAP Foundation
- Dean Witter Foundation
- Hundreds of individuals

Timeline of the Refuge's History

Pre 1820

The Miwok Indians inhabited the Marin Islands. Cultural resources on the Refuge indicate many years of Miwok use.

Approximately 1820

The Mexican Government seized the islands from the Miwoks and held the claim to the islands until the end of the Mexican-American War in 1846.

1848

The Marin Islands were officially transferred to the United States with the signing of the Treaty of Hidalgo in 1848.

1929

The Marin Islands are purchased by shipping magnate Tom Crowley Sr.

1945-46

Thomas Crowley Sr. constructs main house on East Marin Island for use as a retreat

Between 1965 and 1970

Thomas Crowley Sr. builds guest house on East Marin Island.

1983

Crowley Maritime Corporation puts the Marin Islands up for sale for \$4.5 million.

April 16, 1992

Purchase of the Marin Islands complete for \$3 million from public and private sources.

September 19, 1992

Senator Barbara Boxer designated this day Marin Islands National Wildlife Refuge Day.

Refuge Establishment and Explanation of Refuge Purposes

Lands within the Refuge System are acquired and managed under a variety of legislative acts and administrative orders and authorities. The official purpose or purposes for a refuge are specified in or derived from the law, proclamation, executive order, agreement, public land order, funding source, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit. The purpose of a refuge is defined when it is established or may be modified when new land is added to an existing refuge. When an addition to a refuge is acquired under an authority different from the authority used to establish the original refuge, the addition takes on the purposes of the original refuge, but the original refuge does not take on the purposes of the addition. Refuge managers must consider all of the purposes. However, the purposes dealing with the conservation, management, and restoration of fish, wildlife and plants, and their habitats, takes precedent over other purposes in the management and administration of a refuge.

The 1997 Improvement Act directs the Service to manage each refuge to fulfill the mission of the Refuge System, as well as the specific purposes for which that refuge was established. Refuge purposes are the driving force in developing refuge vision statements, goals, objectives, and strategies in the CCP. Refuge purposes are also critical to determining the compatibility of all existing and proposed refuge uses.

Marin Islands National Wildlife Refuge was established under the authority of the Fish and Wildlife Act of 1956 and the Migratory Bird Conservation Act.

According to these authorities, the primary Refuge-wide purposes are:

“...for the development, advancement, management, conservation, and protection of fish and wildlife resources...” 16 USC 742f (a) (4) and “...for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude...” 16 USC 742f (b) (1) (Fish and Wildlife Act of 1956).

According to the environmental assessment establishing the Refuge, The Marin Islands was designated to protect an important existing egret and heron rookery on West Marin Island and to increase colonial nesting bird use on East Marin Island (USFWS 1992).

Interim Refuge Goals at the time Marin Island NWR was established include (from 1996 Interim Goals):

- 1- To protect the herons and egrets that nest on West Marin Island and to protect and enhance the nesting, feeding and roosting habitat that supports them.
- 2- To protect, restore and enhance the unique island ecosystem and adjacent tidelands for a diversity of fish and wildlife species native to the San Francisco Bay area.
- 3- To establish and provide opportunities for wildlife-oriented education and recreation within the highly urbanized San Francisco Bay area.



Heron and Egret Colony
USFWS

Current Management

The Refuge has no staff or offices on site due to the challenge of accessing the Refuge by boat, as well as the lack of available electrical and water resources. Management is conducted by staff who also manages San Pablo Bay NWR and Antioch Dunes NWR from an office in Petaluma, California. This staff includes a refuge manager, a refuge biologist, and a refuge maintenance worker. Refuge staff accesses East Marin Island by refuge watercraft and a dock. Refuge staff rarely access West Marin Island due to its steep surrounding cliffs and the sensitive nature of the wildlife on the island. There is no active management of the tidal areas of the Refuge property. Law enforcement from the San Francisco Bay NWR Complex provides some surveillance of the islands, but refuge management is dependent on law enforcement conducted by the San Rafael Police Department. The San Rafael Police check the Refuge for trespassers during their vessel patrols.

Wildlife Monitoring

Annually during the spring and summer season, the heron and egret colony on West Marin Island is monitored by Audubon Canyon Ranch to determine trends in breeding populations, reproductive success, health, and any disturbance factors. Audubon Canyon Ranch is an organization established to protect heronries on the West Coast through preservation, environmental education and research. Monitoring of the colony began in

1979. Specifically, the great blue heron (*Ardea herodias*), snowy egret (*Egretta thula*), great egret (*Ardea alba*), and black-crowned night heron (*Nycticorax nycticorax*) are monitored annually. Other waterfowl are also included in the survey. Monitoring activities are conducted by boat and from East Marin Island and they do not access West Marin Island to avoid disturbance. Because the nests are mostly shrouded in the vegetation, surveys can only monitor a portion of the colony. Recent surveys found that individuals in the colony may choose another local site for nesting in any given year.

Resident raven (*Corvus corax*) predation of the heron and egret colony has been detected during recent years. A single pair of resident ravens includes the Marin Islands as part of their territory and protects these areas from other potential predators (e.g., red-tailed hawks, peregrine falcon, and other ravens). The pair nests on East Marin Island. Study of raven predatory behavior at the Marin Islands occurred in 1999, 2000, and 2005. The purpose of these studies is to determine the impact of raven predation on the overall populations and reproductive success of heron and egret colony on West Marin Island.

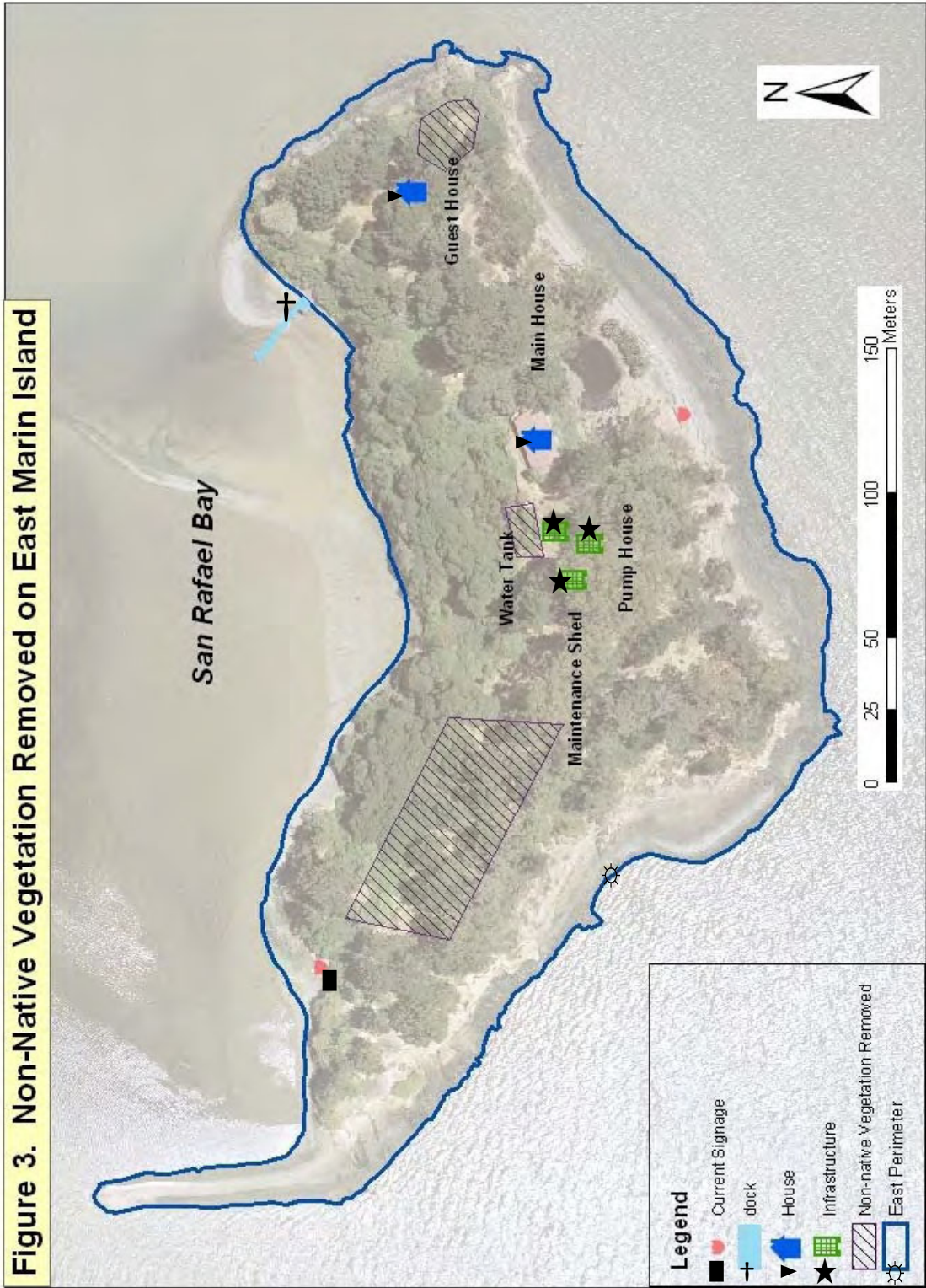
Invasive Vegetation Control

The past human influence on East Marin Island has introduced and resulted in infestations of non-native vegetation. West Marin Island has substantially less non-native vegetation because it was not subjected to disturbance from long-term human activity. Because the Refuge lacks electricity, non-native control has been limited to hand cutting or gas-powered chainsaws to remove fennel, acacia, Scotch broom, and young Monterey Pine. It is not possible to remove invasive plants by prescribed burns, digging or uprooting vegetation because the island soil is considerably sandy and erosive. Figure 3 indicates areas where vegetation has been removed.

Public Access and Wildlife-Dependent Recreation

Public use activities are not allowed on refuges until determined compatible with a refuge's purpose. Such uses include hunting, fishing, wildlife observation, photography, and environmental education and interpretation. Both islands are closed to unrestricted access and no public use activities have been assessed because of wildlife protection and public safety. Signage is posted along the shoreline of both islands noting this restriction. However, recreational boaters are able to view the islands and wildlife from their watercraft. Fishing from boats has existed in the area prior to the Refuge's establishment and continues today. This CCP contains a draft compatibility determination that formally assesses this activity. Fishing is prohibited from the islands' shoreline.

Figure 3. Non-Native Vegetation Removed on East Marin Island



Land Ownership

Several donors were involved with purchasing the islands and the tidelands (as noted in the *Refuge History* section of this document). These islands and tidelands total 339.29 acres and were permanently transferred to the California Department of Fish and Game (CDFG), the State Lands Commission, and the Service for ownership and management (See Appendix S). East Marin Island totals 10.28 acres and West Marin Island totals 2.8 acres, leaving 326.21 acres of tidelands. The Service took ownership of the eastern portion of East Marin Island and approximately 80 acres of tidelands (See Figure 2). The State Lands Commission took ownership of the remaining tidelands within the approved refuge boundary. The CDFG owns West Marin Island (2.8 acres) and the western portion of East Marin Island. Regardless of specific ownership divisions of the area, the entire area of islands and tidelands is designated as the Marin Islands NWR and as a SER. This area is managed under Service and State of California mandates. The Service provides day-to-day management of the entire Marin Islands NWR/SER according to memorandum of understanding (Appendix S) and under the National Wildlife Refuge System Administration Act.

Existing Partnerships for Management

The Refuge has benefited from partnerships with several entities and individuals. The local San Rafael Police Department provides additional law enforcement to support the Service's Law Enforcement efforts. The Save The Bay Association conducts a regular education and plant restoration program on East Marin Island to reestablish native vegetation to the Refuge. The Friends of San Pablo Bay National Wildlife Refuge are currently helping to finance the construction of a greenhouse at the San Pablo Bay Refuge to propagate native plants for habitat restoration activities. The Friends group has also participated in removal of non-native vegetation on East Marin Island.



Volunteers conducting plant restoration

© Save The Bay

Relationship to Ecosystem Management Goals

To the extent possible, a CCP will assist in meeting conservation goals established in existing national and regional plans, State fish and wildlife conservation plans, and other landscape-scale plans covering the same watershed or ecosystem in which the Refuge resides (602 FW 3.3). There are several water and land management plans in place at the Refuge's location in the San Francisco Bay watershed in the Central Basin region. The watershed conveys the waters of the Sacramento and San Joaquin rivers into the Pacific Ocean. The watershed forms the centerpiece of the United States' fourth largest metropolitan region. The freshwater to hypersaline environment also supports a biologically diverse area.

Watershed planning is directed by the Regional Water Quality Control Board (RWQCB), but requires the involvement of several agencies, local governments, nonprofit organizations, and individuals. The RWQCB regulates surface and groundwater sources. The RWQCB developed a Water Quality Control Plan (Basin Plan) for the watershed that is the master policy document that contains descriptions of the legal, technical, and programmatic bases of water quality regulation in the San Francisco Bay region. This document is reviewed every three years to keep up with the technological, hydrological, political, and physical changes in the region.

In addition to the Basin Plan, the San Francisco Estuary Project was formed in 1987 as a vehicle to coordinate Federal, State, and local programs to promote effective management of the San Francisco Bay-Delta Estuary. The U.S. Environmental Protection Agency and the State of California are the primary sponsors of the Estuary Project. The Estuary Project has developed a Comprehensive Conservation and Management Plan (CCMP) to address five critical concerns of the watershed: decline of biological resources; increased pollutants; freshwater diversion and altered flow regime; dredging and waterway modification; and intensified land use. The CCMP strives to maintain, protect, and enhance the ecological integrity of the Estuary within the given urban context. The CCMP reviews several program areas of the watershed including: Aquatic Resources, Wildlife, Wetlands Management, Water Use, Pollution Prevention and Reduction, Dredging and Waterway Modification, Land Use, Public Involvement and Education, and Research and Monitoring.

A Marin County Plan was created to guide the direction of development in Marin County. The Plan considers economic, environmental, and equity elements in the planning process. The natural environment is one component of the Plan, which takes into consideration the need and retention of open space in the county. The Marin Islands NWR is designated an important open space area in this Plan.

Adaptive Management

The Service acknowledges that much remains to be learned about the species, habitats, and physical processes that occur on the Refuge, and about the ecological interactions

between species. When faced with uncertainty resulting from complex ecological interactions or gaps in available data, the most effective approach to resource management over the long term is an adaptive one. *Adaptive management* refers to a management style in which the effectiveness of management actions is monitored and evaluated on an ongoing basis, and future management is modified as needed, based on the results of this evaluation or other relevant information that becomes available. The Service has been practicing adaptive management on the Refuge since 1991 and plans to continue this practice. Accordingly, the management scenario proposed in this CCP provides for ongoing adaptive management of the Refuge; its adaptive management component is described more fully in Chapter 6, *Plan Implementation*. The CCP may be amended as necessary at any time under an adaptive management strategy.

Chapter 2. The Comprehensive Conservation Planning Process

This CCP/EA for the Refuge is intended to meet the dual requirements of compliance with the 1997 Improvement Act and NEPA. The development of this CCP/EA was also guided by the Refuge Planning Policy outlined in Part 602, Chapters 1, 3, and 4 of the Service Manual (Fish and Wildlife Service 2000). Service policy, the 1997 Improvement Act, and NEPA provide specific guidance for the planning process. For example, Service policy and NEPA require the Service to actively seek public involvement in the preparation of environmental documents such as EAs. NEPA also requires the Service to give serious consideration to all reasonable alternatives, including the “no action” alternative, which represents continuation of current conditions and management practices. Alternative management scenarios were developed as part of the planning process and can be found in Appendix H (Environment Assessment).

The Planning Process: How this CCP was Developed

Key steps in the CCP planning process and depicted below and include:

1. Preplanning
2. Identifying issues and developing a vision statement
3. Gathering information
4. Analyzing resource relationships
5. Developing alternatives and assessing environmental effects
6. Identifying a preferred alternative
7. Publishing the draft plan and NEPA document
8. Documenting public comments on the draft plan
9. Preparing the final plan
10. Securing approval of the Regional Director
11. Implementing the plan

California/Nevada Refuge Planning Office. Appendix T lists the members of the planning core team.

The Planning Expanded Team

The expanded team is the advisory forum of the CCP process. Its role is significant because of the Refuge's history of networking and partnerships with local, state and federal agencies, community groups, research institutes, and non-profit organizations concerned with the Marin Islands. The expanded team is composed of state and federal congressional officials, local government officials, non-profit organizations, community groups, and other interested parties. The goal of the expanded team is to provide comments on the goals and strategies of the plan to help the Service with the decision-making process.

Public Involvement in Planning

Public involvement is an important and required component of the CCP and NEPA process. Public scoping meetings allow the Service to provide updated information about the Refuge System and the Refuge. More importantly, these meetings allow refuge staff to hear public comments and concerns. Public meetings provide a forum for important discussion and identify important issues regarding the Refuge and its surrounding area.

The Refuge hosted a public scoping meeting on October 19, 2004. Public comments were generated from the public scoping meeting and the Federal Register Notice published on September 22, 2004. Approximately 15 people attended the meeting. A number of individuals provided comments at the meeting, via email and postal mail. The following organizations submitted comments: The Wilderness Society, Save The Bay Association and Audubon Canyon Ranch (ACR). The following paragraphs describe themes of the comments.

Public Access, including Prohibiting Public Access

Comments regarding public access ranged from prohibiting any access to allowing unlimited public access with interpretive trails. Comments related to prohibiting access ranged from barring public access to prohibiting refuge management from accessing the islands to protect the heron and egret colony and allow natural restoration of the islands. Comments supporting public access included recommendations to create a water trail for use by passive recreation, such as kayaking (as suggested by Save The Bay Association). Another comment recommended that ACR develop a guided tour based on their knowledge of the heron and egret colony on the Refuge. Primarily, public access was supported to allow opportunities for bird watching.

Wildlife and Feeding Habitat

A number of recommendations promoted wildlife protection as the main priority for the Refuge. ACR stressed the need to protect the egret and heron colony, and provide suitable nesting habitat for the colony on East Marin Island. Several individuals

suggested removing the buildings on East Marin Island in order to deter trespassing and wildlife disturbance on the Refuge.

ACR and an individual also recommended monitoring predators and their effects on the colony and if necessary, management of these predators. ACR also recommended developing a protocol for monitoring and quick removal of non-native predators. Two individuals recommended studying the impacts of the resident Canada geese population.

Several recommendations were made to protect or acquire nearby feeding areas that appear to be silting up.

Restore native plants and remove non-native plants

Several individuals and organizations supported the removal of non-native plants and replacement by native plants. San Francisco's Save The Bay Association supports continued public participation in local and community-based opportunities to restore native vegetation on East Marin Island. Another comment recommended burning brush collected from non-native plant removal activities. ACR also recommended monitoring vegetation for changes in structure and recruitment of nest plant species. ACR suggested removing non-native vegetation on East Marin Island and replacing it with predominant native vegetation to reflect assemblages found on the northeast side of West Marin Island. Specific non-native species include eucalyptus and pine which should be replaced gradually with native oak and buckeye.

Maintain/Restore Lagoon

One comment suggested restoring the lagoon area to its original state. Another comment suggested preserving the area for use by waterbirds and shorebirds.



Manmade lagoon on East Marin Island
USFWS

Local Monitoring

Two individuals suggested the use of community-based patrols, including participation by the recreational fishing community.

Removal of Houses and Related Infrastructure

There were several recommendations to remove the housing and related structures from East Marin Island. There were also recommendations to renovate the structures for use as a caretaker office, visitor center, or research facility.

Public Education and Research Opportunities

One individual recommended educating fishermen, guides and private boaters that frequently use the area about appropriate boating around the Refuge. Two comments suggested using the Refuge as a research facility for students.

Boater Traffic Limits

Some recommendations suggested decreasing boater access within the refuge boundary. One comment recommended putting signs on buoys to alert boaters of the habitat value of the islands, while another suggested decreasing traffic in the area to encourage the return of seals and other marine mammals.

Wilderness Area Designation

The Wilderness Society recommended considering wilderness area designation for Refuge.

Research Sub-tidal and Tidal Resources of the Refuge

A number of individuals and Save The Bay Association suggested inventorying the submerged areas of the Refuge. They commented that resources, including possible endangered or threatened species, may occur within refuge boundaries.

Development of Refuge Vision

A vision statement is developed or reviewed for each individual refuge unit as part of the CCP process. Vision statements are grounded in the unifying mission of the Refuge System, and describe the desired future conditions of the refuge unit in the long term (more than 15 years). They are based on the refuge's specific purposes, the resources present on the refuge, and any other relevant mandates.

Development of Refuge Goals, Objectives and Strategies

Refuge goals are necessary for outlining the desired future conditions of a refuge in clear and succinct statements. The Refuge System defines goals as a “descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units” (602 FW 1). Objectives and strategies are then developed to meet those goals. Objectives are defined as a “concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is

responsible for the work” (602 FW 1). Strategies are defined as a “specific action, tool, technique, or combination of actions, tools, and techniques used to meet unit objectives” (602 FW 1). Well-written goals, objectives and strategies direct work towards achieving the Refuge’s vision and purpose. Interim refuge goals were developed within the context of the authorities that established the Refuge, Refuge System mission and goals, the Service goals and policies, and ecoregion goals. The existing interim refuge goals are listed in Chapter 1. These goals will be modified through the CCP development process.

The Refuge is within the Service's Central Valley/San Francisco Bay Ecoregion. The goal identified for all Service activities in this ecoregion is "to restore, conserve, and protect the ecological systems and biological diversity of the Central Valley/San Francisco Bay Ecoregion for present and future generations." (Medlin et al. 1996)

In addition, the goals of the Marin Islands NWR support the Service's urban refuge policy which states that a primary purpose of urban refuges is ..."to foster environmental awareness and outreach programs to develop an informed and involved citizenry that will support fish and wildlife conservation." (Smith 1991)

Development of Alternatives

The CCP process includes the development of a range of alternatives that can be implemented to meet the goals of the Refuge System and the purpose of the Refuge. The Refuge System defines alternatives as “different sets of objectives and strategies or means of achieving refuge purposes and goals, helping fulfill the Refuge System mission, and resolving issues (602 FW 1). The alternatives are developed based on comments from the scoping period, as well as input from the planning team and other Service staff. The EA (Appendix H) describes the development of alternatives, assessment of their environmental effects, and identification of the preferred management alternative (proposed action).

Plan Implementation

The CCP will be reviewed by refuge staff to coordinate annual work plans and update the Refuge Operational Needs System database. This database describes the unfunded budget needs for each refuge and is the basis upon which the Refuge receives funding increases for operational needs. The plan may also be reviewed during routine inspections or programmatic evaluations. Results of the reviews may indicate a need to modify an integral part of the plan implementation, and management activities may be modified if the desired results are not achieved. If minor changes are required, the level of public involvement and NEPA documentation will be determined by the refuge manager. The CCP will be formally revised about every 15 years.

Chapter 3. Refuge and Resource Description

There is little written information about the historic conditions of the Refuge. Prior to human cultivation, the islands represented native vegetation communities representative of the surrounding San Francisco Bay area, as described previously in the Refuge Setting section of this document. West Marin Island rises 26 meters above the bay waters off the shoreline of San Rafael. Native grasses, shrubs, and trees provide the necessary sites for the great egrets, snowy egrets, great blue herons, and black-crowned night herons that nest on West Marin Island. East Marin Island once served as a vacation retreat for a prominent family, and now supports a variety of introduced and native vegetation that provide nesting materials and roosting sites for the water birds that nest on West Marin Island. Little is known about the remaining portion of the Refuge which is submerged tidal and sub-tidal environments. There has been no active monitoring or management of tidal and sub-tidal environments of the Refuge.

Sheltered coves and shallow mudflats support wintering populations of diving ducks and shorebirds, feeding sites for the fledged herons and egrets, and roosting sites for a variety of waterbird species including terns, cormorants, gulls, and pelicans. Refuge facilities include a boat dock and two houses on East Marin Island, which are closed to the public for safety reasons.

Physical Resources

Climate

The summer climate of the West Coast is dominated by a semi-permanent high pressure cell, which is high-centered over the northeastern Pacific Ocean. Because this high pressure cell is quite persistent, storms rarely affect the California coast during the summer. In winter, the Bay Area experiences periods of storminess and moderate-to-strong winds and periods of stagnation with very light winds. The San Francisco Bay Area climate is characterized by moderately wet winters and dry summers. Winter rains (November through April) account for about 90 percent of the average annual rainfall. (BAAQMD 2004)

The eastern side of Marin County has warmer weather and less fog, due to its distance from the outer coast. Nearby San Rafael experiences average maximum winter temperatures in the high 50s to low 60s, and average maximum summer temperatures in the high 70s to low 80s. Average minimum temperatures in San Rafael are in the low 40s in the winter and low 50s in the summer. The prevailing wind directions throughout Marin County show less variation, and are generally from the Northwest. San Rafael reports an average rainfall of 95 centimeters per year. Consistent with the Bay Area Mediterranean climate, 84 percent of the annual rainfall in Marin occurs November through March.

Surface Hydrology

The Refuge is located in San Rafael Bay, which is in the north part of the larger San Francisco Bay estuary. San Rafael Bay is a shallow expanse of open water, averaging less than three meters deep. Massive sedimentation rates after the gold rush (from 1856 to 1887) resulted in the deposit of more than 250 million cubic meters of sediment into the northern portion of the San Francisco Bay estuary. From 1887 to 1922, sediment continued to fill this area, which finally held constant from 1922 to 1951. However, from 1951 to 1983, this portion of the estuary has lost sediment at a rate of about one-quarter of a million meters per year. This sediment loss is a result of reduced peak flows into the Bay (Jaffe et al. 1983).

A tidally-influenced lagoon is located on the south side of East Marin Island at the base of a 75-foot cliff. This stagnant brackish pond receives tidal waters during high tides when wind action allows waves to overtop the island's beach and for water to enter the lagoon. The lagoon is not known to support wildlife or endangered species.

Water Supply

Water is not currently required for refuge management; future plant restoration projects will be planted during the rainy seasons to avoid external water needs. In this situation, refuge management expects to bring water to East Marin Island by boat. The islands were once fed groundwater via a pipeline from the mainland that provides City of San Rafael water to the island. This pipeline has since been damaged by boats that traverse over it and is no longer in service. Some non-potable water is still stored in a 12,500 gallon redwood water tank on East Marin Island. However, once that water is depleted, the tank will not be refilled.



Water tank on East Marin Island
USFWS

Water Quality

Water quality and sediment in San Rafael Bay is impacted by both the salt water of the Pacific Ocean and freshwater drainage from surrounding watersheds. Surrounded by urban and industrial areas, water quality in the San Rafael Bay has been affected by a number of contaminants. In the San Rafael Bay area, trace contaminants including copper, mercury, selenium, and nickel have exceeded water quality standards. The San Francisco Estuary Regional Monitoring Program found that 61 percent of its samples from 1997-2001 contained at least one contaminant at a concentration exceeding its water quality objective (SFEI 2003). Exceeded contaminants include DDTs, arsenic, chromium, copper, mercury, and nickel. Pesticide contamination, including such chemicals as DDE, was most severe in northern areas of the estuary. PCB concentrations were moderate in San Rafael Bay. The San Francisco Estuary Regional Monitoring Program found that 79 percent of samples collected from 1997-2001 exceeded the PCB water quality objective (SFEI 2003). The San Rafael Bay area also incurred the highest levels of polycyclic aromatic hydrocarbons (Bay Institute 2003).

Topography

West Marin Island rises approximately 26 meters above sea level and has a granite base with steep rocky banks and rolling terrain. East Marin Island is 25 meters high and also has steep rocky banks along the majority of its perimeter. The surface of the island is fairly level undulating terrain.

Geology

The Refuge is part of the larger San Francisco Bay watershed and delta. The watershed was formed by 240 million years of tectonic and erosional forces (Page 1986). The subduction of the eastward-moving edge of the Pacific plate along with tectonic uplift along the eastern boundary of the Sierra Nevada range have been the major forces shaping the large-scale features of this landscape. The lower, coastal mountains to the west are primarily composed of sedimentary rock, formed by the crumpling and uplift of marine sediments skimmed off the top of the Pacific Plate during its subduction under the North American plate. During the millions of years of its evolution, the Central Valley was alternately flooded by coastal seas, and exposed as a basin surrounded by slopes that collected and drained the watershed (Page 1986). Alternative layers of coastal marine and alluvial sediments eventually deposited to depths of 15,240 meters (Page 1986).

Generally, the underlying geological structure of the watershed was formed about two million years ago, though many topographic features changed dramatically with the advance and retreat of the great ice sheets of the Pleistocene epoch, which extended from two million to 15 thousand years before present (Page 1986). During each glacial episode, sea level dropped several dozen meters, exposing much of the continental shelf and draining what remained of the shallow inland sea that had filled portions of the Central Valley. This reduction in sea level, combined with tectonic uplift, caused the major rivers of the Central Valley to incise deep channels (Page 1986). Their combined outflows

traversed a deep gorge through the Coast Ranges (today's Golden Gate), and then flowed across a coastal plain that extended out to the Farallon Islands.

About 15,000 years ago, a climatic warming trend known as the "Holocene Transgression" signaled the final retreat of the Sierran glaciers (Page 1986). Rapid melting continued for about 9,000 years, causing global sea level to rise at a rate of approximately 20mm/yr (Atwater et al. 1979). The major sedimentary features of the watershed were formed during this period. River channels deposited large amounts of sediments, building new channels and floodplains within their entrenched valleys and resulting in the remarkably flat and uniform floor of the Central Valley (Bay Institute 1998). The rising ocean first inundated a coastal plain that is today's continental shelf, and then continued to intrude inland of the Golden Gate. By 10,000 years before the present, San Francisco Bay had started to form.

The Refuge is located in a seismically active region. The Rodgers Creek Fault-Hayward Fault runs directly through the San Rafael Bay area, which has a 27 percent probability of a 6.7 or greater earthquake before 2032 (USGS 2003). Two other fault lines, San Andreas and Concord-Green Valley are within 30 miles of the Refuge. The 1989 Loma Prieta earthquake, with a Richter magnitude of 6.9, was epicentered about 80 miles south of the Refuge. Based on its location, the Refuge is expected to experience earthquake activity in the future.

Soils

Marin Islands is made up of soil type 178 Tocaloma-McMullin complex, with 15 to 30 percent slope (Soil Conservation Service 1978). Tocaloma-McMullin is made up of two soil conditions described as shallow to moderately deep, and as moderately steep to very steep. These upland soil types are well-drained soils underlain by sandstone and shale. Tocaloma soils are moderately deep and well-drained. The surface layer is grayish brown loam, which is soil material that is seven to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles. Tocaloma subsoil is light yellowish brown very gravelly loam underlain by weathered, fractured sandstone. Tocaloma soil has moderately high permeability, and therefore low water capacity. Runoff is rapid and the hazard of water erosion is high.

McMullin soils are shallow and well-drained, which makes available water capacity very low to low. Runoff is rapid, and the hazard of water erosion is high. The surface layer is grayish brown gravelly loam. McMullin subsoil is light yellowish brown gravelly loam underlain by hard fractured sandstone. The native vegetation is mainly mixed hardwoods and brush. Elevation ranges from 15 to 460 meters.

Wilderness Inventory

As required by Service planning policy, a wilderness inventory (Appendix R) was conducted for the Refuge. None of the Refuge's lands were eligible for wilderness designation as defined in the Wilderness Act of 1964.

Air Quality

The Refuge is located in California's San Francisco Bay Area Air Basin (California Air Resources Board 2002). This area is subject to state and federal air quality standards. Areas that do not meet the standards are designated as non-attainment areas, and those that do comply are designated as attainment areas.

The primary types of pollutants regulated by state and federal law include:

- Particulate matter less than 10 microns in diameter (PM10),
- Ozone
- Carbon monoxide (CO)
- Nitrogen dioxide (NO₂)
- Sulfur dioxide (SO₂), and
- Lead

The San Francisco Bay Area Air Basin is an attainment area for state and federal CO, NO₂, SO₂, and lead standards. It is a nonattainment area for state and federal ozone standards, and State PM10 standards. Attainment reports are unknown for PM10 federal Standards (BAAQMD 2004). It is unlikely that the Service's activities would affect ozone levels. However, refuge management activities that alter the vegetative cover may expose soil to blowing wind, possibly increasing PM10 emissions.

Air pollution potential is highest on the eastern side of Marin County. This is where the semi-sheltered valleys and largest population centers are located (BAAQMD 2004).

Hazardous Materials and Contaminants

A Level 1 Survey, Contaminant Survey Checklist, was completed in 1990 for the proposed Marin Islands NWR by a Service Environmental Contaminant Specialist. The site inspection reported on-site buildings: Chemical storage, equipment repair, solvents and an on-site "sterile" or modified water bodies. No further sampling was required. In 1994, a Level 1 Survey was completed for Tract 10, with nothing to report and no further sampling was required. Recently, a limited asbestos survey was conducted by Ninyo and Moore Consultants (Ninyo and Moore 2000). Asbestos containing materials (ACMs) in good condition were found in both the main and guest houses. A Certified Asbestos Consultant should be on site for asbestos removal when it occurs. The cost of professional asbestos removal is included in the total cost of removing the buildings as figured in the Table 6.

A 2004 engineering survey yielded a low-level PCB leakage from the electrical unit in the

housing structure. The surveyors recommended removal of the entire electrical system in order to avoid any accidents on the Refuge.

Biological Resources at the Refuge

Vegetation

Vegetation on the Refuge is limited to West and East Marin Islands because the majority of the Refuge's acreages are submerged. The current estimated number of native flora for both islands is approximately 95 species. Most of East Marin Island's woody vegetation is dominated by planted non-native trees and shrubs that compete with native vegetation (Baye 2004). West Marin Island's lack of sustained human presence has resulted in persistence of native California buckeye (*Aesculus californica*), coast live oak (*Quercus agrifolia*), and blackberry (*Rubus discolor*), which have provided breeding habitat for egrets and herons of the region. No listed rare, threatened, or endangered plants are known to occur or breed at Marin Islands, although a number of species are considered rare or uncommon for Marin County (See Appendix G). A description of native and non-native vegetation types can be found in the following table. Plant list is available in Appendix C and D.



Coast live oak bud
USFWS

East Marin Island

The principal native vegetation types of East Marin Island are stands of mature coast live oak woodland with California buckeye, understory shrubs, and vines of the oak-buckeye woodland, coastal scrub dominated by California sage, coastal sea-bluff scrub/forb associations, and coastal grassland/forb associations as shown in Table 1 (Baye 2004). All native vegetation types found on the Marin Islands are heavily invaded or locally dominated by naturalized non-native shrubs and grasses that have spread from past introductions and cultivation.

Table 1. Native and Non-Native Vegetation Types on East Marin Island

<i>Vegetation Patches</i>	<i>Description</i>
Mature coast live oak woodland	also interspersed with California buckeye; generally on gently sloping/moist north-aspect slopes, sheltered from drying winds and full sun, native trees are infrequent and dwarfed on exposed southern and southwest slopes
Mature non-native blue gum (<i>Eucalyptus globulus</i>) and Monterey pine (<i>Pinus radiata</i>)	primarily mature stands with few recruitment of young stands
Extensive shrub layers dominated by introduced French broom (<i>Genista monspessulanus</i>)	extensive recruitment and quickly invades open habitat
Shrub to low tree layers dominated by local horticultural escapes of ornamental non-native plants	generally limited expansion and low recruitment
Evergreen liana and shrub layers (including ground layer) dominated by introduced ivy (<i>Hedera helix</i>), Himalayan blackberry (<i>Rubus discolor</i>), and periwinkle (<i>Vinca major</i>)	extensive expansion around the coastline and steep areas
Bulb-dominated grassland	occurring under coastal woodland, blue gum and Monterey pine overstory; also occurring beneath horticultural tree plantings
Mixed non-native annual and perennial grassland	occurring in the understory of coastal woodland, blue gum and Monterey pine
Blue wildrye (<i>Elymus glaucus</i>) and bulb grassland	occurring on sloping terraces beneath horticultural tree plantings
Coastal scrub dominated by California sage scrub	prevalent on coarse-textured unstable soils of south-facing scarps and landslide slopes exposed to southwest winds and full sun
Non-native succulent cliff vegetation	prickly-pear and iceplant species have spread along bluffs and the south shore
Mesic coastal bluff scrub	similarly exposed to coastal scrub, but occurs mostly on fractured bedrock with no soil development

Coast Live Oak Woodland

East Marin Island supports relatively mature coast live oak woodland with well-developed trunks and closed canopy, similar to stands on Angel Island. Mature California buckeye individuals occur on East Marin Island, but dominate West Marin Island. California bay (*Umbellularia californica*) is a minor component of the woodland, occurring in small clusters of small trees. The live oak woodland is associated with variable native shrub understory components, and is heavily invaded by non-native ornamental shrubs and lianas (woody vines). The woodland is minimally invaded by non-native trees, and is actively recruiting oak seedlings and saplings in the absence of browsing animals. Coast live oak seedlings show successful recruitment in recent years, but there is no comparable recruitment seen for California buckeye. (Baye 2004)



Lupinus species (sp.)
© Peter Chan

Understory Shrubs and Vines

Native understory species include poison oak (*Toxicodendron diversilobum*), snowberry (*Symphoricarpos albus* var. *laevigatus*), oceanspray (*Holodiscus discolor*), wood rose (*Rosa gymnocarpa*), and blue elderberry (*Sambucus mexicana*). California honeysuckle (*Lonicera hispidula* var. *vacillans*) is a common woody vine clambering in the trees. Three ferns also inhabit the understory, including California maidenhair (*Adiantum jordanii*, uncommon), wood fern (*Dryopteris arguta*, common), and California polypody (*Polypodium californicum*, common). Bee-plant (*Scrophularia californica*) is limited in this community, while toyon (*Heteromeles arbutifolia*) is a common shrub on the island (Ornduff and Vasey 1995).

Coastal Scrub

Northern coastal scrub is well-developed on East Marin Island, occurring at the tops and faces of the cliffs along the western, southern, and eastern portions of the island. However, this vegetation has been degraded by the dominance of blue gum litter and shade, which facilitates non-native shrub development. California sagebrush (*Artemisia californica*), seaside wooly sunflower (*Eriophyllum staechadifolium*), and bush monkeyflower (*Mimulus aurantiacus*) are common components of this community. A single individual of coyote brush (*Baccharis pilularis*) was noted in the early 1990s on the island and is considered rare. Other forbs scattered on the island include yarrow (*Achillea millefolium*), California poppy (*Eschscholzia californica*), cudweed (*Gnaphalium stramineum*), and miner's lettuce (*Claytonia perfoliata*). The sedge *Carex barbarae* forms large, conspicuous groups and *Dichondra donelliana* occur on the eastern end of the island (Ornduff and Vasey 1995).

Coastal Grassland

Common native grasses and forbs occur on the plateau of East Marin Island including needlegrass (*Nassella lepida*), soap plant (*Chlorogalum pomeridianum*), snakeroot (*Sanicula crassicaulis*), and hedge nettle (*Stachys ajugoides* var. *rigida*) (Ornduff and

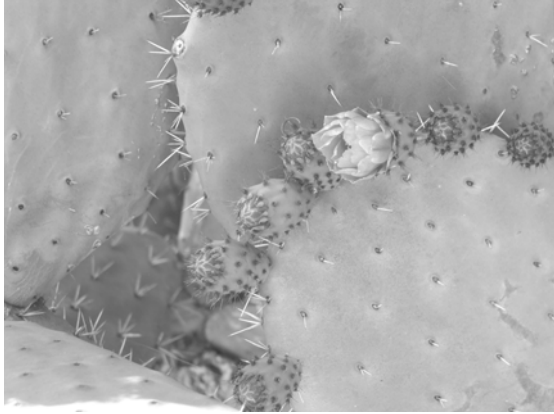
Vasey 1995). Nonnative grasses include *Claytonia perfoliata* and *Polypodium californicum*. Intact stands of native perennial grassland have been well-preserved on East Marin Island due to recent (more than 10 to 15 years ago) intense sheep grazing (Baye 2004).

The 2004 vegetation survey indicated a short-term recovery of native grasslands species diversity. Native perennial grassland elements, including bunchgrass (*Nasella* spp.), blue wildrye (*Elymus glaucus*), creeping wildrye (*Leymus triticoides*), bentgrass (*Agrostis pallens*), bulbs (*Tritelia*, *Chlorogalum*, and *Zigadenus*), appear stable or are increasing in partially shaded understory grassland of southern island slopes beneath mature non-native tree plantings (Baye 2004).

Non-native Vegetation

East Marin Island is dominated by introduced, overstory species, including Monterey pine (*Pinus radiata*), blue gum (*Eucalyptus globulus*), and French broom (*Genista monspessulana*). The Monterey pine and blue gum stands are predominately mature with patches of young pines and young blue gums. This suggests that prior maintenance reduced the recruitment of blue gum and pine, and therefore, it is likely that stand density would increase without regular maintenance. East Marin Island is also dominated by a number of non-native legume species such as French broom that are likely to cause elevated nitrogen in the soil (Baye 2004). French broom is a highly invasive, persistent nitrogen-fixing shrub. It forms monotypic stands in open vegetation and semi-shaded woodland, and leaves abundant persistent seed banks that can regenerate juvenile populations for many years after the adults are removed (Baye 2004). French broom on the island consists of all age classes, and spreads quickly through open habitat and under coast live oak canopies. Stands of non-native *Acacia* spp. also have considerable recruitment on the island. Fennel is another legume species that has covered landslide areas on the south bluff. Pride-of-Madiera (*Echium candicans*, syn. *E. fastuosum*) is abundant to co-dominant on the island. Ornamental horticultural plants brought during previous ownership are located near the residences. These plants have not shown potential to spread across the island.

Along the shore, stands of invasive ivy (*Hedera helix*) and periwinkle (*Vinca major*) have spread over the north shore slopes near the boat dock. Prickly-pear cacti (*Opuntia ficus-carica*) on the southeast wave-cut bluffs of the island have been relatively slow, but persistent in invading the area. There is one tidally influenced lagoon (approximately 0.4 acres) located on the south side of East Marin Island (See Figure 5). This area is designated as depauperate Coastal Salt Marsh, with saltgrass (*Distichlis spicata*), jaumea (*Jaumea carnosa*), and pickleweed (*Salicornia virginica*). Aquatic green alga (*Cladophora* sp.) and ditch-grass (*Ruppia maritima*) are present in this lagoon. Several Canary Island date palms are located at the highest high tideline separating the lagoon from the Bay. These palms do not appear to have a high potential to expand and propagate.



Non-native prickly pear cactus
USFWS

On the cliff faces, live-forever (*Dudleya cymosa* ssp. *Paniculata*), wild buckwheat (*Eriogonum nudum*), California broom (*Lotus scoparius*), and sand-spurrey (*Spergularia macrotheca*) predominantly occur as scattered individuals. At the base of the southern cliff, there are large colonies of annual *Phacelia distans*, with a few plants of perennial *Stephanomeria elata* observed on the rocky slopes at the east end of the island. Some individuals of *Arbutus* also occur at the plateau. (Ornduff and Vasey 1995). During the winter, lichen are present on the soil, rocks, and trees, including *Flavopunctelia flaventior*, *Physcia callosa*, *Punctelia subrudecta*, *Rinodina* sp., and *Xanthoria polycarpa* (Ornduff and Vasey 1995).



California Buckeye
USFWS

Figure 5. East Marin Island
Lagoon Detail



Generally, the long-term trend for East Marin Island suggests an overall reduction in abundance and diversity of all native species. Native grasses could decline as the density of overstory trees expands and the trees produce more vegetation litter. Expanding non-natives are also a concern, including Bermuda-buttercup, Himalayan blackberry, jubata grass, and *Ehrharta erecta*. Currently, the most urgent threat to native plant cover on East Marin Island is the presence and continued spread of French broom.



Non-native Pride-of-Madiera
USFWS

West Marin Island

West Marin Island's primary vegetation types consist of coast live oak woodland and coastal sage scrub. West Marin Island has experienced less human activity than East Marin Island, resulting in less exposure to non-native vegetation. There is minimal information about this island because access is restricted due to the sensitivity of the heron and egret colony. West Marin Island is considered depauperate woodland dominated with low, spreading buckeyes, and occasional dwarfed coast live oak (Baye 2004). The island is not heavily forested compared to East Marin Island. Western portions of the island are mixed with coast live oak, toyon, and shrubs of wood rose. The eastern portion is dominated by larger coast live oak, toyon, and blue elderberry. Several trees in the eastern area are covered with English ivy. The dominant tree in the central and northern slopes is the California buckeye, which is a favored nesting site for herons and egrets. Some coast live oak trees occur in this area, but are dwarfed by the buckeyes (Ornduff and Vasey 1995). All of the overstory trees are dwarfed in stature relative to East Marin Island's individuals.

Northern coastal scrub on the island occurs in two areas. The southern and eastern margin of the island is dominated by California sagebrush, a few shrubs of bush monkeyflower, live-forever (*Dudleya cymosa*), wild buckwheat and the introduced sow

thistle (*Sonchus oleraceus*). Northern coastal scrub along the western and northern margins of the island includes coyote brush and seaside woolly sunflower. Northside cliffs host the perennial herb bee-plant and California polypody. (Ornduff and Vasey 1995)



Monkeyflower
USFWS

Coastal salt marsh elements occur between the cliffs and cobble beach around the island. This element includes *Frankenia salina*, sand-spurrey (*Spergularia macrotheca*), and pickleweed. (Ornduff and Vasey 1995)

Vegetation surveys indicate an increasing trend in native and non-native species richness on both islands of the refuge based on past species richness (plant list) data (Baye 2004). An increase in the number of identified plant species may be due, in part, to the increased intensity of plant surveys through time. However, over the long-term it is suspected that native species richness would be reduced by long-term expansion of invasive, non-native vegetation (Baye 2004).

Wildlife

One of the most notable features of the Marin Islands is the heron and egret colony on West Marin Island. The colony occurs primarily on the northeast side of the island and is active primarily from February through July of each year. The colony has been monitored in conjunction with other Bay Area colony sites for the past several decades by state, non-profit research institutes, and individuals. The California Department of Fish and Game conducted periodic statewide nesting inventories of major ardeid colonies from 1969-1982. Audubon Canyon Ranch (ACR) has monitored the number of nesting egrets and herons on West Marin Island since 1979 from viewing positions on East Marin Island and by boat. In 1993, ACR began monitoring annual reproductive success of great egrets and great blue herons. The colony is made up of snowy egrets, great egrets, black-crowned night-herons, and great blue herons. One nesting pair of little blue herons

(*Egretta caerulea*) was recorded on West Marin Island in 1965, but has not since been recorded on the Refuge. (Calif. Dept. of Fish and Game 1967)

It is not known how long the colony has existed on the island. The egret and heron colony of Marin Island were present around the late 1920s when the islands were privately owned (Peabody 2004). There are no records of successful nesting by herons and egrets on East Marin Island despite past nesting attempts. Despite the lack of successful nesting, herons and egrets use East Marin Island to gather nest material and to roost. Herons and egrets also forage along the shoreline of East Marin Island.



Great egret fishing
© Greg Block

The number of active heron and egret nests on West Marin Island has ranged from 767 in 1982 to 183 in 2004, with snowy egrets and great egrets comprising the greatest proportion of total nests. The number of great blue heron nests has increased gradually since they colonized West Marin Island in 1990 (Kelly and Fischer 2004). A 1993 report indicates that West Marin Island accounts for 27 percent of the San Francisco Bay Area's nesting egrets and herons (Kelly et al. 1993). Approximately 48 percent of snowy egret nests and 32 percent of black-crowned night-heron nests in the San Francisco Bay Area occur on West Marin Island (Kelly et al. 1993). Since the annual surveys began, large annual fluctuations have occurred in the nesting population of egrets and herons on West Marin Island. Overall, there has been no clear trend in the number of nesting great egrets and snowy egrets, while great blue herons have recently increased nesting numbers. There was an apparent decline during the 1980s in the number of nesting black-crowned night herons on West Marin Island, but abundances have apparently since stabilized (Kelly and Fischer 2004). However, considerable annual variation persists, apparently reflecting the between-year movements of nesting birds to and from other colony sites in the region associated with influences of food availability and disturbance events.

Table 2. 2004 Egret and Heron Colony Survey

	<i>Nests in 2004</i>	<i>Nest Survivorship¹</i>	<i>Nests in 2003</i>	<i>Nest Survivorship¹</i>
Great Egret	83	80%	81	83%
Snowy Egret	59	N/A ²	103	N/A ²
Black-crowned Night Heron	29	N/A ²	51	N/A ²
Great Blue Heron	12	73%	10	40% ³

¹percent of nests fledging at least one young

²conceal their nests

³2 of the 10 nests were not able to be monitored

Source: Kelly and Fischer 2004.

Egrets

Great and snowy egrets breed in similar habitats that require proximity to fresh-, salt- or brackish-water bodies. Both egret species are also platform nesters requiring tall shrubs and trees several feet high (5-40 feet). At West Marin Island, the great egrets favor buckeye trees, but also nest in the coast live oak. The snowy egrets place their nests predominantly in blackberry shrubs although they also use buckeye trees. Number of active great egret nests has remained relatively stable since 1994 but overall numbers remain smaller than those observed over the last decade (Kelly and Fischer 2004). The annual number of active snowy egret nests has varied since 1997, although a steady decline has been observed since 2001. Since annual monitoring began in 1979, the lowest count of active snowy egret nests was recorded in 2004.

The first records of raven predation of the heron and egret colony were in 1993. A raven was observed killing an adult snowy egret in 2001, and each year since 2000, observers have found the remains of 2 to 14 adult snowy egrets near the common raven nest site on East Marin Island, suggesting that resident ravens have been killing adult snowy egrets (Kelly et al. 2005). Other factors contributing to an increase or decrease in the size of the colony include regional shifts in distribution and changes in habitat quality (e.g., vegetative condition). For example, recent declines in the number of active snowy egret nests may be the result of reduced blackberry cover, which provides predation protection (Kelly and Fischer 2004). Predation by other species can also lead to nest declines. In 1993 and 1994, repeated disturbance of courting snowy egrets by a red-tailed hawk led to large-scale nest abandonment and reduced nest numbers through the late 1990s, although the colony has recovered considerably by 1997. During this period, the number of nesting snowy egrets increased at other colony sites in the region, including heronries at Red Rock, Napa State Hospital, and Santa Rosa Creek.

Hérons

Great blue herons and black-crowned night herons also generally breed in the same habitat as egrets (Ehrlich et al. 1998). At West Marin Island, great blue herons generally nest in California buckeye trees while black-crowned night herons generally nest in blackberry shrubs and grasses. Great blue herons have shown a consistent increase in

nesting abundance. Great blue herons were sighted on West Marin Island as early as 1970, where one active nest was recorded (Calif. Dept. of Fish and Game 1970). The 2004 survey produced the highest count of nests on record for West Marin Island since birds colonized on the island in 1990 (Kelly and Fischer 2004). There was an average of 2.43 young counted per nest (pre-fledgling).



Great blue heron
© Greg Block

Black-crowned night-herons on the Refuge showed a continued decline in numbers in 2004 from previous years (Kelly and Fischer 2004). An earlier decline can be attributed to a fire on the island on July 4, 1981 (Pratt 1983). Like the impacts to the snowy egret colony, raven predation may also have strong effects on the nesting black-crowned night-heron population (Kelly and Fischer 2004, Kelly et al. 2005). However, recent declines at the site may be consistent with annual shifts in distribution to other regional sites. Kelly and Fischer suggest that some birds on West Marin Island may have moved to a new, unknown location. Since night-herons conceal their nests in dense vegetation, estimates may only provide a rough index. Nest survivorship at West Marin Island could not be determined due to concealed nests.

Contaminant levels among heron and egrets have not been studied in depth to determine trends and threats to the populations. Mean concentrations of PCBs in black-crowned night herons in 1989 and egret eggs in 1990 were lower on West Marin Island than at Bair Island in the South Bay area (Hothem et al. 1995). This could suggest that PCB threats are lower in the North Bay than the South Bay. However, deformities observed in black-crowned night heron chicks from West Marin Island resembled those attributed to PCBs in double-crested cormorants (Hoffmann et al. 1993). Mercury concentrations in egrets and herons on West Marin Island may result in reproductive impairment (Hoffman et al. 1993). More studies would be needed to determine whether contaminants pose significant threats to the reproductive success of egrets and herons in the greater San Francisco Bay Area.

Abundant egrets and herons nesting on West Marin Island suggest the possibility of an expansion onto East Marin Island. It is not clear why nesting has not yet occurred on East Marin Island. Human activity or lack of suitable nesting trees could be factors,

although East Marin Island may still be a viable alternative nesting area in the event of a significant habitat loss or nest disturbance at West Marin Island.

Other Breeding Birds

Other bird species that are known to breed at Marin Islands include the western gull, black oystercatcher, common raven, and Canada goose. Western gulls and cormorants were sighted on the island as early as 1982 (Pratt 1982). In 1983, geese were sighted and gull nests appeared to be expanding. Since the sighting in 1983, geese have intermittently nested or roosted on the island while gull nests have continued to expand. One Canada goose was observed on West Marin Island in the 2004 surveys. Western gulls are also present on West Marin Island, with 46 nest sites observed in 2004 (Kelly and Fischer 2004). A single pair of black oystercatchers has been observed nesting annually at West Marin Island since 1993 (Kelly et al. 1993). At least three pairs of black oystercatchers were observed throughout the breeding season of 2005 with sightings of two fledglings along the shoreline of East Marin Island. Oystercatchers were first observed on the shoreline in 1988.

A single pair of ravens has been present at the Marin Islands since 1990 and were first observed nesting on East Marin Island in 1999 (Kelly et al. 2005). The resident pair of ravens successfully fledged three young in 2004 and four young in 2003; they spent much of their time preying upon heron and egret eggs or young in the heron and egret colony (Kelly et al. 2005). Shell fragments found near raven nests or cache sites indicate that heron and egret eggs are taken regularly by ravens; the majority of eggs recovered were taken from black-crowned night herons (Kelly et al. 2005). Further analysis of prey remains and predation rate data indicate that resident ravens fulfill most of their energy requirements taking herons and egrets on West Marin Island (Kelly et al. 2005).

Ironically, a single pair of ravens may also reduce the threat of predation by other predators. A red-tailed hawk (*Buteo jamaicensis*) was observed harassing heron and egret nests, but the hawk was eventually driven away by the resident ravens (Kelly and Fischer 2004). The ravens have also been observed chasing peregrine falcons (*Falco peregrinus*), red-shouldered hawks (*Buteo lineatus*), and other raven individuals within the Marin Islands area. Increases in the number of common ravens in the San Francisco Bay area suggest a continuing likelihood of raven predation on the Refuge (Kelly et al. 2002, Kelly and Roth 2001).



Nesting Canada goose

© Peter Chan

In the tidal and sub-tidal environments surrounding the islands, several waterfowl and waterbird species are present during breeding, migratory, or wintering periods. Diving waterfowl commonly observed include the surf scoter, scaup (*Athya spp.*), canvasback (*Athya valisineria*), western grebe (*Aechmophorus occidentalis*), ruddy duck (*Oxyura jamaicensis*), and bufflehead (*Bucephala olbeola*). Other species recorded include common loon (*Gavia immer*), Clark's grebe (*Aechmophorus clarkia*), horned grebe (*Podiceps nigricollis*), long-tailed duck (*Clangula hyemalis*), red-breasted merganser (*Mergus serrator*), common golden-eye (*Bucephala clangula*), and mallard (*Anas platyrhynchos*). Waterfowl species known to occur during the summer include the mallard and scaup. Because scaup breed in more northern latitudes, individuals present during summer are considered non-breeding for the year.

Waterbirds that commonly roost along the shorelines and forage in the surrounding mudflats and sub-tidal environments include the brown pelican (*Pelecanus occidentalis*), white pelican (*Pelecanus erythrorhynchos*), double-crested cormorant (*Phalacrocorax auritus*), black oystercatcher (*Haematopus bachmani*), Caspian tern (*Sterna caspia*), Forster's tern (*Sterna forsteri*), and spotted sandpiper (*Actitis macularia*). A bird species table is listed in Appendix E.

Raptors observed in the vicinity include the turkey vulture (*Cathartes aura*), red-tailed hawk, red-shouldered hawk, peregrine falcon, American kestrel (*Falco sparverius*), white-tailed kite (*Buteo albicaudatus*), and osprey (*Pandion haliaetus*). Pellets of great horned owls (*Bubo virginianus*) were observed on East Marin Island in 2002.

Mammals, reptiles, and amphibians

During summer 2002, refuge staff surveyed East Marin Island for small mammals through trapping. No small mammals were captured. Despite known harbor seal (*Phoca vitulina*) haul-out sites in the vicinity of the Marin islands, no records exist documenting this species' use of the Marin islands. Harbor seals have been observed within the waters surrounding the islands. No other marine mammals have been recorded in the vicinity of Marin Islands. The only known reptile species on the islands is the western fence lizard

(*Sceloporus occidentalis*) (east slope of East Marin Island). The California slender salamander (*Batrachoseps attenuatus*) was first documented on East Marin Island in 2003. Surveys specific for marine mammals, reptiles, or amphibians have not been conducted at the Marin Islands.

Fish

A variety of fish species have been sampled in San Rafael Bay; the area is well known for striped bass (*Morone saxatilis*) and white sturgeon (*Acipenser transmontanus*). CDFG conducts open water trawls and beach seine samples. No species has been identified as endangered. Appendix F lists the types of fish that are found in the area near the Refuge. According to the surveys, some of the more abundant fish include the bay goby (*Lepidogobius lepidus*), English sole (*Pleuronectes vetulus*), longfin smelt (*Spirinchus thaleichthys*), Pacific staghorn sculpin (*Leptocottus armatus*), plainfin midshipman (*Porichthys notatus*), and speckled sanddab (*Citharichthys stigmaeus*) (CDFG, unpub. data).

Federally and State Listed Species at the Refuge

Federally-listed species that have been observed at the Refuge are the California brown pelican and the previously-listed peregrine falcon. Both of these species do not breed at the Refuge, but use the islands as roosting and foraging sites. Other species that visit the Refuge are listed as Species on Concern, which is detailed in Appendix G.

Cultural Resources

Cultural resources are physical remains, sites, objects, records, oral testimony, and traditions that connect us to our Nation's past. Cultural resources include archaeological and historical artifacts, sites, landscapes, plants, animals, sacred locations, and cultural properties that play an important role in the traditional, and continuing, life of a community. The currently known cultural resources in and within one mile of the congressionally authorized boundaries of the Refuge consist of one prehistoric site and several historic sites.

Cultural resources, especially archaeological sites, are fragile and nonrenewable. Most consist of worked stone, fire-altered rocks, and organically enriched soil on or close to the surface. When compared to the surrounding landscape and contemporary cultural features such as roads, ditches, and structures, archaeological sites are small and subtle.

The Marin Islands have a cultural history of at least 1,300 years. Human occupation of East Marin Island can be broken into three segments; prehistoric use, military use, and private residence. Archaeological evidence of prehistoric use from the island demonstrates Native Americans harvested shellfish, hunted sea mammals, birds, and fish (Valentine 2005). Along with these faunal remains were found fire-cracked rocks, obsidian tools, and ground stone, indicating greater variety in island activities than just food processing. Evidence suggests that a range of subsistence-related and perhaps

ceremonial activities occurred (Luby 1994). Given the seasonal presence of some of the animals harvested and the lack of a fresh water source, occupation of the island may have been seasonal (Valentine 2005).

The early English explorer, Sir Frances Drake is believed to be the first European to encounter Marin County and the Miwok Indians in the early 1600s. A written account from a crew member indicates that the area had an abundance of game and fish, including deer and rabbit. Coastal Miwok Indians inhabiting the San Francisco Bay Area are also said to have occupied the islands.

In 1824, a Native American leader and a small band of the Coast Miwok took refuge on East Marin Island to thwart attacks by Mexican military. Popular belief says this leader was Chief Marin, for whom Marin Islands and Marin County are named. In 1867, the United States government took control of the islands, along with Alcatraz and Angel Island, as strategic bases to protect the greater Bay Area. A rock quarry of the south face of East Marin Island was established to provide material for military installations. Purportedly portions of the sea wall that are still standing at the northeast corner and south side of the island were built at this time.

In 1929, the Crowley Launch and Tugboat Company bought the island from the U.S. Government. The Crowley family constructed two residential houses and related structures on East Marin Island. The architecture of the buildings is considered historically important with teak and redwood woodwork and stone work. Bay area architects Mario Corbett and Clarence Mayhew were responsible for the designs, which are considered culturally distinct to the 1945 and 1965 time periods they were built. Stone material was quarried from the south end of East Marin Island to construct San Quentin Prison, which has resulted in a brackish water pond still present today (pers. comm., Peabody). To assist in building and supplying the main house, a small steam engine and railroad were built. Palm, pine, fruit trees, and other ornamentals were planted and a garden established.

Social and Economic Environment

Land Use

There are two residential buildings, a pump house, a water tank, storage structures and a dock on East Marin Island. Figure 6 shows the location of these structures. These structures were built and used by the previous owners of the islands. These buildings are in poor condition due to vandalism, and are not currently used by the public. Moreover, materials used to construct the building contain asbestos and may be considered a health hazard. Part of the island was quarried to collect rocks for building materials for the two residential buildings. The quarried area has a lagoon which was used by the previous owners of the islands. East Marin Island has also been planted with non-native vegetation by the previous owners. The dock was replaced in 2001.

Marinas, residential properties, and some commercial properties are located beyond the Refuge's boundaries. There are no agricultural properties that would be impacted by activities on the Refuge.

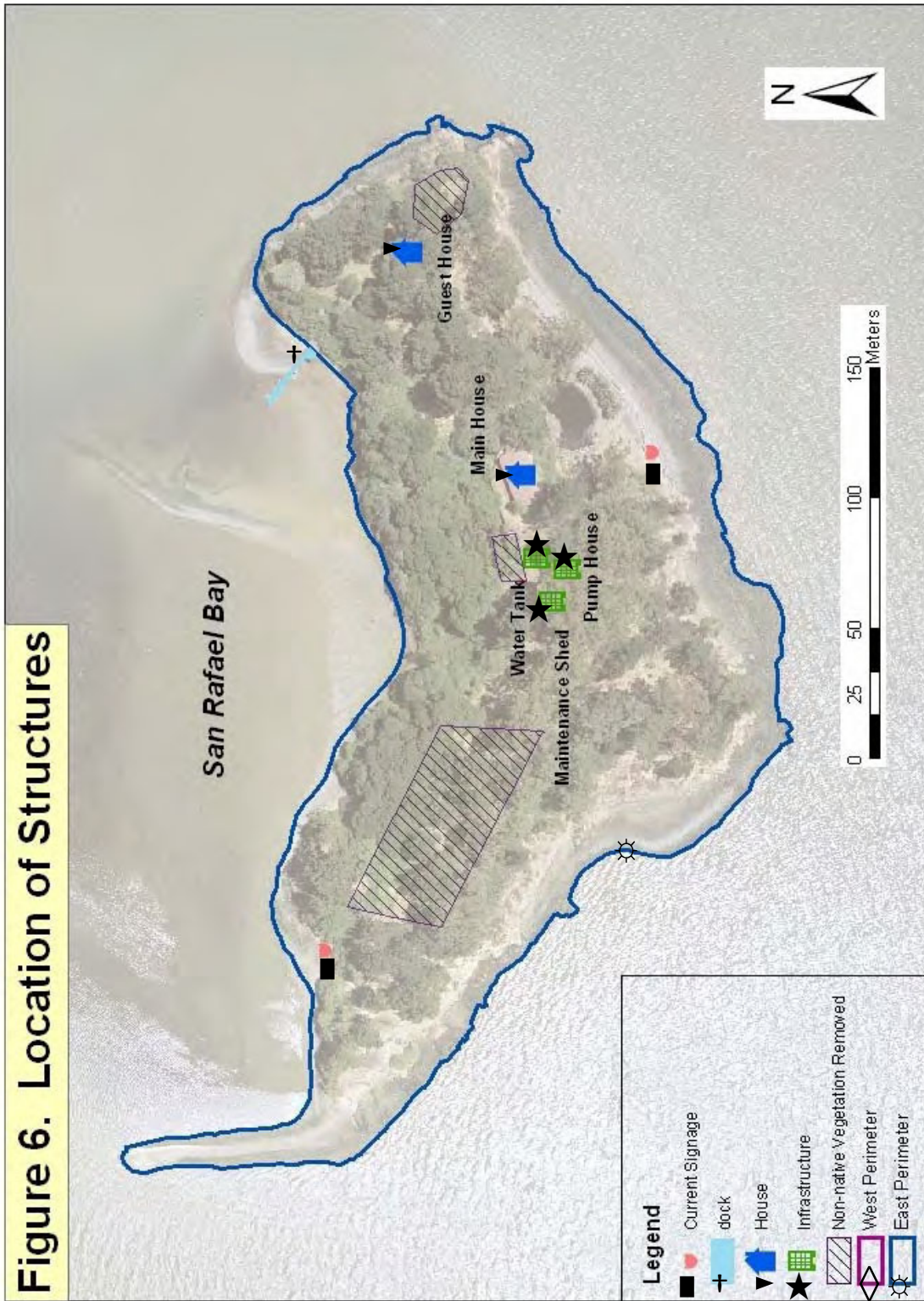
Traffic and Public Access

Public access is not allowed on West and East Marin Island. However, there have been illegal dockings by non-motorized vessels, including kayaks. Such trespassing has resulted in vandalism of the buildings on the Refuge. Refuge management estimates that trespass occurs once per week. The structures have been ransacked, resulting in broken glass, damaged doors, and use of non-working bathrooms. Further damage has been minimized by leaving doors unlocked and disconnecting power. Also, signs are posted warning trespassers they are prohibited on the Refuge and in any of the building structures on the Refuge. The waters surrounding the islands are currently open to boating and the public according to the Public Trust Doctrine of California. Vessels may pass through water surrounding and between West and East Marin Island, including those waters within the Refuge's boundary. Management of the Refuge is not expected to interrupt boating activities near the Refuge. Some of these vessels fish off the shores of both islands. Refuge staff accesses East Marin Island by Service small watercraft and a dock platform, but rarely land on West Marin Island given the island's sensitive wildlife.

Recreation

There are currently no recreation opportunities on the land portion of the Refuge. However, recreational boating and fishing from boats does occur in the Refuge's tidelands. Also, kayakers and other non-motorized vessels can be seen recreating near the Marin Islands. Impact of these activities upon wildlife of the Marin Islands is unknown.

Figure 6. Location of Structures



Employment

The Refuge is part of a larger economic region in Marin County. For the purposes of this environmental assessment, that larger region is considered to include the San Francisco Metropolitan Statistical Area (SF MSA), as defined by the State Employment Development Department (Employment Development Department 2002). The SF MSA is dominated by the service industry, which makes up over half of all employment.

An estimated 867,016 jobs are held in the SF MSA (Table 3). The largest employment sectors are the service sector (51.8 percent of jobs), retail (11.2 percent), and finance and insurance (8.4 percent).

Table 3. Employment characteristics of the San Francisco Metropolitan Statistical Area (2002)

<i>Industry</i>	<i>Jobs Provided</i>	<i>Percent Total</i>
Agriculture	3,552	<1%
Mining	198	<1%
Utilities	7,744	<1%
Construction	46,491	5.4%
Manufacturing	49,057	5.7%
Wholesale Trade	29,302	3.4%
Retail Trade	97,016	11.2%
Transportation and Warehousing	40,400	4.7%
Information	48,809	5.6%
Finance and Insurance	73,214	8.4%
Real Estate and Rental and Leasing	22,369	2.6%
Services	448,864	51.8%
TOTAL	867,016	100%

Source: Employment Development Department 2002

The average unemployment rate in the SF MSA is 4.7 percent, which falls below the unadjusted unemployment rate of 6.1 percent for California and 5.4 percent for the nation during the same period (Employment Development Department 2002).

The Refuge prohibits visitors, and therefore, does not contribute directly to the income and employment of the region. It is not expected that the Refuge will provide or impact indirect income to the region.

Environmental Justice

On February 11, 1994, the President issued Executive Order 12898 (*Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*) which directs the U.S. Environmental Protection Agency (EPA) to ensure that agencies analyze environmental effects on minority and low-income communities. The purpose of the executive order is to avoid the disproportionate placement of any adverse environmental, economic, social, or health impacts resulting from federal actions and policies on minority and low-income populations. No specific minority and low-income

populations have been identified in the community surrounding the San Rafael shoreline nearest to the Refuge.

Ethnic and Income Characteristics

For compliance with Executive Order 12898, county level data was analyzed to determine the demographics of the potential impact area. For this environmental justice assessment, ethnic and income characteristics for Marin County were compared to the state of California to determine high minority or low-income composition.

According to the information contained in the 2000 census, the total population of Marin County was approximately 247,289 in 2000 (FAIR 2001). This figure represents a 7.5 percent increase from the 1990 census. Based on the 2000 census, the 2004 population is estimated to be 250,409. Table 4 below shows the county's ethnic composition, with minority populations less than 16 percent of the total population. Marin County's most recent estimates for median household income in 1999 were \$71,306, while per capita income was \$44,962. Based on 1999 data, 6.6 percent of the persons in the county are considered below poverty (U.S. Census Bureau 2004).

Table 4. Marin County Ethnicity

<i>Ethnicity</i>	<i>Percentage</i>
White	84%
Hispanic or Latino	11%
Asian	4.5%
African-American	2.9%

Source: U.S. Census Bureau 2004

Chapter 4. Challenges and Opportunities

Challenges

The Refuge was established to protect the islands' egret and heron colony because they are an important nesting location in the Bay Area. The primary challenges the Refuge faces are declining habitat, human disturbance and predation of the heron and egret colony. Located in a highly urbanized environment, species on this Refuge are constantly faced with habitat loss, habitat fragmentation, and urban development.

Coastal Scrub and Oak Woodland Habitat

The original coastal scrub and oak woodland habitat made up of primarily coast live oak, buckeye and toyon have been significantly altered due to human habitation of the Refuge. Past private owners planted a variety of ornamental and fruit-bearing vegetation on East Marin Island that has resulted in an unfettered expansion that competes with native vegetation today. Non-native vegetation continues to effectively disperse seeds and develop on the Refuge. The heron and egret colony is limited to West Marin Island. Colony reports indicate that individuals have attempted to nest on East Marin Island, but

never have been successful. Refuge management is uncertain why the colony has not expanded to East Marin Island. One potential reason could be the abundance of non-native vegetation that is inappropriate for nesting.

Disturbance

The Refuge is currently closed to the public and there is no refuge staff to provide daily surveillance. Because of its proximity to the shore, trespassing is believed to be a common occurrence on East Marin Island, averaging once per week. The structures and dock on East Marin Island have shown regular evidence of entry and use. Uncontrolled human presence can cause undesirable impacts to the Refuge, including litter, vandalism, fires, and disease spread threats to birds and rare plants on the Refuge. This activity and exposure to marine conditions has led to the deterioration of the buildings and related infrastructure on East Marin Island.

Ravens were first reported at Marin Islands in 1993. A single pair of ravens occupies the islands year-round and nests on East Marin Island. During the breeding season, the colony (eggs, young, adults) may satisfy most or all of the nesting ravens energetic requirements. Snowy egret and black-crowned night heron eggs, young, and adults have been the primary target for the ravens. Despite documented predation, monitoring has not clearly indicated whether this predation has begun to impact productivity of the colony. Raven predation has resulted in significant declines at other heron and egret colony sites in the region (e.g., Bolinas Lagoon) and the potential exists for impacts to the Marin Islands populations.

Wildlife

Aside from the heron and egret colony, black oystercatchers are known to nest on West Marin Island. However, not enough data is available regarding their needs and threats. There is verbal, but no recorded evidence of harbor seals hauling out on East Marin Island. Harbor seals have been found at all other islands in the Bay Area except the Marin Islands. It is unknown why they have not used the islands.

Chapter 5. Management Direction

The Refuge is one of the increasingly rare coastal areas in the San Francisco Bay where migratory birds, including herons and egrets, can nest with limited human disturbance. West Marin Island provides one of only a few remaining nesting locations for local heron and egret populations in the San Francisco Bay area. The unique assemblage of native plant communities on the Refuge (especially West Marin Island) is also not found throughout coastal northern California. In addition, the Refuge contains unique cultural resources that exemplify the history of San Francisco Bay. Therefore, a comprehensive plan for managing the Refuge is essential to protect the habitat, wildlife, and cultural history of the Bay landscape. The CCP presents goals, objectives, and strategies to

protect these resources during the 15-year lifetime of this plan. Overall goals and objectives may not be achieved within the 15-year timeframe and will require re-assessment when the CCP is renewed.

Refuge Vision Statement

The Marin Islands National Wildlife Refuge will provide one of the few protected sanctuaries of native San Francisco Bay habitat to local and migratory birds in the heavily urbanized San Francisco Bay area. West Marin Island will provide nesting habitat for great egrets, black-crowned night herons, snowy egrets, great blue herons, black oystercatchers, and other colonial nesting waterbirds free from human disturbance. East Marin Island will, over time, be reverted to native coastal scrub and oak woodland habitat that may be colonized by the herons and egrets.

Visitors and the community will develop an understanding of the importance of migratory bird habitat and cultural history in the San Francisco Bay area. A public use program will provide the local community and visitors with opportunities to experience the unique resources of the Refuge. The Refuge will be a classroom where visitors will learn about the wildlife, habitat, and cultural history of San Francisco Bay through compatible wildlife-dependent recreation delivered by high quality interpretive materials, staff-led tours, and partnerships. Lastly, the Refuge will have an active and diverse volunteer group to support the purpose and continued preservation of the Marin Islands.

Refuge Management Goals

Refuge management activities are articulated through goals, objectives, and strategies in this CCP. The Service defines goal as a “descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose, but does not define measurable units”. Refuge goals are a means to achieving refuge purposes.

The Service defines objectives as concise statements of what will be achieved, how much will be achieved, and when and where it will be achieved on a refuge. Objectives are derived from goals and they are accomplished through management strategies. Finally, strategies specify the action, tools, technique, or combination thereof to meet objectives. Table 5 and Figure 7 at the end of this chapter describe the management goals, objectives, and strategies.

Goals were developed to provide management directions in four principal areas: wildlife management, habitat management, wildlife-dependent public use, and cultural resources.

Goal 1: Maintain and restore, where possible, wildlife communities and coastal scrub and oak woodland plant communities native to San Francisco Bay, including biological and physical features that provide optimal habitat for the heron and egret colony, as well as other coastal wildlife.

Goal 2: Provide visitors with compatible wildlife-dependent recreational and educational opportunities to foster an understanding and appreciation of San Francisco Bay native wildlife and plant communities.

Goal 3: Provide interpretation to instill appreciation within the community and visitors of the cultural resources and history of the Refuge.

Refuge Objectives and Management Strategies

GOAL 1: Maintain and restore, where possible, wildlife communities and coastal scrub and oak woodland plant communities native to San Francisco Bay, including biological and physical features that provide optimal habitat for the heron and egret colony as well as other coastal wildlife.

The Refuge was established to protect important existing egret and heron colonies on West Marin Island that serve as one of the largest egret and heron colonies in the San Francisco Bay area. The Refuge will maintain the colonies nesting on West Marin Island and encourage expansion of the colonies to East Marin Island. Native coastal plant communities, particularly the California buckeye and coast live oak woodland, provide nesting habitat for the egret and heron colony. Although West Marin Island is primarily composed of this oak-buckeye woodland, East Marin Island is dominated by non-native vegetation as a result of human disturbance. Habitat restoration activities on East Marin Island would include removal of invasive plants to be replaced by native plant communities representative of the Bay Area including oak-buckeye woodland, coastal scrub, coastal sea-bluff scrub, and coastal grassland scrub. The restored oak-buckeye woodland on East Marin Island could potentially serve as nesting material or sites for the colony. In addition, building structures would be removed to provide additional areas for native plantings.

Objective 1.1:

Over the long-term (15 to 30 years), restore native coastal scrub and oak woodland plant communities to 75 percent of the area land cover on East Marin Island (totaling approximately 10 acres) to enhance existing nesting habitat for herons, egrets, and other migratory birds.

Rationale:

Invasive species represent the single greatest threat to the Refuge System and the Service's wildlife conservation mission. East Marin Island's native plant assemblage is displaced by non-native vegetation. While vegetation surveys have resulted in a comprehensive list of species that are present, the extent of native and non-native vegetation on the Refuge has not been quantified. The current need would be to assess the extent of non-native species and prioritize removal of these species along with appropriate timing of native replanting. In the initial implementation of the CCP, it will

be necessary to inventory and assess all vegetation on the Refuge to develop a timeline for removal and planting.

Additional nesting habitat and colonization/restoration sites for native plants can be created through the removal of all building structures on the Refuge. None of the current buildings and structures on the Refuge is necessary for future management. Moreover, these buildings and the boat dock have been the target of vandalism by trespassers to the Refuge despite signage and locking of the facilities. In addition, when trespassers access the buildings, migratory birds have become trapped inside, resulting in mortality. The buildings also pose health hazards because interior materials contain asbestos.

Strategies:

- Use the Weed Information Management System (WIMS) or Refuge Lands GIS (Geographic Information System) to annually inventory and map data on invasive and native plant colonies including priority species, size of colony, and exact location.
- Control/eradicate invasive plant species utilizing appropriate integrated pest management strategies including mechanical and chemical methods. (See Appendix K and L for detailed table of species, extent of infestations on the Refuge, timeframe and instruction on removal.)
- Restore and maintain native plants appropriate for nesting habitat and materials for local birds. (See Appendix K and M for detailed table of species, location of colony, timeframe and instruction on restoration.)
- Contract removal of non-significant buildings.

Objective 1.2:

Over the life of the Plan, maintain 95 percent of the existing native coastal scrub and oak woodland plant communities on West Marin Island for heron, egret, and other migratory bird nesting habitat.

Rationale:

Due to the inaccessibility of West Marin Island, the island has had relatively little human intrusion resulting in unspoiled native vegetation compared to East Marin Island. Both the Service and the Refuge System identify native plant conservation as a key component of their mission. Moreover, the native coastal scrub and oak woodland vegetation on West Marin Island provides nesting habitat for the herons and egrets. Executive Order 13186 directs federal agencies to ensure that agency plans and actions promote programs and recommendations of comprehensive migratory bird planning efforts. Maintaining the native coastal scrub and oak woodland habitat would continue to support the needs of the herons, egrets and other migratory birds that nest on the Refuge.

Strategies:

- Map native plants and prioritize threats on the entire West Marin Island.

- Conduct annual surveys to monitor management changes in native and invasive vegetation through the Refuge Lands GIS or WIMS databases, and adapt management accordingly.

Objective 1.3:

Within two years of the Plan’s approval, reduce unauthorized trespassing on the Refuge by 50 percent to minimize vandalism, wildlife disturbance, spread of disease, and habitat destruction/degradation.

Rationale:

The Refuge is located in an urban area with daily boat traffic in the surrounding area. Off-refuge recreational boaters such as kayakers and small motor boat operators frequently fish the waters surrounding the islands. Trespassing is an ongoing concern because the Refuge staff is not present on the islands on a daily basis. Evidence indicates that trespassing and vandalism occur once per week, and concern is high for arson or accidental fire. Safety on the Refuge is also a concern because both islands are composed of shale-like soil and steep, rocky cliffs which are subject to natural erosion.

Strategies:

- Install signage prohibiting public access to the Refuge’s islands.
- Develop brochures/signs to display in the local community (e.g., community centers, marina businesses, libraries).
- Increase law enforcement patrols and organize community-based monitoring to minimize unauthorized use of the Refuge.
- Conduct a study of the egret and heron colony to determine impact of human disturbance, including fishing and boating activities; acquire funding to conduct the study.

Objective 1.4:

Within five years of the Plan’s approval, determine the effect of raven predation on the heron and egret colony and develop methods to evaluate predation effects on heron and egret populations.

Rationale:

Ravens were first reported at Marin Islands in 1993. A single pair of ravens occupies the islands year-round and nests on East Marin Island. During the breeding season, the colony (eggs, young, adults) may satisfy most or all of the nesting ravens energetic requirements (Kelly et al. 2005). For example, egg shell fragments of 250 eggs were found on East Marin Island in 2003 (Kelly and Fischer 2004). Behavioral studies conducted at the Marin Islands in 1999-2001 and 2005 documented the taking of heron and egret eggs, young and adults (Kelly et al. 2005, Kelly and Block, unpublished data). Like adults, fledgling ravens spend extended periods of time in the colony (Kelly and Fischer

2005) during the breeding season. Snowy egret and black-crowned night heron eggs, young, and adults have been the primary target for the ravens.

Monitoring has not clearly indicated whether this predation is impacting the population trends for the colony's species. The predatory behavior of ravens in the Bay Area was greater when ravens raised more young (Kelly et al. 2005). This knowledge is confounded by the fact that increases or decreases in number of active nests may be the result of regional shifts in distribution. In addition, resident ravens of the Marin Islands provide protection from other potential nest predators including other ravens and raptors. In 2005, researchers initiated a study examining a technique (egg oiling, which disrupts oxygen exchange through the egg shell) to reduce raven productivity at Marin Islands. The action resulted in a failed raven nesting attempt and a second nesting attempt. The ravens successfully hatched young in 2005 but much later in the season, potentially reducing raven predation to adult birds only. At the time when second group of raven young hatched, most of the heron and egret colony had already fledged young. Continued study of this technique and its effect on resident raven and productivity of the colony will guide future management actions and allow for adaptive measures in the event of heron and egret regional population declines.

Strategies:

- Continue monitoring the heron and egret colony annually through a partnership with Audubon Canyon Ranch. Support research for contaminant threats to the colony by partnering with research organizations and universities.
- Develop methods to better estimate black-crowned night heron and snowy egret productivity to determine effects of raven predation on productivity.
- Conduct predator surveys with a focus on ravens.
- Continue study of techniques to reduce raven productivity and its effect on heron and egret productivity.
- Evaluate the need for future raven control measures based on site-specific and regional trends in heron and egret colony to determine when predator control is warranted.

Objective 1.5:

Over the life of the Plan, develop a needs assessment for management and restoration of sub-tidal areas of the Refuge.

Rationale

A significant percentage of the Refuge is underwater. The Service currently does not conduct any management activities for these sub-tidal areas. Conducting a needs assessment on how best to manage this area will be beneficial to preserving sensitive sub-tidal resources of the San Francisco Bay region.

Strategies:

- Research available data on the sub-tidal areas.
- Coordinate with other agencies in sub-tidal monitoring, restoration or preservation.
- Inventory biological resources in the sub-tidal areas.
- Prioritize management and restoration needs.

GOAL 2: Provide visitors with compatible wildlife-dependent recreational and educational opportunities to foster an understanding and appreciation of San Francisco Bay native wildlife and plant communities.

The 1997 Improvement Act established guidelines for providing wildlife-dependent public uses at refuges when compatible with the conservation of fish, wildlife, and plant resources. Wildlife-dependent uses include hunting, fishing, wildlife-observation, photography, environmental education, and interpretation. Since establishment of the Refuge, public access has not been permitted due to limited availability of resources, safety issues, and the sensitivity of wildlife and cultural resources. The Refuge is designated an open space area by the city. This CCP describes specific wildlife-dependent uses that will be offered at the Refuge consistent with the 1997 Improvement Act. Providing wildlife-dependent recreational opportunities would establish a human-wildlife interface that will likely foster public support for long-term wildlife and habitat conservation on the Refuge.

Objective 2.1:

Within two to five years of the Plan's approval, establish environmental education, interpretation and recreation opportunities for visitors and the local community.

Rationale:

The Refuge is located off a heavily urbanized shoreline, which residents and visitors can easily view from homes, businesses and marinas. There are three marinas near the Refuge where many recreational boaters launch. The Refuge provides wildlife-viewing opportunities to these boaters. Also, recreational fishing occurs in Refuge waters. Providing wildlife education and interpretation to these refuge visitors would promote wildlife protection. Recreational guidelines will be developed for fishing and wildlife-viewing to best protect the sensitive wildlife on the Refuge. Moreover, staff will provide a limited number of guided tours (no more than six per year) on East Marin Island when requested by groups or a group of individuals. Tour sizes will be limited to a minimum of five persons and a maximum of 15 persons. Tour participants must provide their own transportation to East Marin Island. This will allow some public access in the form of environmental education and interpretation while limiting disturbance to wildlife, research activities, and restoration activities.

Strategies:

- Provide and encourage opportunities for wildlife observation and wildlife photography through kayaking and privately-led kayak tours (no landing on the islands) in refuge waters around the islands.
- Provide staff-led tours (no more than six tours per year, fifteen persons per tour) on East Marin Island when requested by groups and groups of individuals. Participants must provide their own transportation to East Marin Island.
- Install an interpretive display and designate a foot trail on East Marin Island to facilitate staff-led tours.
- Provide fishing guidance through brochures and flyers, and make available at local marinas.

Objective 2.2:

Within five to ten years of the Plan's approval, more than 50 percent of residents within the shoreline communities of the San Rafael will be familiar with the Refuge's existence and purpose.

Rationale:

Environmental education is identified in the 1997 Improvement Act as a priority use for refuges when it is compatible with refuge purposes. While the Refuge can be viewed from the shoreline of San Rafael, its existence or purpose is not well known in the nearby community. Community outreach programs may provide further protection for the wildlife and cultural resources on the Refuge. The Refuge will provide community and school presentations in addition to staff-led tours and restoration opportunities in order to meet this goal.

Strategies:

- Develop and disseminate educational materials to local boating organizations, businesses, Friends groups, schools, and recreation centers.
- Install a Web Cam during breeding season.
- Arrange public groups, schools, etc. to participate in revegetation projects or biological monitoring on East Marin Island.
- Provide presentations to local businesses, community organizations, and the public.
- Conduct a mail survey after 10 years of the CCP's implementation to determine if objective is successful.

GOAL 3: Provide interpretation to instill appreciation within the community and visitors of the cultural resources and history on the Refuge.

Like much of the San Francisco Bay Area, the Refuge preserves an extensive human history dating back to Native American activity and recent private ownership by a local San Francisco family. However, a comprehensive inventory and assessment of the cultural resources has not been initiated. It would be important to conduct such a review

given the prevalent vandalism and natural erosion currently occurring on the islands. It also would be beneficial to provide interpretation of this history to visitors and local residents which may enhance protection of such cultural resources.

Objective 3.1:

Within two to three years of the Plan's approval, the Refuge's cultural resources will be better protected through increasing law enforcement and other refuge staff surveillance to at least bi-weekly visits.

Rationale:

The Refuge is not staffed on a daily basis and trespassing has occurred. As a result, building structures have been vandalized. The Service is concerned about the protection of these structures and other cultural resources on the Refuge.

Strategies:

- Prohibit public access to the islands, except for volunteer restoration programs and staff-led tours on East Marin Island.
- Provide signage on and off-site noting access to the islands is prohibited.
- Increase law enforcement patrols with the addition of a refuge officer and organize community-based monitoring.
- Monitor potential erosion areas. If necessary, install equipment to reduce erosion.
- Safeguard cultural resources from damage during refuge management activities such as building demolition and plant restoration activities by avoidance or other mitigation measures prior to the activities. Coordinate with affiliated Native American Tribal representatives.

Objective 3.2:

Within five years of the Plan's approval, the Refuge's cultural resources and history will be assessed for the purpose of developing a report, outreach materials and complying with regulatory requirements.

Rationale:

Interpretation is identified in the 1997 Improvement Act as a priority use for refuges when it is compatible with refuge purposes. The Refuge has a rich human history which has not been studied in depth. Conducting an inventory would provide records in the event that cultural resources are vandalized or naturally deteriorate. The inventory would also provide the basis for cultural interpretation for visitors and the local community.

Strategies:

- Photograph, research and document cultural resources on the Refuge in coordination with a Service, or other qualified archaeologist. Identify any potential sites where historical objects may be sensitive to refuge management activities

such as building demolition or plant restoration activities. Contract for the preservation or mitigation of significant historic structures.

- In conjunction with wildlife tours, provide cultural resource interpretation.
- Develop interpretive materials to be displayed on and off the Refuge.

Table 5. Management Goals

<i>Expand and Improve Resource Management and Public Use</i>	
<p>Goal 1: Maintain and restore, where possible, wildlife and coastal scrub and oak woodland plant communities native to San Francisco Bay, including biological and physical features that provide optimal habitat for the heron and egret colony, as well as other coastal wildlife.</p>	<p>Objective 1.1: Over the long-term (15 to 30 years), restore native coastal scrub and oak woodland plant communities to 75 percent of the area land cover on East Marin Island (totaling approximately 10 acres) to enhance existing nesting habitat for herons, egrets, and other migratory birds.</p> <p><i>Strategies:</i></p> <ul style="list-style-type: none"> • Use the Weed Information Management System (WIMS) or Refuge Lands GIS (Geographic Information System) to annually inventory and map data on invasive and native plant colonies including priority species, size of colony, and exact location. • Control/eradicate invasive plant species utilizing appropriate integrated pest management strategies including mechanical and chemical methods. (See Appendix K and L for detailed table of species, extent of infestations on the Refuge, timeframe and instruction on removal.) • Restore and maintain native plants appropriate for nesting habitat and materials for local birds. (See Appendix K and M for detailed table of species, location of colony, timeframe and instruction on restoration.) • Contract removal of non-significant buildings. <p>Objective 1.2: Over the life of the Plan, maintain 95 percent of the existing native coastal scrub and oak woodland plant communities on West Marin Island for heron, egret, and other migratory bird nesting habitat.</p> <p><i>Strategies:</i></p> <ul style="list-style-type: none"> • Map native plants and prioritize threats on the entire West Marin Island. • Conduct annual surveys to monitor management changes in native and invasive vegetation through the Refuge Lands GIS or WIMS databases, and adapt management accordingly. <p>Objective 1.3: Within two years of the Plan’s approval, reduce unauthorized trespassing on the Refuge by 50 percent to minimize vandalism, wildlife disturbance, spread of disease, and habitat destruction/degradation.</p> <p><i>Strategies:</i></p> <ul style="list-style-type: none"> • Install signage prohibiting public access to the Refuge’s islands. • Develop brochures/signs to display in the local community (e.g., community centers, marina businesses, libraries). • Increase law enforcement patrols and organize community-based monitoring to minimize unauthorized use of the Refuge. • Conduct a study of the egret and heron colony to determine impact of human disturbance, including fishing and boating activities; acquire funding to conduct the study. <p>Objective 1.4: Within five years of the Plan’s approval, determine the effect of raven predation on the heron and egret colony and develop methods to evaluate predation effects on heron and egret populations.</p> <ul style="list-style-type: none"> • Continue monitoring the heron and egret colony annually through a partnership with Audubon Canyon Ranch. Support research for contaminant threats to the colony by partnering with research organizations and universities. • Develop methods to better estimate black-crowned night heron and snowy egret productivity to determine effects of raven predation on productivity. • Conduct predator surveys with a focus on ravens. • Continue study of techniques to reduce raven productivity and its effect on heron and egret productivity. • Evaluate the need for future raven control measures based on site-specific and

regional trends in heron and egret colony to determine when predator control is warranted.

Objective 1.5:

Over the life of the Plan, develop a needs assessment for management and restoration of sub-tidal areas of the Refuge.

Strategies:

- Research available data on the sub-tidal areas.
- Coordinate with other agencies in sub-tidal monitoring, restoration or preservation.
- Inventory biological resources in the sub-tidal areas.
- Prioritize management and restoration needs.

GOAL 2: Provide visitors with compatible wildlife-dependent recreational and educational opportunities to foster an understanding and appreciation of San Francisco Bay native wildlife and plant communities.

Objective 2.1:

Within two to five years of the Plan's approval, establish environmental education, interpretation and recreation opportunities for visitors and the local community.

Strategies:

- Provide opportunities for wildlife observation and wildlife photography through kayaking and privately-led kayak tours (no landing on the Refuge) in refuge waters around the islands.
- Provide staff-led tours (no more than six tours per year, fifteen persons per tour) on East Marin Island when requested by groups and groups of individuals. Participants must provide their own transportation to East Marin Island.
- Install an interpretive display and designate a foot trail on East Marin Island to facilitate staff-led tours.
- Provide fishing guidance through brochures and flyers, and make available at local marinas.

Objective 2.2:

Within five to ten years of the Plan's approval, more than 50 percent of residents within the shoreline communities of the San Rafael will be familiar with the Refuge's existence and purpose.

Strategies:

- Develop and disseminate educational materials to local boating organizations, businesses, Friends groups, schools, and recreation centers.
- Install a Web Cam during breeding season.
- Arrange public groups, schools, etc. to participate in revegetation projects or biological monitoring on East Marin Island.
- Provide presentations to local businesses, community organizations, and the public.
- Conduct a mail survey after 10 years of the CCP's implementation to determine if objective is successful.

GOAL 3: Provide interpretation to instill appreciation within the community and visitors of the cultural resources and history on the Refuge.

Objective 3.1:

Within two to three years of the Plan's approval, the Refuge's cultural resources will be better protected through increasing law enforcement and other refuge staff surveillance to at least bi-weekly visits.

Strategies:

- Prohibit public access to the islands, except for volunteer restoration programs and staff-led tours on East Marin Island.
- Provide signage on and off-site noting access to the islands is prohibited.
- Increase law enforcement patrols with the addition of a refuge officer and organize community-based monitoring.
- Monitor potential erosion areas. If necessary, install equipment to reduce erosion.
- Safeguard archaeological objects from damage during refuge management activities such as building demolition and plant restoration activities by avoidance or reburial prior to the activities. Coordinate with affiliated Native American Tribal representatives.

Objective 3.2:

Within five years of the Plan's approval, the Refuge's cultural resources and history will be assessed for the purpose of developing a report, outreach materials and complying with regulatory requirements.

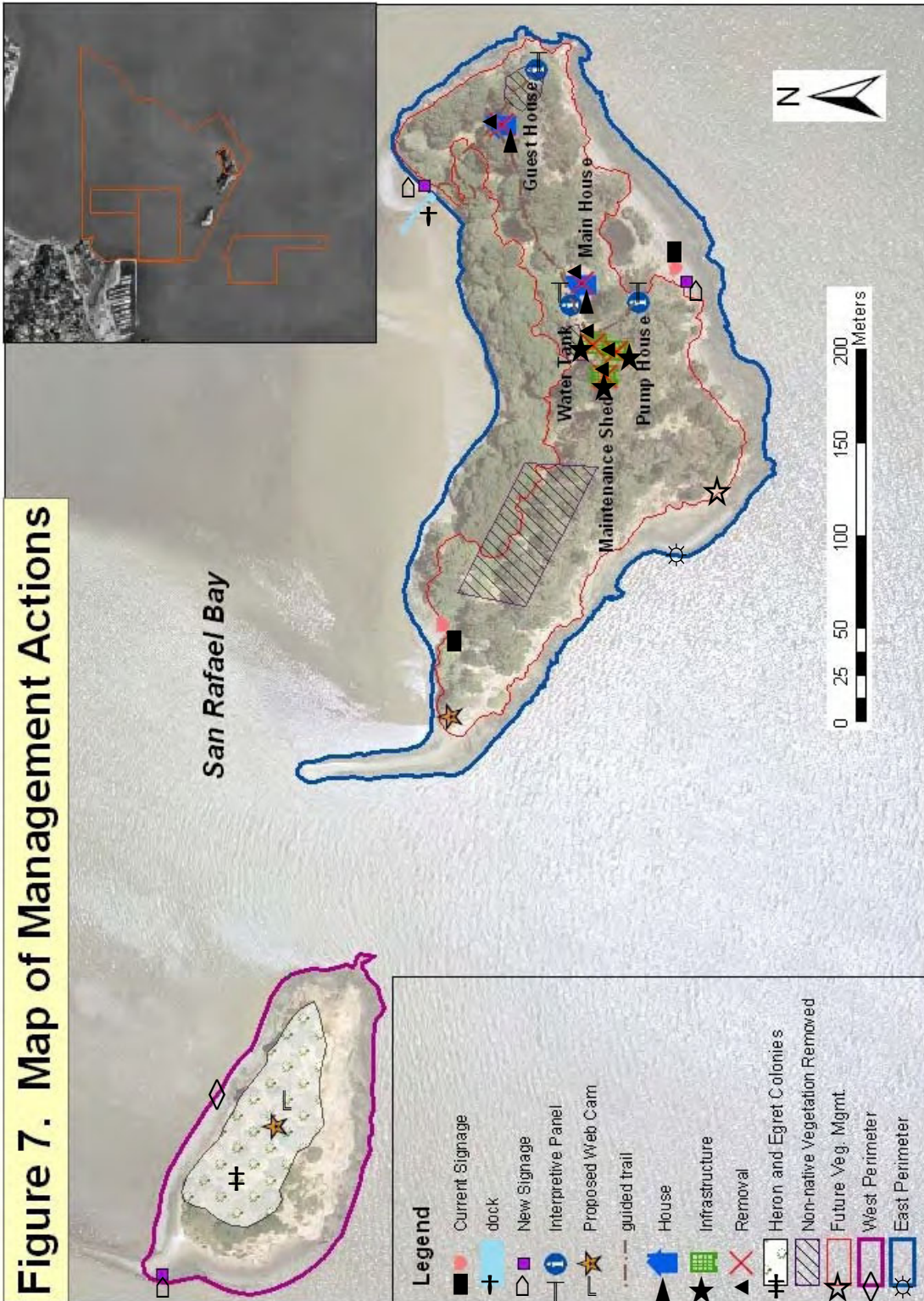
Strategies:

- Photograph, research and document cultural resources on the Refuge in coordination with a Service, or other qualified archaeologist. Identify any potential sites where historical objects may be sensitive to refuge management activities such

as building demolition or plant restoration activities. Contract for the preservation or mitigation of significant historic structures.

- In conjunction with wildlife tours, provide cultural resource interpretation.
- Develop interpretive materials to be displayed on and off the Refuge.

Figure 7. Map of Management Actions



Chapter 6. Plan Implementation

Once the CCP has been approved and the Service has notified the public of its decision, the implementation phase of the CCP process will begin. During the next 15 years, the objectives and strategies presented in this CCP will be put in place; the CCP will serve as the primary reference document for all refuge planning, operations, and management until it is formally revised at the end of this period. The Service will implement the final CCP with assistance from partner agencies, organizations, and the public.

Activities required to accomplish the management strategies discussed in this CCP are referred to as projects. Every effort will be made to implement these projects by the deadlines established here. However, the timing of implementation of the management activities proposed in this document is contingent upon a variety of factors, including:

- Funding,
- Staffing,
- Completion of Step-Down Plans
- Compliance with other Federal regulations,
- Partnerships, and
- The results of monitoring and evaluation.

Each of these factors will be described briefly as it applies to the Service's proposed action.

CCPs provide long-term guidance for management decisions and set forth goals, objectives, and strategies needed to accomplish refuge purposes and identify the Service's best estimate of future needs. These plans detail program planning levels which may be above current budget allocations and, as such, are primarily for Service strategic planning and program prioritization purposes. Plans do not guarantee a commitment of resources.

Funding and Personnel

To implement the proposed action and to achieve the objectives and goals of this CCP, the Service will need additional funding. Existing needs are recorded in the Maintenance Management System (MMS) and Refuge Operating Needs System (RONS) for the Refuge System. Maintenance projects are generally large one-time projects that are beyond the capacities of the staff and regular operation budget, and can include replacement of certain refuge equipment, such as vehicles, and removal or repair of refuge structures. RONS projects are annual proposed refuge projects that do not represent replacement of existing equipment or facilities. RONS projects for this Refuge include the addition of new law enforcement personnel and equipment, habitat restoration projects, wildlife monitoring and visitor services programs. An estimated \$719,500 in non-salary funding is needed to implement projects in the CCP based on 2005 dollars. On average, this amounts to \$47,967 per year for the next 15 years. A total of \$60,795 (based on 2005 salary costs) is needed to fund two additional staff positions, which would work

half-time for the Marin Islands NWR to implement the CCP; this figure does not include salary increases over time. Table 6 describes the staffing needs for the Refuge for each project proposed by this CCP and Table 7 describes the budget proposal needed to implement the CCP.

The Refuge is managed as a satellite refuge within the San Francisco Bay NWR Complex. Staff from the San Pablo Bay Refuge provides management of the Refuge. Law enforcement staff assigned to the overall complex provides intermittent patrols of the Refuge. A significant cost of implementing the CCP includes salaries. Funding for two additional permanent staff is needed to implement the objectives and strategies of the CCP. New permanent positions will be necessary to implement law enforcement and visitor service objectives identified in the plan. The CCP recommends the following staff additions for Marin Islands NWR:

Table 6. Staffing Plan and Needs

<i>Current Staffing Level</i>	<i>Staffing Additions</i>
Refuge Manager GS-0485-12	Law Enforcement Officer GS-0025-7/9
Wildlife Biologist GS-0486-11	Outdoor Recreation Planner GS-0023-09
Maintenance Worker WG-4749-08	

A full time law enforcement officer would meet the needs for public safety and protection of refuge property. The addition of an outdoor recreation planner would allow implementation of the CCP's public outreach and access objectives. Both of these positions would also carry the same responsibilities for staffing and managing San Pablo Bay Refuge. The Refuge will continue to rely on nonprofit conservation groups for habitat restoration activities. The Refuge will also continue to manage the Refuge through an agreement with state agencies.

Table 7. Budget proposal for Marin Islands NWR Comprehensive Conservation Plan

<i>Project Description</i>	<i>Priority</i>	<i>Start Year</i>	<i>Completion Year</i>	<i>Duration (years)</i>	<i>Operational Cost for Startup</i>	<i>Average Annual Cost</i>	<i>Staffing (FTE)</i>	<i>RONS/MMS</i>
Replace 13' Boston Whaler	Medium	2008	2008	1	\$40,000			MMS #00101155
Remove 4 abandoned buildings and water storage tank	High	2008	2008	1	\$179,000			MMS #97109424
Protect heron and egret colony	High	2007			\$129,000	\$37,166*	0.5	RONS #97605
Purchase LE equipment	High	2007	2021		\$92,000			RONS #03001

and
transportation

Restore habitat on East Marin Island	Medium	2007	2021	\$168,000				RONS #97602
Develop Refuge Brochure, Displays and Web Cam	Medium	2008	2010	\$81,500	\$23,629*	0.5		RONS #98601
Ciconiformes colony annual monitoring	High	2006	2021	\$30,000				RONS #97601
TOTAL				\$719,500	\$60,795	1		

*Only half the salary is accounted here because the additional staff will also work half-time for the San Pablo Bay NWR.

Step-Down Management Plans

Some objectives in the plan require more detailed planning than the CCP process is designed to provide. To meet these objectives, the Service has prepared step-down management plans and other guidance to provide additional details necessary for implementation. A recreational sport fishing management plan (Appendix I) and fire management plan (Appendix J) have been developed for the Refuge. A vegetation management plan (Appendix K) was developed in 2005 that provides guidance for managing native and non-native plant communities on the Refuge for a 15-year period.

Compatibility Determination

Federal law and policy provide the direction and planning framework to protect the Refuge System from incompatible or harmful human activities while ensuring that Americans can enjoy Refuge System land and waters for the purposes they were established. The 1997 Improvement Act provided the key provisions that now guide management of public uses.

Before public uses and certain Service activities are allowed on a refuge, a compatibility determination must be completed. A compatible use is defined as a proposed or existing wildlife-dependent recreational use or any other use of a national wildlife refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the Refuge System mission or the purposes of the national wildlife refuge. Sound professional judgment is defined as a decision that is consistent with the principles of the Service's management and administration, available science and resources, and adherence to the requirements of the 1997 Improvement Act, and other applicable laws. Wildlife-dependent recreational uses may be authorized on a refuge when they are compatible and not inconsistent with public safety.

Compatibility determinations are included in Appendices M-P for research and monitoring, wildlife observation and photography, environmental education and interpretive staff-led tours, and sport fishing.

Compliance Requirements

This CCP was developed to comply with all Federal laws, executive orders, and legislative acts. As it is located inside the San Francisco Bay estuary, the CCP must comply with the Bay Area Conservation and Development Commission requirements to the extent practicable and when not in conflict with federal requirements.

Partnership Opportunities

The Refuge has partnered with non-governmental organizations to conduct habitat restoration activities. These partners play an important role in helping the Service achieve its mission and the Refuge’s goals. The Service will continue to rely on these and other partners in the future to help implement this CCP and to provide input for future CCP updates. Comments through the CCP process suggest great potential for local community participation and assistance in the monitoring and restoration of the Refuge. The Refuge will continue to work with these organizations and seek out new partnerships in the local community and school system for achieving refuge goals.

Monitoring and Evaluation

This CCP is designed to be implemented for a 15-year period. The plan will be reviewed and revised as required to ensure that established goals and objectives are still applicable. The monitoring program will focus on issues involving habitat restoration activities, wildlife monitoring and public use activities. Specific to the Refuge, the success of the CCP will be evaluated by the level of reduction of non-native vegetation; restoration of native vegetation; and population trends of the heron and egret colony. Collection of population data on the egret and heron colony’s populations will continue. This data will be used to update existing area species inventory and modify management of habitat areas. Other wildlife will be observed and included in the annual reports as needed. Specific monitoring strategies have been integrated into the goals and objectives; further details are provided in Table 8. As historical numbers are not available for plant species, baseline surveys would be established to compare change over time once the CCP is implemented.

Table 8. Monitoring Methods

<i>Study Variable</i>	<i>Monitoring Methods</i>
Heron and Egret Colony	Number of active nests during the breeding season will be conducted annually for each of the species: snowy egret, great egret, great blue heron, and black-crowned night heron. The survey is conducted through a Special Use Permit by Audubon Canyon Ranch (ACR) annually during the spring. Trained ACR affiliates conduct the survey. The survey does not require access to West Marin Island and

	observations are recorded by a boat that encircles the island from a distance that does not cause disturbance of the colony. Adults, chicks and eggs are counted when visible. The data collected is provided in the form of a report to the Service on an annual basis.
Effects of Non-Native Vegetation Control Measures	Large areas of non-native vegetation areas will be mapped and the data stored in a WIMS and Refuge Lands GIS database. Areas where control activities are planned or conducted will be also be mapped. Changes in plant cover will be estimated visually using cover classes.
Survival of Planted Native Seedlings	Planted native groupings will be assigned a plot area. Survivorship and percent cover of native plantings will be monitored annually for at least 3 years. Percent survival will be estimated visually. Data will be entered into a refuge GIS database.

Adaptive Management

Adaptive management is characterized by management that monitors the results of policies and/or management actions, and integrates this new learning, adapting policy and management actions as necessary (Jacobson 2003). Adaptive management promotes flexible, effective decision-making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances our understanding of the system and helps adjust policies. Adaptive management incorporates natural variability in evaluating ecological resilience and productivity (Trulio and Clark 2005).

Adaptive management provides the framework within which biological measures and public use can be evaluated by comparing the results of management to results expected from objectives. Habitat, wildlife, and public use management techniques and specific objectives would be regularly evaluated as results of a monitoring program and other new technology and information become available. These periodic evaluations would be used over time to adapt both the management objectives and strategies to better achieve management goals. Such a system embraces uncertainty, reduces option foreclosure, and provides new information for future decision-making while allowing resource use.

Plan Amendment and Revision

The CCP is intended to evolve as the Refuge changes, and the 1997 Improvement Act specifically requires that CCPs be formally revised and updated at least every 15 years. The formal revision process would follow the same steps as the CCP creation process. In the meantime, the Service would be reviewing and updating this CCP periodically based on the results of the adaptive management process. Refuge staff will incorporate the CCP into annual work plans and Refuge databases. The CCP may also be reviewed during routine inspections or programmatic evaluations. Results of any or all of these

reviews may indicate a need to modify the plan. The goals described in this CCP would not change until they are reevaluated as part of the formal CCP revision process. However, the objectives and strategies may be revised to better address changing circumstances or to take advantage of increased knowledge of the resources on the Refuge. It is the intent of the Service to have this CCP apply to any new lands that may be acquired. If changes are needed, the refuge manager will determine the appropriate public involvement and associated NEPA documentation.

The intent of the CCP is for progress and/or achievement of refuge objectives during the lifetime of this plan. Management activities would be phased in over time and implementation is contingent upon and subject to results of monitoring and evaluation, funding through Congressional appropriations and other sources, and staffing.

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Appendix B. Glossary of Terms and Acronyms

ACM	asbestos containing materials
ACR	Audubon Canyon Ranch
CCP	Comprehensive Conservation Plan
CDFG	California Department of Fish and Game
EA	Environmental Assessment
EO	Executive Order
EPA	Environmental Protection Agency
GIS	Geographic Information System
NEPA	National Environmental Policy Act
NWR	National Wildlife Refuge
NWRS/Refuge System	National Wildlife Refuge System
PCB	Polychlorinated biphenyls
Refuge	Marin Islands National Wildlife Refuge
SER	State Ecological Reserve
SF MSA	San Francisco Metropolitan Statistical
USFWS/Service	U.S. Fish and Wildlife Service
WCB	Wildlife Conservation Board
WIMS	Weed Information Management System Area

Appendix C. Refuge Native Plant Species List

Native vascular flora of Marin Islands. Compiled from Ornduff and Vasey (1995) and preliminary November 2003 survey by the Baye (2005). EMI = East Marin Island. WMI = West Marin Island. OV= Ornduff and Vasey (1995). DS = Observations by Doreen Smith in 2003. PB = author. Author's initials in parentheses indicate probable but not confirmed identification of same taxon.

Species	Family	Observer	EMI	WMI
<i>Achillea millefolium</i> L.	Asteraceae	OV, DS	X	
<i>Adiantum jordanii</i> C. Mueller	Pteridaceae	OV, DS	X	
<i>Aesculus californica</i> (Spach) Nutt.	Hippocastanaceae	OV	X	
<i>Agrostis pallens</i> Trin. [intermediate with <i>A. hallii</i>]	Poaceae	[DS, as <i>Agrostis</i> undet. sp.], PB	X	
<i>Amsinckia</i> sp. (<i>A. menziesii</i> var. <i>intermedia</i>)	Boraginaceae	OV	X	
<i>Arbutus menziesii</i> Pursh	Ericaceae	DS	X	
<i>Artemisia californica</i> Less.	Asteraceae	OV, DS	X	X
<i>Artemisia douglasiana</i> Besser	Asteraceae	OV	X	
<i>Aster chilensis</i> Nees	Asteraceae	DS	X	
<i>Atriplex triangularis</i> Willd.	Chenopodiaceae	DS	X	
<i>Baccharis pilularis</i> DC	Asteraceae	OV, DS	X	X
<i>Brodiaea californica</i> Lindl. var <i>californica</i>	Liliaceae	OV	X	
<i>Brodiaea elegans</i> Hoover ssp. <i>elegans</i>	Liliaceae	DS	X	
<i>Bromus carinatus</i> Hook. & Arn.	Poaceae	DS	X	
<i>Calystegia purpurata</i> (E. Greene) Brummit ssp. <i>purpurata</i>	Convolvulaceae	OV (DS)	X	
<i>Camissonia ovata</i> (Torr. & A. Gray) Raven	Onagraceae	OV, DS	X	
<i>Carex barbarae</i> Dewey	Cyperaceae	OV	X	
<i>Carex globosa</i> Boott	Cyperaceae	DS	X	
<i>Chlorogalum pomeridianum</i> (DC) Kunth var. <i>pomeridianum</i>	Liliaceae	OV, DS	X	X
<i>Clarkia rubicunda</i> (Lindl.) H. Lewis and M. Lewis	Onagraceae	OV	X	
<i>Claytonia perfoliata</i> Willd. ssp. <i>perfoliata</i>	Portulacaceae	OV, DS	X	X
<i>Crassula connata</i> (Ruiz Lopez & Pavon) A. Berger	Crassulaceae	DS	X	

<i>Cressa truxillensis</i> Kunth	Convolvulaceae	OV, DS	X	
<i>Cynoglossum grande</i> Lehm.	Boraginaceae	OV, DS	X	
<i>Dichelostemma capitatum</i> Alph. Wood ssp. <i>capitatum</i>	Liliaceae	OV, DS	X	
<i>Dichondra donnelliana</i> Tharp & M. Johnston	Convolvulaceae	OV, DS	X	
<i>Distichlis spicata</i> (L.) E. Greene	Poaceae	OV, DS	X	X
<i>Dryopteris arguta</i> (Kaulf.) Maxon	Dryopteraceae	OV, DS	X	X
<i>Dudleya</i> sp. [<i>D. cymosa</i> (Lemaire) Brotton & Rose ssp. <i>paniculata</i> (Jeps.) K. Nakai, acc. OV; <i>D.</i> <i>farinosa</i> (Lindley) Britton & Rose, acc. DS]	Crassulaceae	OV, DS	X	X
<i>Elymus glaucus</i> Buckley	Poaceae	DS	X	
<i>Erigeron foliosus</i> Nutt. var. <i>franciscensis</i> G. Nesom	Asteraceae	DS	X	
<i>Eriogonum nudum</i> Benth. [var. <i>nudum</i> acc. OV, DS; likely var. <i>auriculatum</i> (Jeps.) Bentham, or intergrade with <i>E. latifolium</i>]	Polygonaceae	OV, DS	X	X
<i>Eriophyllum confertiflorum</i> (DC.) A. Gray var. <i>confertiflorum</i>	Asteraceae	DS	X	
<i>Eriophyllum stoechadifolium</i> Lagasca [corrected spelling]	Asteraceae	OV, DS	X	X
<i>Eschscholzia californica</i> Cham.	Papaveraceae	OV, DS	X	X
<i>Festuca californica</i> Vasey	Poaceae	OV, DS	X	X
<i>Festuca rubra</i> L.	Poaceae	DS	X	
<i>Frankenia salina</i> (Molina) I.M. Johnston	Frankeniaceae	OV, DS	X	X
<i>Galium aparine</i> L.	Rubiaceae	DS	X	
<i>Galium porrigens</i> Dempster	Rubiaceae	DS	X	
<i>Gnaphalium canescens</i> DC	Asteraceae	OV	X	
<i>Gnaphalium californicum</i> DC	Asteraceae	DS	X	
<i>Heteromeles arbutifolia</i> (Lindley) Roem.	Rosaceae	OV, DS	X	X
<i>Holodiscus discolor</i> (Pursh) Maxim	Rosaceae	OV, DS	X	X
<i>Iris macrosiphon</i> Torrey	Iridaceae	PB	X	
<i>Iva axillaris</i> Pursh ssp. <i>robustior</i> (Hook.) Bassett	Asteraceae	PB	X	
<i>Jaumea carnosa</i> (Less.) A. Gray	Asteraceae	OV, DS	X	
<i>Lathyrus vestitus</i> Nutt. var. <i>vestitus</i>	Fabaceae	(OV) DS, PB	X	X

<i>Leymus triticoides</i> (Trin.) Pilger	Poaceae	PB	X	
<i>Lomatium utriculatum</i> (Torr. & Gray) J. Coult. & Rose	Apiaceae	OV	X	
<i>Lomatium dasycarpum</i> ssp. <i>dasycarpum</i>	Apiaceae	DS	X	
<i>Lonicera hispidula</i> Douglas var. <i>vacillans</i> A. Gray	Caprifoliaceae	OV, DS	X	
<i>Lotus humistratus</i> E. Greene	Fabaceae	DS	X	
<i>Lotus micranthus</i> Benth.	Fabaceae	DS	X	
<i>Lotus scoparius</i> (Nutt.) Ottley var. <i>scoparius</i>	Fabaceae	OV, DS	X	X
<i>Lotus wrangelianus</i> Fischer & C. Meyer	Fabaceae	DS	X	
<i>Lupinus nanus</i> Benth.	Fabaceae	OV	X	
<i>Lupinus succulentus</i> Koch	Fabaceae	DS	X	
<i>Luzula comosa</i> E. Meyer	Juncaceae	OV	X	
<i>Mimulus aurantiacus</i> Curtis	Scrophulariaceae	OV, DS	X	X
<i>Melica californica</i> Scribner	Poaceae	DS	X	
<i>Melica torreyana</i> Scribner	Poaceae	OV, DS	X	
<i>Monardella villosa</i> Benth. var. <i>villosa</i>	Lamiaceae	DS	X	
<i>Nasella lepida</i> (A. Hitch.) Barkworth	Poaceae	OV, DS	X	
<i>Nasella pulchra</i> (A. Hitch.) Barkworth	Poaceae	OV, DS	X	
<i>Pentagramma triangularis</i> (Kaulf.) G. Yatschkievych, M.D. Windham & E Woflenweber ssp. <i>triangularis</i>	Pteridaceae	OV, DS	X	
<i>Perideridia kelloggii</i> (A. Gray) Mathias	Apiaceae	DS	X	
<i>Phacelia distans</i> Benth.	Hydrophyllaceae	OV, DS	X	
<i>Piperia</i> sp.	Orchidaceae	DS	X	
<i>Plantago erecta</i> E. Morris	Plantaginaceae	DS	X	
<i>Polycarpon depressum</i> Nutt.	Caryophyllaceae	OV	X	
<i>Polypodium</i> sp. (<i>P. californicum</i> Kaulf. acc. OV; <i>P. calirhiza</i> S. Whitmore & A. R. Smith acc. DS for EMI)	Polypodiaceae	OV, DS	X	X
<i>Potentilla glandulosa</i> Lindley sp. <i>glandulosa</i>	Rosaceae	DS	X	
<i>Quercus agrifolia</i> Nee	Fagaceae	OV, DS	X	X
<i>Rumex salicifolius</i> J.A. Weinm.	Polygonaceae	OV, DS	X	X

var. crassus (Rech. f.) J. Howell				
<i>Rosa gymnocarpa</i> Nutt.	Rosaceae	OV, DS	X	X
<i>Rubus ursinus</i> Cham. & Schldl.	Rosaceae	DS, PB	X	
<i>Ruppia maritima</i> L.	Potamogetonaceae	OV, DS	X	
<i>Salicornia virginica</i> L	Chenopodiaceae	OV, DS	X	X
<i>Sambucus mexicana</i> C. Presl.	Caprifoliaceae	OV, DS	X	X
<i>Sanicula crassicaulis</i> DC	Apiaceae	OV, DS	X	
<i>Scrophularia californica</i> Cham. & Schlecht. spp. <i>californica</i>	Scrophulariaceae	OV, DS	X	X
<i>Sisyrinchium bellum</i> S. Watson	Iridaceae	DS	X	
<i>Solidago californica</i> Nutt.	Asteraceae	DS	X	
<i>Spergularia macrotheca</i> (Hornem) Heynh. var. <i>macrotheca</i>	Caryophyllaceae	OV, DS	X	X
<i>Stachys ajugoides</i> Benth. var. <i>rigida</i> Jeps. & Hoover	Lamiaceae	OV, DS	X	X
<i>Stephanomeria elata</i> Nutt.	Asteraceae	OV, DS	X	
<i>Symphoricarpos albus</i> (L.) S.F. Blake var. <i>laevigatus</i>	Caprifoliaceae	OV, DS	X	
<i>Symphoricarpos mollis</i> Nutt.	Caprifoliaceae	DS	X	
<i>Toxicodendron diversilobum</i> (Torr. & A. Gray) E. Greene	Anacardaceae	OV, DS	X	X
<i>Triphysaria pusilla</i> (Benth.) Chuang and Heckard	Scrophulariaceae	OV, DS	X	
<i>Tritelia laxa</i> Benth.	Liliaceae	DS	X	
<i>Tritelia peduncularis</i> Lindley	Liliaceae	DS	X	
<i>Umbellularia californica</i> (Hook. & Arn.) Nutt.	Lauraceae	OV, DS	X	X
<i>Wyethia angustifolia</i> (DC.) Nutt	Asteraceae	DS	X	
<i>Vicia americana</i> Willd. var. <i>americana</i>	Fabaceae	OV, DS	X	
<i>Viola pedunculata</i> Torr. & A. Gray	Violaceae	OV	X	
<i>Zigadenus fremontii</i> (Torr.) S. Watson	Liliaceae	OV, DS	X	X

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Appendix B. Glossary of Terms and Acronyms

ACM	asbestos containing materials
ACR	Audubon Canyon Ranch
CCP	Comprehensive Conservation Plan
CDFG	California Department of Fish and Game
EA	Environmental Assessment
EO	Executive Order
EPA	Environmental Protection Agency
GIS	Geographic Information System
NEPA	National Environmental Policy Act
NWR	National Wildlife Refuge
NWRS/Refuge System	National Wildlife Refuge System
PCB	Polychlorinated biphenyls
Refuge	Marin Islands National Wildlife Refuge
SER	State Ecological Reserve
SF MSA	San Francisco Metropolitan Statistical
USFWS/Service	U.S. Fish and Wildlife Service
WCB	Wildlife Conservation Board
WIMS	Weed Information Management System Area

Appendix C. Refuge Native Plant Species List

Native vascular flora of Marin Islands. Compiled from Ornduff and Vasey (1995) and preliminary November 2003 survey by the Baye (2005). EMI = East Marin Island. WMI = West Marin Island. OV= Ornduff and Vasey (1995). DS = Observations by Doreen Smith in 2003. PB = author. Author's initials in parentheses indicate probable but not confirmed identification of same taxon.

Species	Family	Observer	EMI	WMI
<i>Achillea millefolium</i> L.	Asteraceae	OV, DS	X	
<i>Adiantum jordanii</i> C. Mueller	Pteridaceae	OV, DS	X	
<i>Aesculus californica</i> (Spach) Nutt.	Hippocastanaceae	OV	X	
<i>Agrostis pallens</i> Trin. [intermediate with <i>A. hallii</i>]	Poaceae	[DS, as <i>Agrostis</i> undet. sp.], PB	X	
<i>Amsinckia</i> sp. (<i>A. menziesii</i> var. <i>intermedia</i>)	Boraginaceae	OV	X	
<i>Arbutus menziesii</i> Pursh	Ericaceae	DS	X	
<i>Artemisia californica</i> Less.	Asteraceae	OV, DS	X	X
<i>Artemisia douglasiana</i> Besser	Asteraceae	OV	X	
<i>Aster chilensis</i> Nees	Asteraceae	DS	X	
<i>Atriplex triangularis</i> Willd.	Chenopodiaceae	DS	X	
<i>Baccharis pilularis</i> DC	Asteraceae	OV, DS	X	X
<i>Brodiaea californica</i> Lindl. var <i>californica</i>	Liliaceae	OV	X	
<i>Brodiaea elegans</i> Hoover ssp. <i>elegans</i>	Liliaceae	DS	X	
<i>Bromus carinatus</i> Hook. & Arn.	Poaceae	DS	X	
<i>Calystegia purpurata</i> (E. Greene) Brummit ssp. <i>purpurata</i>	Convolvulaceae	OV (DS)	X	
<i>Camissonia ovata</i> (Torr. & A. Gray) Raven	Onagraceae	OV, DS	X	
<i>Carex barbarae</i> Dewey	Cyperaceae	OV	X	
<i>Carex globosa</i> Boott	Cyperaceae	DS	X	
<i>Chlorogalum pomeridianum</i> (DC) Kunth var. <i>pomeridianum</i>	Liliaceae	OV, DS	X	X
<i>Clarkia rubicunda</i> (Lindl.) H. Lewis and M. Lewis	Onagraceae	OV	X	
<i>Claytonia perfoliata</i> Willd. ssp. <i>perfoliata</i>	Portulacaceae	OV, DS	X	X
<i>Crassula connata</i> (Ruiz Lopez & Pavon) A. Berger	Crassulaceae	DS	X	

<i>Cressa truxillensis</i> Kunth	Convolvulaceae	OV, DS	X	
<i>Cynoglossum grande</i> Lehm.	Boraginaceae	OV, DS	X	
<i>Dichelostemma capitatum</i> Alph. Wood ssp. <i>capitatum</i>	Liliaceae	OV, DS	X	
<i>Dichondra donnelliana</i> Tharp & M. Johnston	Convolvulaceae	OV, DS	X	
<i>Distichlis spicata</i> (L.) E. Greene	Poaceae	OV, DS	X	X
<i>Dryopteris arguta</i> (Kaulf.) Maxon	Dryopteraceae	OV, DS	X	X
<i>Dudleya</i> sp. [<i>D. cymosa</i> (Lemaire) Brotton & Rose ssp. <i>paniculata</i> (Jeps.) K. Nakai, acc. OV; <i>D.</i> <i>farinosa</i> (Lindley) Britton & Rose, acc. DS]	Crassulaceae	OV, DS	X	X
<i>Elymus glaucus</i> Buckley	Poaceae	DS	X	
<i>Erigeron foliosus</i> Nutt. var. <i>franciscensis</i> G. Nesom	Asteraceae	DS	X	
<i>Eriogonum nudum</i> Benth. [var. <i>nudum</i> acc. OV, DS; likely var. <i>auriculatum</i> (Jeps.) Bentham, or intergrade with <i>E. latifolium</i>]	Polygonaceae	OV, DS	X	X
<i>Eriophyllum confertiflorum</i> (DC.) A. Gray var. <i>confertiflorum</i>	Asteraceae	DS	X	
<i>Eriophyllum stoechadifolium</i> Lagasca [corrected spelling]	Asteraceae	OV, DS	X	X
<i>Eschscholzia californica</i> Cham.	Papaveraceae	OV, DS	X	X
<i>Festuca californica</i> Vasey	Poaceae	OV, DS	X	X
<i>Festuca rubra</i> L.	Poaceae	DS	X	
<i>Frankenia salina</i> (Molina) I.M. Johnston	Frankeniaceae	OV, DS	X	X
<i>Galium aparine</i> L.	Rubiaceae	DS	X	
<i>Galium porrigens</i> Dempster	Rubiaceae	DS	X	
<i>Gnaphalium canescens</i> DC	Asteraceae	OV	X	
<i>Gnaphalium californicum</i> DC	Asteraceae	DS	X	
<i>Heteromeles arbutifolia</i> (Lindley) Roem.	Rosaceae	OV, DS	X	X
<i>Holodiscus discolor</i> (Pursh) Maxim	Rosaceae	OV, DS	X	X
<i>Iris macrosiphon</i> Torrey	Iridaceae	PB	X	
<i>Iva axillaris</i> Pursh ssp. <i>robustior</i> (Hook.) Bassett	Asteraceae	PB	X	
<i>Jaumea carnosa</i> (Less.) A. Gray	Asteraceae	OV, DS	X	
<i>Lathyrus vestitus</i> Nutt. var. <i>vestitus</i>	Fabaceae	(OV) DS, PB	X	X

<i>Leymus triticoides</i> (Trin.) Pilger	Poaceae	PB	X	
<i>Lomatium utriculatum</i> (Torr. & Gray) J. Coult. & Rose	Apiaceae	OV	X	
<i>Lomatium dasycarpum</i> ssp. <i>dasycarpum</i>	Apiaceae	DS	X	
<i>Lonicera hispidula</i> Douglas var. <i>vacillans</i> A. Gray	Caprifoliaceae	OV, DS	X	
<i>Lotus humistratus</i> E. Greene	Fabaceae	DS	X	
<i>Lotus micranthus</i> Benth.	Fabaceae	DS	X	
<i>Lotus scoparius</i> (Nutt.) Ottley var. <i>scoparius</i>	Fabaceae	OV, DS	X	X
<i>Lotus wrangelianus</i> Fischer & C. Meyer	Fabaceae	DS	X	
<i>Lupinus nanus</i> Benth.	Fabaceae	OV	X	
<i>Lupinus succulentus</i> Koch	Fabaceae	DS	X	
<i>Luzula comosa</i> E. Meyer	Juncaceae	OV	X	
<i>Mimulus aurantiacus</i> Curtis	Scrophulariaceae	OV, DS	X	X
<i>Melica californica</i> Scribner	Poaceae	DS	X	
<i>Melica torreyana</i> Scribner	Poaceae	OV, DS	X	
<i>Monardella villosa</i> Benth. var. <i>villosa</i>	Lamiaceae	DS	X	
<i>Nasella lepida</i> (A. Hitch.) Barkworth	Poaceae	OV, DS	X	
<i>Nasella pulchra</i> (A. Hitch.) Barkworth	Poaceae	OV, DS	X	
<i>Pentagramma triangularis</i> (Kaulf.) G. Yatschkievych, M.D. Windham & E Woflenweber ssp. <i>triangularis</i>	Pteridaceae	OV, DS	X	
<i>Perideridia kelloggii</i> (A. Gray) Mathias	Apiaceae	DS	X	
<i>Phacelia distans</i> Benth.	Hydrophyllaceae	OV, DS	X	
<i>Piperia</i> sp.	Orchidaceae	DS	X	
<i>Plantago erecta</i> E. Morris	Plantaginaceae	DS	X	
<i>Polycarpon depressum</i> Nutt.	Caryophyllaceae	OV	X	
<i>Polypodium</i> sp. (<i>P. californicum</i> Kaulf. acc. OV; <i>P. calirhiza</i> S. Whitmore & A. R. Smith acc. DS for EMI)	Polypodiaceae	OV, DS	X	X
<i>Potentilla glandulosa</i> Lindley sp. <i>glandulosa</i>	Rosaceae	DS	X	
<i>Quercus agrifolia</i> Nee	Fagaceae	OV, DS	X	X
<i>Rumex salicifolius</i> J.A. Weinm.	Polygonaceae	OV, DS	X	X

var. crassus (Rech. f.) J. Howell				
<i>Rosa gymnocarpa</i> Nutt.	Rosaceae	OV, DS	X	X
<i>Rubus ursinus</i> Cham. & Schldl.	Rosaceae	DS, PB	X	
<i>Ruppia maritima</i> L.	Potamogetonaceae	OV, DS	X	
<i>Salicornia virginica</i> L	Chenopodiaceae	OV, DS	X	X
<i>Sambucus mexicana</i> C. Presl.	Caprifoliaceae	OV, DS	X	X
<i>Sanicula crassicaulis</i> DC	Apiaceae	OV, DS	X	
<i>Scrophularia californica</i> Cham. & Schlecht. spp. <i>californica</i>	Scrophulariaceae	OV, DS	X	X
<i>Sisyrinchium bellum</i> S. Watson	Iridaceae	DS	X	
<i>Solidago californica</i> Nutt.	Asteraceae	DS	X	
<i>Spergularia macrotheca</i> (Hornem) Heynh. var. <i>macrotheca</i>	Caryophyllaceae	OV, DS	X	X
<i>Stachys ajugoides</i> Benth. var. <i>rigida</i> Jeps. & Hoover	Lamiaceae	OV, DS	X	X
<i>Stephanomeria elata</i> Nutt.	Asteraceae	OV, DS	X	
<i>Symphoricarpos albus</i> (L.) S.F. Blake var. <i>laevigatus</i>	Caprifoliaceae	OV, DS	X	
<i>Symphoricarpos mollis</i> Nutt.	Caprifoliaceae	DS	X	
<i>Toxicodendron diversilobum</i> (Torr. & A. Gray) E. Greene	Anacardaceae	OV, DS	X	X
<i>Triphysaria pusilla</i> (Benth.) Chuang and Heckard	Scrophulariaceae	OV, DS	X	
<i>Tritelia laxa</i> Benth.	Liliaceae	DS	X	
<i>Tritelia peduncularis</i> Lindley	Liliaceae	DS	X	
<i>Umbellularia californica</i> (Hook. & Arn.) Nutt.	Lauraceae	OV, DS	X	X
<i>Wyethia angustifolia</i> (DC.) Nutt	Asteraceae	DS	X	
<i>Vicia americana</i> Willd. var. <i>americana</i>	Fabaceae	OV, DS	X	
<i>Viola pedunculata</i> Torr. & A. Gray	Violaceae	OV	X	
<i>Zigadenus fremontii</i> (Torr.) S. Watson	Liliaceae	OV, DS	X	X

Appendix D. Refuge Non-Native Plant Species List

Nonnative flora of East Marin Island. Compiled from Ornduff and Vasey (1995) and Baye (2005). Nomenclature follows Hickman (1993). Ranking of invasive status specific to Marin Island habitats, considering species potential for region. cv. = cultivar; aff. = affinity; undet. = undetermined taxon or cultivar.

Species	Common Name	Family	Invasive status	Local abundance
<i>Acacia baileyana</i>	Bailey acacia	Fabaceae	moderate spread	locally common
<i>Acacia decurrens</i>	green wattle	Fabaceae	invasive	locally common
<i>Acacia melanoxylon</i>	blackwood acacia	Fabaceae	invasive	locally abundant
<i>Acacia retinodes</i>	water wattle	Fabaceae	invasive	locally abundant
<i>Acanthus mollis</i>	Acanthus	Acanthaceae	clonal; slight spread	local
<i>Aeonium arboreum</i>	Aeonium	Crassulaceae	Local, slight spread	high
<i>Allium</i> sp. aff. <i>A. neopolitanum</i>	white-flowered onion	Amaryllidaceae	clonal; locally aggressive	locally abundant
<i>Allium triquetrum</i>	european wild onion	Amaryllidaceae	clonal; locally aggressive	locally abundant
<i>Amaryllis belladonna</i>	naked ladies	Amaryllidaceae	non-invasive, persisting from cultivation	local
<i>Anagallis arvensis</i>	scarlet pimpernel	Primulaceae	invasive, mostly disturbed moist soils	occasional, minor
<i>Atriplex semibaccata</i>	Australian saltbush	Chenopodiaceae	High tide line	rare (regionally common)
<i>Avena barbata</i>	bearded oat	Poaceae	invasive	abundant
<i>Briza maxima</i>	rattlesnake grass	Poaceae	invasive	abundant
<i>Briza minor</i>	small rattlesnake grass	Poaceae	invasive	abundant
<i>Bromus diandrus</i>	ripgut brome	Poaceae	invasive	abundant
<i>Bromus hordeaceus</i>	soft brome	Poaceae	invasive	abundant
<i>Cakile maritima</i>	sea-rocket	Brassicaceae	local, shoreline; minor sp.	local, minor [not recorded 2004]
<i>Carduus pycnocephala</i>	italian thistle	Asteraceae	highly invasive	local, disturbed soils
<i>Carpobrotus edulis</i>	iceplant	Aizoaceae	invasive to highly invasive	local, bluff toe
<i>Centaurea melitensis</i>	Napa starthistle	Asteraceae	highly invasive	local, disturbed soils
<i>Chasmanthe floribunda</i>	Montebretia	Iridaceae	mostly clonal	locally abundant, north slopes, plantings
<i>Cotula coronopifolia</i>	brass-buttons	Asteraceae	shoreline, pond edge; low potential for spread	local
<i>Cortaderia jubata</i>	jubata grass	Poaceae	highly invasive , coastal bluffs	currently local, minor
<i>Cupressus</i>	Monterey cypress	Cupressaceae	normally nvasive,	local, minor, but

<i>macrocarpa</i>			dominant on coast	reproducing
<i>Drosanthemum floribundum</i>	iceplant	Aizoaceae	clonal mat; very local	southern cliff edges
<i>Echium candicans</i>	Pride-of-Madeira	Boraginaceae	infrequently invasive	occasional
<i>Ehrharta erecta</i>	[erect Ehrharta]	Poaceae	highly invasive in maritime California	currently local, minor
<i>Eucalyptus ficifolia</i>	scarlet or fig gum	Myrtaceae	non-invasive	persistent planting
<i>Eucalyptus globulus</i>	blue gum	Myrtaceae	highly invasive, dominant	dominant: canopy
<i>Euphorbia peplus</i>	petty spurge	Euphorbiaceae	invasive, esp. disturbed sites	local
<i>Ficus carica</i>	fig	Moraceae	local, persisting from cultivation	local, persisting from plantings
<i>Filago gallica</i>	French cudweed	Asteraceae	minor	disturbed soil, bluffs
<i>Foeniculum vulgare</i>	fennel	Apiaceae	invasive to highly invasive, bluffs	locally abundant, disturbed bluffs, grassland
<i>Galium aparine</i>	bedstraw	Rubiaceae	slightly invasive, mostly disturbed soils	locally common, woodland understory
<i>Genista monspessulanus</i>	French broom	Fabaceae	highly invasive	locally dominant, north slopes and plateau
<i>Geranium dissectum</i>	cut-leaved cranesbill	Geraniaceae	invasive, but not dominant	
<i>Geranium molle</i>	soft-leaved cranesbill	Geraniaceae	invasive, but not dominant	occasional to common, grassland
<i>Gladiolus</i> cv.	gladiolus	Iridaceae	local, persisting from cultivation	plantings, persistent
<i>Hedera helix</i>	ivy	Araliaceae	highly invasive, dominant	locally dominant, north slopes
<i>Hordeum murinum</i> ssp. <i>leporinum</i>	foxtail barley	Poaceae	invasive	widespread
<i>Hypochaeris glabra</i>	smooth cat's-ear	Asteraceae	invasive	widespread
<i>Hypochaeris radicata</i>	cat's-ear	Asteraceae	invasive	
<i>Iris</i> cv.	bearded iris	Iridaceae	noninvasive; persisting from cultivation	local, minor
<i>Lathyrus tingitanus</i>	Tangier pea	Fabaceae	invasive	widespread
<i>Lepidium latifolium</i>	perennial pepperweed	Brassicaceae	highly invasive only in brackish wetlands	limited
<i>Ligustrum japonicum</i>	wax-leaf privet	Oleaceae	persisting from cultivation	plantings
<i>Lolium multiflorum</i>	italian ryegrass	Poaceae	moderately invasive, mostly disturbed or wet soils	common, grassland
<i>Malus domestica</i> cv. undet.	apple	Rosaceae	noninvasive, persisting from	local

			cultivation	
<i>Medicago polymorpha</i>	bur-clover	Fabaceae	invasive	minor, disturbed soil
<i>Melilotus indica</i>	yellow sweet-clover	Fabaceae	invasive, disturbed sites	minor, disturbed soil
<i>Muhlenbeckia compressa</i>	mattress-vine	Polygonaceae	highly invasive but local	very local, abundant
<i>Narcissus cvs.</i>	narcissus	Amaryllidaceae	clonal, local; persisting from cultivation	local, minor
<i>Olea europaea</i>	olive	Oleaceae	noninvasive; persisting from cultivation	local, minor
<i>Opuntia ficus-carica</i>	prickly-pear cactus	Cactaceae	locally invasive, clonal fragments	locally abundant to dominant, south bluffs only
<i>Oxalis pes-caprae</i>	Bermuda-buttercup	Oxalidaceae	clonal, highly invasive	locally abundant
<i>Pelargonium hortorum</i>	geranium	Geraniaceae	noninvasive, persisting from cultivation	occasional, minor
<i>Petroselinum crispum</i>	parsley	Apiaceae	naturalized, noninvasive	widespread, minor
<i>Phoenix canariensis</i>	Canary Islands date palm	Arecaceae	persisting from plantings; slightly invasive	very localized mature stand; few isolated seedlings
<i>Poa annua</i>	annual bluegrass	Poaceae	moderately invasive, mostly disturbed moist soils	occasional, paths
<i>Poa pratensis</i>	Kentucky bluegrass	Poaceae	moderately invasive, mostly disturbed or moist soils	occasional, grassland
<i>Pinus radiata cv.</i>	Monterey pine	Pinaceae	invasive	dominant: canopy
<i>Plantago lanceolata</i>	English plaintain	Plantaginaceae	invasive	widespread, moderate (grassland)
<i>Polycarpon tetraphyllum</i>		Polygonaceae	invasive, mostly disturbed soils	minor, grassland and bluff
<i>Prunus domestica cv. undet.</i>	plum	Rosaceae	noninvasive, persisting from cultivation	local, minor
<i>Prunus cerasifera cv.</i>	cherry	Rosaceae	noninvasive, persisting from cultivation	local, minor
<i>Raphanus sativa</i>	radish	Brassicaceae	invasive, mostly disturbed soils	rare
<i>Rosmarinus officinalis</i>	rosemary	Lamiaceae	noninvasive, persisting from cultivation	local, minor
<i>Rubus discolor</i>	Himalayan blackberry	Rosaceae	invasive to highly invasive	locally dominant
<i>Rumex acetosella</i>	sheep-sorrel	Polygonaceae	invasive but seldom abundant	widespread, minor (grassland)
<i>Salsola soda</i>	saltwort	Chenopodiaceae	local, shoreline; invasive	low, local

<i>Senecio vulgaris</i>	common groundsel	Asteraceae	invasive, mostly disturbed soils	minor
<i>Silene gallica</i>	windmill pink	Caryophyllaceae	invasive, mostly disturbed soils	minor, bluffs
<i>Sisymbrium officinale</i>	hedge mustard	Brassicaceae	invasive, mostly disturbed soils	minor
<i>Spartina densiflora</i>	Chilean cordgrass	Poaceae	invasive, upper intertidal zone	extirpated individual 2004
<i>Spartium junceum</i>	Spanish broom	Fabaceae	invasive, mostly sandy disturbed soils	[not recorded 2004]
<i>Stellaria media</i>	chickweed	Caryophyllaceae	invasive, mostly disturbed soils	locally abundant, north bluffs
<i>Sonchus asper</i>	prickly sow-thistle	Asteraceae	invasive, mostly disturbed soils	minor
<i>Sonchus oleraceus</i>	common sow-thistle	Asteraceae	invasive, mostly disturbed soils	minor
<i>Tetragonia tetragonioides</i>	New Zealand spinach	Aizoaceae	shoreline, bluff only;	local, minor
<i>Tropaeolum majus</i>	nasturtium	Tropaeolaceae	spreading locally from cultivation, gen. noninvasive	local, minor
<i>Vicia benghalensis</i>	red vetch			local
<i>Vicia sativa</i>	common vetch			local
<i>Vinca major</i>	periwinkle	Plumbaginaceae	invasive, highly persistent	locally abundant

**Appendix E. Refuge Bird Species List
(includes species sighted on or near the Refuge)**

Common Name	Scientific Name
Common loon	<i>Gavia immer</i>
Horned grebe	<i>Podiceps auritus</i>
Clark's grebe	<i>Aechmophorus clarkii</i>
Western grebe	<i>Aechmophorus occidentalis</i>
American white pelican	<i>Pelecanus erythrorhynchos</i>
Brown pelican	<i>Pelecanus occidentalis</i>
Double-crested cormorant	<i>Phalacrocorax auritus</i>
Black-crowned night heron	<i>Nycticorax nycticorax</i>
Great blue heron	<i>Ardea herodias</i>
Snowy egret	<i>Egretta thula</i>
Great egret	<i>Casmerodius albus</i>
Turkey vulture	<i>Cathartes aura</i>
Canada goose	<i>Branta Canadensis</i>
Mallard	<i>Anas platyrhynchos</i>
Gadwall	<i>Anas strepera</i>
Canvasback	<i>Aythya valisineria</i>
Scaup	<i>Athya spp.</i>
Surf scoter	<i>Melanitta perspicillata</i>
Old squaw	<i>Clangula hyemalis</i>
Common Goldeneye	<i>Bucephala clangula</i>
Bufflehead	<i>Bucephala albeola</i>
Red-breasted merganser	<i>Mergus serrator</i>
Osprey	<i>Pandion haliaetus</i>
White-tailed kite	<i>Elanus leucurus</i>
Red-shouldered hawk	<i>Buteo lineatus</i>
Red-tailed hawk	<i>Buteo jamaicensis</i>
Golden eagle	<i>Aquila chrysaetos</i>
Peregrine falcon	<i>Falco peregrinus</i>
Black oystercatcher	<i>Haematopus bachmani</i>
Black-necked stilt	<i>Himantopus mexicanus</i>
Willet	<i>Catoptrophorus semipalmatus</i>
Spotted sandpiper	<i>Actitis macularia</i>
Western sandpiper	<i>Calidris mauri</i>
Western gull	<i>Larus occidentalis</i>
Caspian tern	<i>Sterna caspia</i>
Forster's tern	<i>Sterna forsteri</i>
Mourning dove	<i>Zenaida macroura</i>
Great horned owl	<i>Bubo virginianus</i>
Anna's hummingbird	<i>Calypte anna</i>

Common Name	Scientific Name
Allen's hummingbird	<i>Selasphorus sasin</i>
Belted kingfisher	<i>Ceryle alcyon</i>
Scrub jay	<i>Aphelocoma coerulescens</i>
American crow	<i>Corvus brachyrhynchos</i>
Common raven	<i>Corvus corax</i>
Chestnut-backed chickadee	<i>Poecile rufescens</i>
House wren	<i>Troglodytes aedon</i>
Hermit thrush	<i>Catharus guttatus</i>
Yellow-rumped warbler	<i>Dendroica coronata</i>
Wilson's warbler	<i>Wilsonia pusilla</i>
Spotted towhee	<i>Pipilo maculatus</i>
California towhee	<i>Pipilo crissalis</i>
Golden-crowned sparrow	<i>Zonotrichia atricapilla</i>
Song sparrow	<i>Melospiza melodia</i>
Dark-eyed junco	<i>Junco hyemalis</i>
House finch	<i>Carpodacus mexicanus</i>
American goldfinch	<i>Carduelis tristis</i>
White-throated swift	<i>Aeronautes saxatalis</i>

Source: USFWS Annual Narrative Report 2004

Appendix F. Fish Species List

Common Name	Scientific Name
American shad	<i>Alosa sapidissima</i>
arrow goby	<i>Clevelandia ios</i>
barred surfperch	<i>Amphistichus argenteus</i>
bat ray	<i>Myliobatis californica</i>
bay goby	<i>Lepidogobius lepidus</i>
bay pipefish	<i>Syngnathus leptorhynchus</i>
bearded goby	<i>Tridentiger barbatus</i>
big skate	<i>Raja binoculata</i>
black perch	<i>Embiotoca jacksoni</i>
black rockfish	<i>Sebastes melanops</i>
bonehead sculpin	<i>Artedius notospilotus</i>
brown rockfish	<i>Sebastes auriculatus</i>
brown smoothhound	<i>Mustelus henlei</i>
cabezon	<i>Scorpaenichthys marmoratus</i>
California halibut	<i>Paralichthys californicus</i>
California lizardfish	<i>Synodus lucioceps</i>
California tonguefish	<i>Symphurus atricauda</i>
chameleon goby	<i>Tridentiger trigonocephalus</i>
cheekspot goby	<i>Ilypnus gilberti</i>
chinook salmon	<i>Oncorhynchus tshawytscha</i>
curlfin sole	<i>Pleuronichthys decurrens</i>
diamond turbot	<i>Hypsopsetta guttulata</i>
dwarf perch	<i>Micrometrus minimus</i>
English sole	<i>Pleuronectes vetulus</i>
green sturgeon*	<i>Acipenser medirostris</i>
inland silverside	<i>Menidia beryllina</i>
jacksmelt	<i>Atherinopsis californiensis</i>
leopard shark	<i>Triakis semifasciata</i>
lingcod	<i>Ophiodon elongatus</i>
longfin smelt	<i>Spirinchus thaleichthys</i>
night smelt	<i>Spirinchus starksi</i>
northern anchovy	<i>Engraulis mordax</i>
Pacific herring	<i>Clupea pallasii</i>
Pacific lamprey	<i>Lampetra tridentata</i>
Pacific pompano	<i>Peprilus simillimus</i>
Pacific sanddab	<i>Citharichthys sordidus</i>
Pacific sardine	<i>Sardinops sagax</i>
Pacific staghorn sculpin	<i>Leptocottus armatus</i>
Pacific tomcod	<i>Microgadus proximus</i>
pile perch	<i>Rhacochilus vacca</i>

plainfin midshipman	<i>Porichthys notatus</i>
rainwater killifish	<i>Lucania parva</i>
river lamprey	<i>Lampetra ayresi</i>
rubberlip seaperch	<i>Rhacochilus toxotes</i>
Sacramento pike minnow	<i>Ptychocheilus grandis</i>
saddleback gunnel	<i>Pholis ornata</i>
sand sole	<i>Psettichthys melanostictus</i>
shimofuri goby	<i>Tridentiger bifasciatus</i>
shiner perch	<i>Cymatogaster aggregata</i>
showy snailfish	<i>Liparis pulchellus</i>
speckled sanddab	<i>Citharichthys stigmaeus</i>
spiny dogfish	<i>Squalus acanthias</i>
Splittail minnow*	<i>Pogonichthys macrolepidotus</i>
spotted cusk-eel	<i>Chilara taylori</i>
starry flounder	<i>Platichthys stellatus</i>
striped bass	<i>Morone saxatilis</i>
striped seaperch	<i>Embiotoca lateralis</i>
surf smelt	<i>Hypomesus pretiosus</i>
threadfin shad	<i>Dorosoma petenense</i>
threespine stickleback	<i>Gasterosteus aculeatus</i>
topsmelt	<i>Atherinops affinis</i>
tube-snout	<i>Aulorhynchus flavidus</i>
walleye surfperch	<i>Hyperprosopon argenteum</i>
western mosquitofish	<i>Gambusia affinis</i>
white croaker	<i>Genyonemus lineatus</i>
white seaperch	<i>Phanerodon furcatus</i>
white sturgeon	<i>Acipenser transmontanus</i>
whitebait smelt	<i>Allosmerus elongatus</i>
yellowfin goby	<i>Acanthogobius flavimanus</i>
yellowtail rockfish	<i>Sebastes flavidus</i>

Source: California Department of Fish and Game, Marine Resource Region. <http://www.dfg.ca.gov/mrd/>

*Considered sensitive fish species, but not federally listed.

Appendix G. Refuge Species of Concern

Common and/or Scientific Name	Legal Status: Federal/BCC ¹ /State/CNPS ²
Plants	
<i>Calystegia purpurata</i> Brummit ssp. <i>Purpurata</i>	-/-/1B
<i>Piperia</i> sp. (<i>P. michaelii</i>)	-/-/4
Wildlife	
Brown pelican <i>Pelecanus occidentalis</i>	E/-/SE/-
Peregrine falcon <i>Falco peregrinus</i>	-/X/SE/-
Black oystercatcher <i>Haematopus</i> <i>bachmani</i>	-/X/-/-

¹Birds of Conservation Concern

²California Native Plant Society