APPENDIX B

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APPENDIX B-1

Bair Island Restoration Monitoring Plan

BAIR ISLAND RESTORATION PROJECT MONITORING PLAN

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U.S. Fish and Wildlife Service
Don Edwards San Francisco Bay
National Wildlife Refuge
San Francisco Bay Wildlife Society

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BAIR ISLAND RESTORATION PROJECT
MONITORING PLAN

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1.0 INTRODUCTION

Bair Island is located adjacent to the San Francisco Bay in Redwood City, San Mateo County, California (Figure 1). Historically, Bair Island was part of a large complex of tidal marshes and mud flats within the drainage of Bay and Belmont Sloughs (PWA 2000). Bair Island was diked in the late 1800's and early 1900's for agricultural practices including cattle grazing. The island was converted to salt evaporation ponds by Leslie Salt Company starting in 1946, and remained in salt production until 1965. The lands were drained and eventually sold to a series of real estate development companies.

The California Department of Fish and Game (CDFG) and the Don Edwards San Francisco Bay National Wildlife Refuge (hereafter, "Refuge") both acquired portions of Bair Island over time. In 1997, the Peninsula Open Space Trust (POST) purchased the remaining portions of Bair Island and turned over their interest in the property to these agencies. The San Carlos Airport also retains a portion of Inner Bair Island as a safety zone. In addition, two easements exist on Bair Island for PG&E towers and transmission lines that run throughout the Bair Island complex and the South Bay System Authority (SBSA) force main that runs underneath most of the southern part of the levee on Inner Bair.

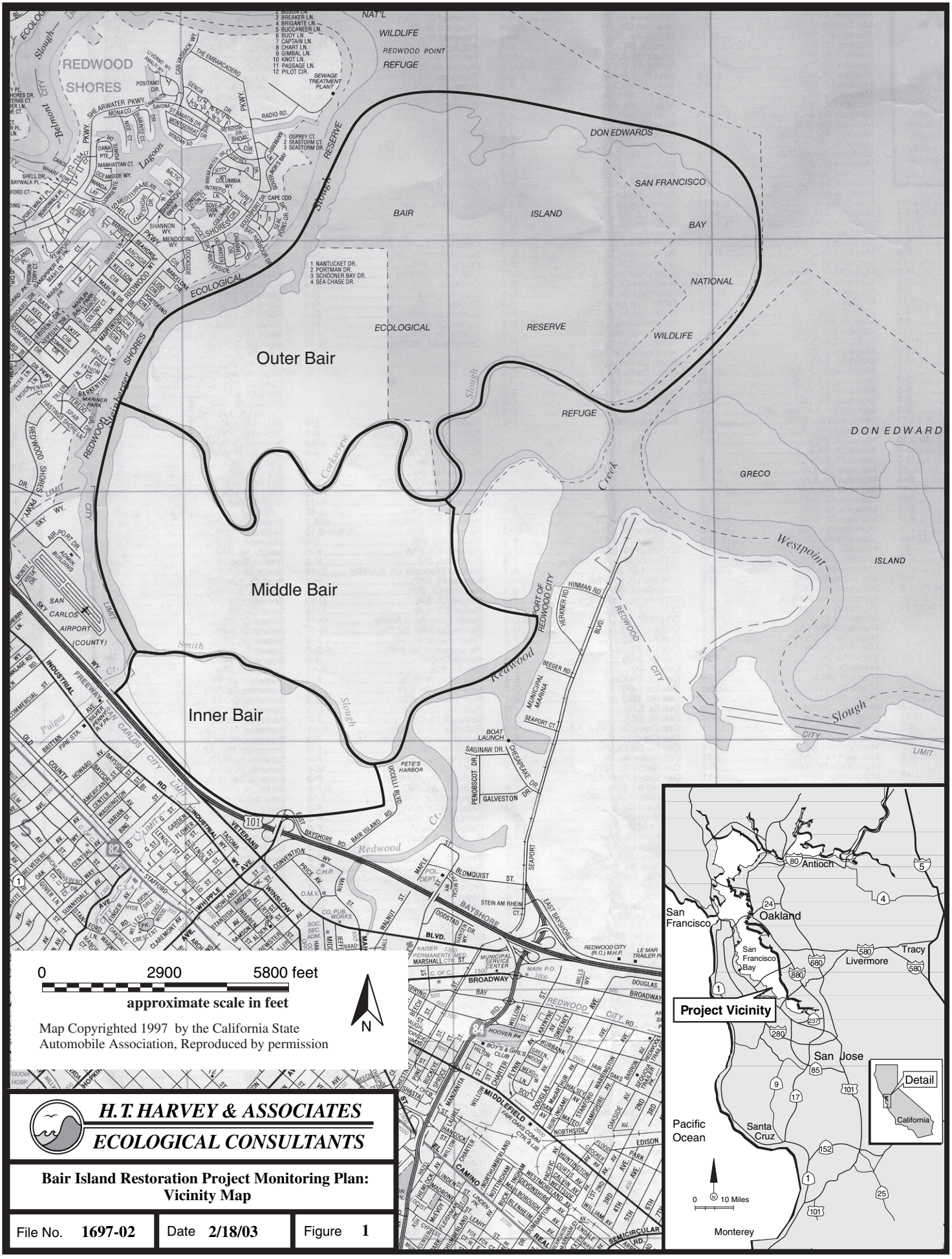
This site is a large, restorable complex of former salt evaporators, and has been a major priority for addition to the Refuge since the original boundaries were drawn. The restoration of tidal habitats at Bair Island is ecologically important to South San Francisco Bay. Following restoration, Bair Island will become an integral part of the extensive wetland complex within the Refuge and adjacent state and privately owned wetlands.

In addition to restoring 1400 acres of tidal wetlands to the much depleted South San Francisco Bay (SFB) tidal-marsh complex, the restoration activities planned for Bair Island provide a unique opportunity for documenting the effects and chronology of events that evolve during the implementation of a tidal salt-marsh restoration. Although similar restoration projects have occurred within the SFB (Cooley Landing, Warm Springs), project development has not been documented to the extent that a specific set of guidelines could be produced for use during subsequent restoration projects. Therefore, the restoration plan, while primarily describing the steps required to produce a successful salt-marsh restoration, also provides a monitoring plan and the testing of hypotheses. These efforts will track the development of the tidal marsh as well as providing valuable information for future restoration projects.

1.1 PROJECT GOALS AND OBJECTIVES

The San Francisco Bay Wildlife Society (SFBWS) and the U. S. Fish and Wildlife Service (USFWS) developed goals and objectives for restoration of Bair Island. These goals and objectives, presented below, are consistent with the policies of the Don Edwards San Francisco Bay National Wildlife Refuge, to which Bair Island now belongs.

We assume a 50-year planning horizon, consistent with that used by other San Francisco Bay restoration projects currently in planning.



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Bair Island Restoration Project Monitoring Plan: Vicinity Map

File No. **1697-02**	Date **2/18/03**	Figure **1**

Goals of the Bair Island Restoration Project

- Restore Bair Island to native tidal salt-marsh habitat.
- Provide habitat for endangered and other natives species.
- Enhance the public's appreciation and awareness of the unique resources of Bair Island.

Objectives for the Bair Island Restoration Project

- Restore and enhance habitat for the endangered California Clapper Rail (*Rallus longirostris obsoletus*) and salt marsh harvest mouse (*Reithrodontomys raviventris*).
- Create and enhance habitat for the endangered California Least Tern (*Sterna antillarum*), California sea-blite (*Suaeda californica*), and other wetland dependent species, if compatible with restoration for the Clapper Rail and harvest mouse.
- Minimize disturbance to sensitive species (e.g., Clapper Rails, harbor seals [*Phoca vitulina*]).
- Provide the control of undesirable species including invasive plants, undesirable predators, and mosquitoes.
- Enhance the public's awareness of the unique resources at Bair Island by providing opportunities for wildlife-oriented recreation and nature study.

1.2 PROPOSED RESTORATION DESIGN

The proposed action restores full tidal inundation to Inner, Middle, and Outer Bair. For Middle and Outer Bair, natural estuarine sedimentation will raise the marshplain surface to allow complete vegetation establishment over time. Restoration will include features to encourage reestablishment of the natural tidal drainage network and discourage the capture of tidal flows by borrow ditches at these two islands. At Inner Bair, dredged material, most likely from Redwood Creek, will be used to raise the marsh plain elevation prior to breaching. Placement of dredged material has the additional advantage of expediting the establishment of emergent marsh vegetation.

Channel modifications would be made at Smith and Corkscrew sloughs to minimize project related effects on high sedimentation rates in the Redwood Creek shipping channel and flow velocities at Pete's Outer Harbor. These channel modifications include the realignment of Smith Slough to its historic meander through Inner Bair and the partial blocking of Corkscrew Slough to the east of the Middle Bair breaches. For details of these project design features please see the Bair Island Restoration and Management Plan (H.T. Harvey & Associates 2002).

Middle and Outer Bair Islands. Levees will be breached at selected historic slough channel locations on Middle and Outer Bair islands, restoring natural tidal flows. Pickleweed-dominated marsh vegetation will establish quickly in areas already at high intertidal elevations. Natural estuarine sedimentation on the lower mud-flat areas will gradually build up these areas to elevations high enough for the establishment of cordgrass and pickleweed. Borrow-ditch cutoff berms will be created to prevent tidal capture by the existing borrow ditches, allowing the natural channel system to re-establish. Interior berms and levees will be lowered or removed where possible, creating additional tidal habitat. Levees desired for upland refuge habitat or required to protect infrastructure from wind-wave erosion would be left in place.

Based on initial ground elevations and predicted sediment supply, some vegetation colonization will begin immediately following restoration implementation. Most of this marsh formation will occur along the perimeter of the restoration areas, along historic slough channels or on higher elevation areas. Substantial tidal marsh vegetation establishment is expected at Outer Bair within 30 to 50 years and at Middle Bair within approximately 50 years.

Inner Bair Island. Dredged material, or other sources of fill, would be used to expand the southern levee of Inner Bair Island to adequately protect the SBSA sewer line and create a cross-levee that protects the San Carlos Airport property on Inner Bair Island. Levees will be breached at historic slough channel locations on Inner Bair Island and borrow ditch cutoff berms will be created to prevent tidal capture by the existing borrow ditches. Although historic slough channels and borrow ditches may be filled with dredged material, differential settlement of the dredged material will result in a lower elevation, and therefore channel development may still occur in these areas.

Fill will be used to raise ground levels on Inner Bair from current elevations of approximately 0.0 to between 2.0 and 3.0 feet NGVD, requiring between 400 – 500,000 cubic yards of fill. This target is close to the 538,000 cubic yards dredged from Redwood Creek during an average dredging event. Redwood Creek has been dredged eight times between 1977 and 1999, and the average annual accumulation rate is estimated to be 200,000 cubic yards.

The area within the cross-levee system protecting the San Carlos Airport safety zone, as well as the alignment of the SBSA sewer line, will be filled with dredged material to an elevation that is above MHHW. By creating upland and transitional habitats in these areas, some of the primary constraints associated with reintroducing tidal action to Inner Bair Island are minimized. From the created upland areas, the fill material will gradually slope down to the lower elevations of the restored marshplain. Fill elevations will be highly varied, ideally providing ample areas of transitional habitat, including upland, seasonal wetland, and supratidal wetland areas. The lower elevations will be high enough for pickleweed and cordgrass to immediately colonize once the site is breached, but low enough to allow some channel development through natural tidal scour. A limited number of perennial pickleweed starter plantings will be installed. Potential drawbacks of dredged material placement are cost and impaired tidal channel development at Inner Bair (as the existing remnant slough system may be covered). Sediment quality would also need to be appropriate for wetland reuse.

No public access will be allowed on Outer and Middle Bair Island except by Refuge guided trips and other specific exceptions that are approved by a Refuge Special Use Permit. Public access for pedestrians and bicyclists will be allowed along a 2.7-mile levee trail on Inner Bair. This trail will be provided along the perimeter of Inner Bair, running from the Refuge's parking lot near Pete's Harbor. An orientation kiosk and viewing/environmental education platforms will be provided at the ends of the levee trail, adjacent to Smith Slough.

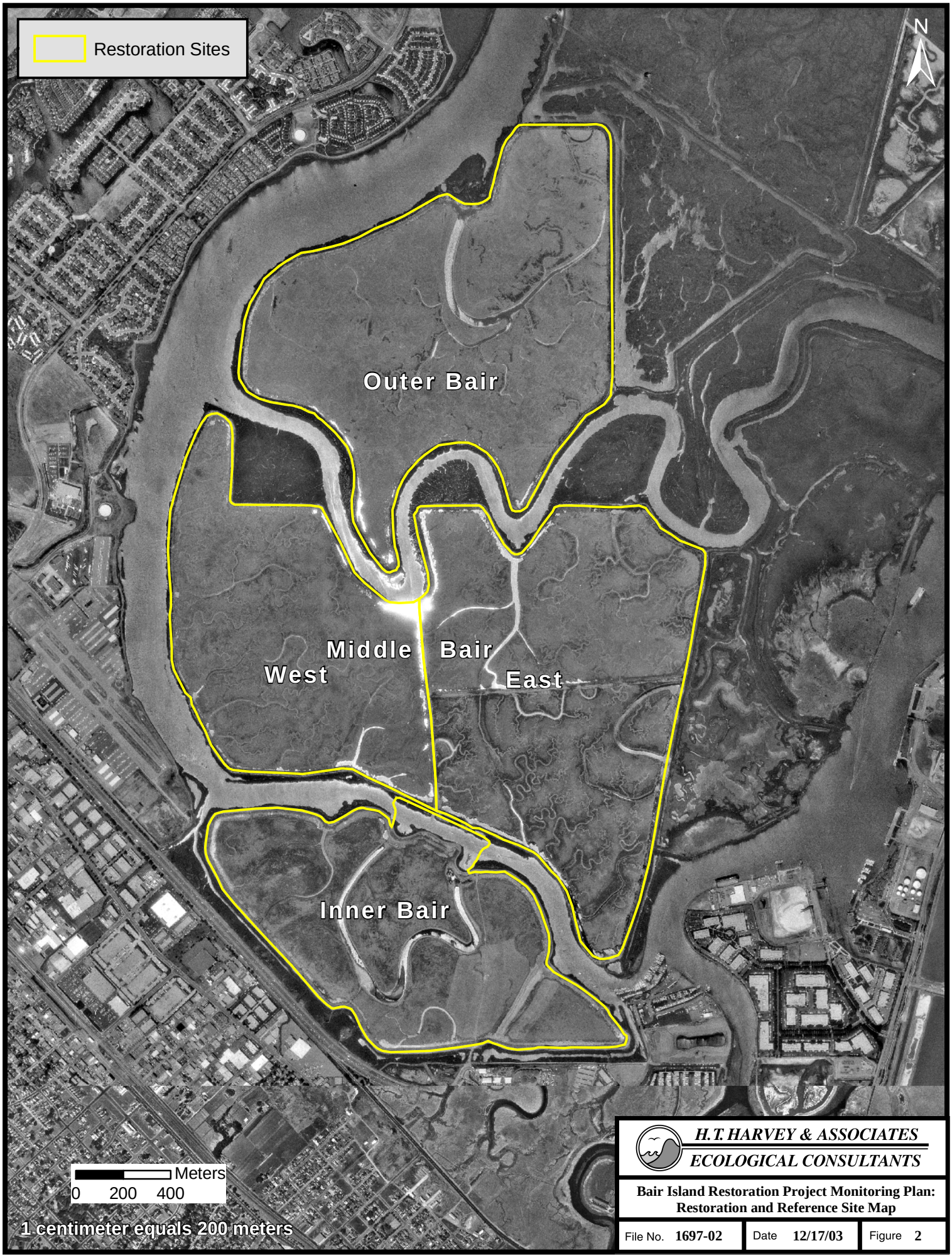
Fishing from boats in Smith, Corkscrew and Steinberger Sloughs and Redwood Creek will be allowed, however fishing will not be permitted from land. Hunting of waterfowl on Outer Bair Island will be allowed per state regulations.

1.3 PROJECT TIMELINE

It is anticipated that Bair Island Restoration project will be implemented in 2005. The project is large scale and therefore will be implemented over a period of several years.

1.4 MONITORING OBJECTIVES

The objectives for the monitoring program are to ensure the restoration meets the project's objectives by achieving the goals stated above. Adaptive management decisions based on monitoring data will increase the potential for project success, especially since tidal restoration at Bair Island will be implemented in phases. One additional objective is to provide data for future, tidal, salt-marsh restoration projects in San Francisco Bay.



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Bair Island Restoration Project Monitoring Plan: Restoration and Reference Site Map

File No. 1697-02	Date 12/17/03	Figure 2

2.0 MONITORING ELEMENTS

Specific monitoring elements that will provide information for evaluating the evolution of site functions have been identified. These monitoring elements have been selected as pertinent indicators of progress towards the project's specific goals and objectives.

2.1 MONITORING LIMITATIONS/ASSUMPTIONS

There are no specific performance criteria for the Bair Island Restoration project. However, the restoration project was designed to achieve overall objectives of restoring Bair Island to native tidal salt-marsh habitat, and providing habitat for endangered species (California Clapper Rails and salt marsh harvest mice). Monitoring of the restoration project will facilitate evaluation of the project's progress towards achieving those objectives.

Certain elements of the plan, especially some of the physical elements, will be discontinued, once there is a clear indication that the site is evolving in the predicted fashion, as described below. It is likely that the distinct subsections, or "ponds" (Inner Bair, Middle Bair East, Middle Bair West, and Outer Bair), within this restoration will achieve their objectives in different time frames. Therefore, this monitoring program will end within each pond once California Clapper Rails and salt marsh harvest mice have colonized that unit.

2.2 PHYSICAL ELEMENTS

Physical monitoring will be carried out at specified intervals to help to understand how the physical system is responding to the restoration design implementation and to determine if any intervention is required. This part of the monitoring program includes several geomorphic and hydrologic elements that will be monitored by a qualified engineer or geomorphologist. Monitoring locations are shown in Figure 3 and 4. The monitoring schedule and frequency are described in Table 1 of Section 4. The exact locations of the monitoring data will be determined by Global Positioning Systems (GPS) to facilitate accurate mapping.

Tidal Circulation. Water levels and drainage patterns will be monitored in the tidal sloughs and inside the restored ponds to evaluate hydrologic functions at the site. Tidal circulation is important since characteristics of the hydroperiod affect vegetation colonization, sediment delivery to the marshplain, ecologic functions of the site, and drainage of adjacent low-lying areas.

Tidal damping conditions in slough channels and restored ponds are expected during initial tidal restoration of Middle Bair because parts of the slough network will be initially undersized and because the new flow-control structures will reduce the amount of tidal flow routed through Redwood Creek. Initially, Inner Bair, Middle Bair, and the upstream reach of Steinberger Slough are not expected to drain completely at low tide. However, low-tide drainage is expected to improve as the sloughs deepen and internal drainage networks inside the ponds develop.

figure 3

Bair Island

Monitoring Stations: Tide Gauges & Current Velocities

Basemap: aerial photograph (2/18/00)

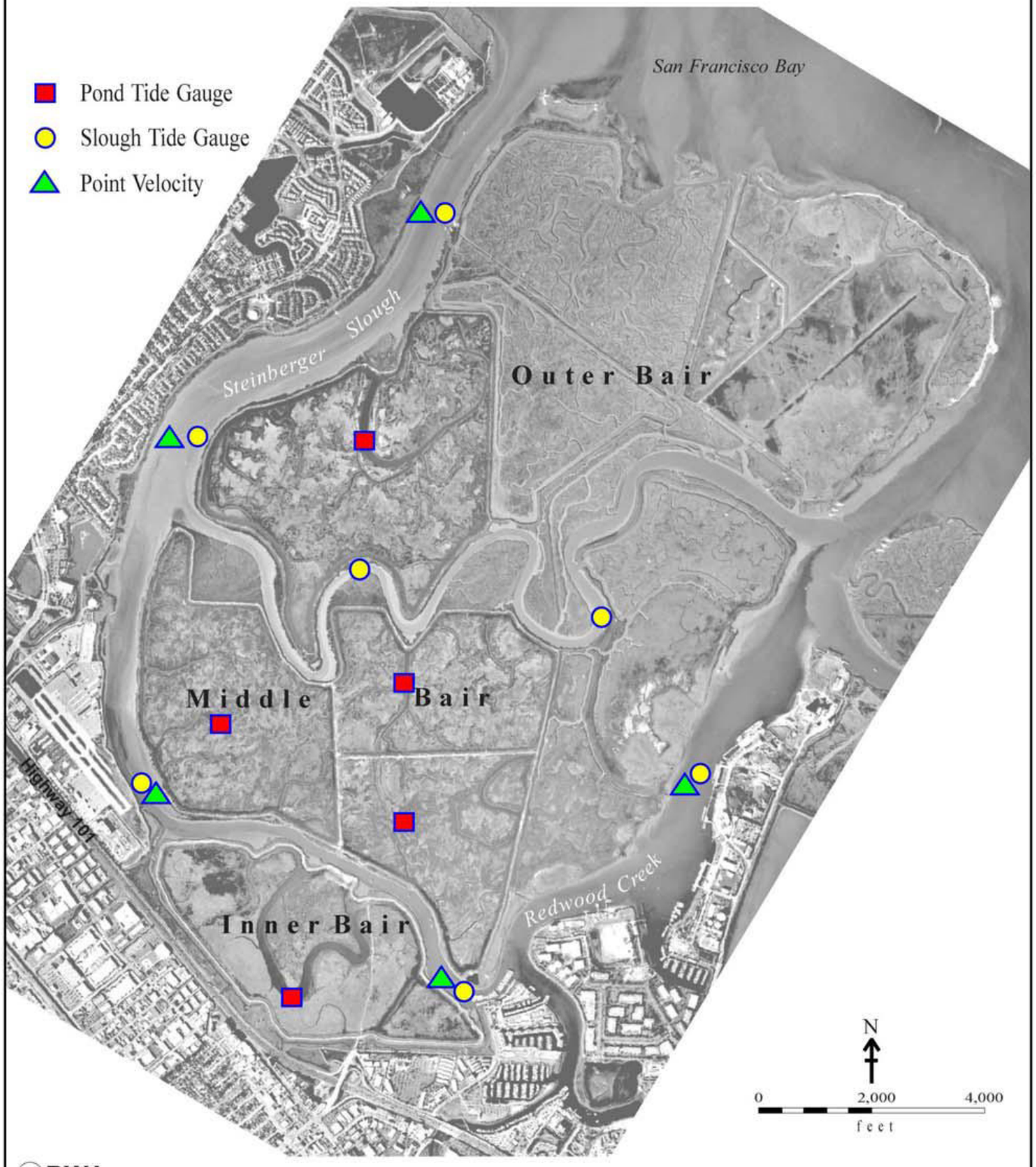

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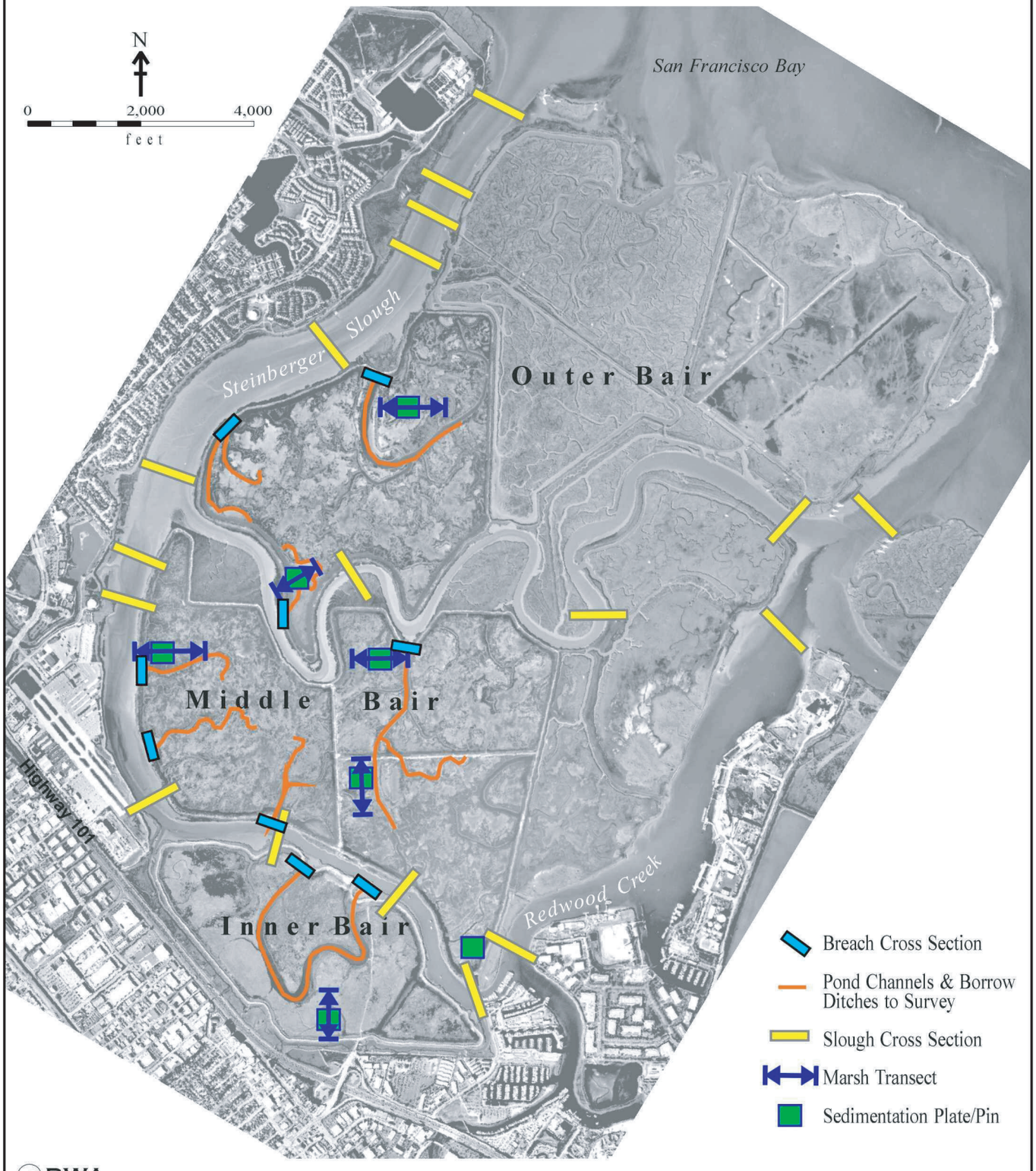
figure 4

Bair Island

Monitoring Stations: Slough and Marsh Morphology

Basemap: aerial photograph (2/18/00)



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Water-level elevations will be measured continuously over a spring neap cycle (about 14 days) concurrently at locations within the slough network and inside Outer, Middle, and Inner Bair Islands. Water-surface elevation data will be used to determine whether tidal damping is present inside the sloughs and ponds. If the monitoring team concludes that tidal dampening is present and poses a significant threat to site development, then remedial measures will be developed and proposed in the monitoring reports. Internal levees, ditch blocks, under-sized sloughs, and slow re-establishment of the historic pond channels are examples of conditions that may contribute to inadequate low-water elevation drainage.

Slough Morphology. The goal of the slough morphology monitoring is to understand how the existing looped slough networks of Redwood Creek, Steinberger Slough, Corkscrew Slough, and Smith Slough (Figure 4) are responding to the tidal restoration project. Increased tidal flows are expected to erode sections of Steinberger Slough, while decreased flows due to flow-control structures are expected to cause siltation in other portions of the slough system. These trends of erosion and siltation will influence water levels at the site and conveyance of flood flows from Pulgas and Cordilleras Creeks.

Steinberger Slough is currently undersized to convey the additional tidal prism associated with restoration of Inner, Middle, and Outer Bair, and is expected to deepen as increased tidal flows scour sediment. Bed erosion is likely to occur preferentially along the thalweg, where velocities are greatest, resulting in improved low-water drainage in the upstream reaches of the slough and in areas of Middle Bair that drain to Steinberger Slough. Increased conveyance along Steinberger Slough will be necessary to offset decreases in conveyance associated with rerouting streamflow from Pulgas and Cordilleras Creeks that presently discharge to San Francisco Bay through Redwood Creek. Targeted cross sections of Steinberger Slough will be surveyed more frequently than other parts of the slough network to assess morphological changes that affect its ability to route flood flows. This more frequent flood assessment will include numerical modeling to establish changes in flood conveyance along Steinberger Slough, as described in the EIR/S.

As described in PWA (2003), a revised flood assessment may be required if monitoring of water levels indicates that the channel restrictors are not performing as expected (i.e., the amount of tidal flows in the Redwood Creek and Smith Slough are significantly higher than existing conditions). If a revised flood assessment is required, cross sections will be surveyed along Steinberger Slough, at the locations shown in Figure 4. Significantly fewer (approximately half) cross sections will required if a revised flood assessment is not required. Data form cross sections along Smith and Corkscrew Sloughs will also be collected, although less frequently. Additionally, cross section data will also be collected along Redwood Creek to document whether or not tidal restoration of Bair Island has increased the shoaling rate along the Shipping Channel. Cross sections will be surveyed before restoration (Year 0) at every monitoring station to establish baseline conditions and at the time intervals shown in Table 2 in Section 4.

Satellite imagery collected for habitat evolution (see below) will also be used to assess morphological changes along Steinberger Slough, especially at its mouth where substantial erosion through the outboard mudflat is expected.

Marsh Morphology. The morphology of the restored marshplain will be monitored to measure whether the site is evolving along the expected trajectory. Since it is expected to take many

decades for the site to reach elevations close to those of natural marshes, monitoring will provide data that can be used to estimate the rate of evolution and the functions of the restored wetland in its transitional state. Components of the marsh monitoring include:

1. Pond Drainage Network. In the current pond configuration, historic pond channels and some of the borrow ditches in the interior of the ponds are expected to capture most of the tidal flows onto the marshplain, therefore the restoration design includes channel connectors and "cut-off berms" to allow for adequate drainage without the borrow ditches becoming the primary drainage network. In order to track slough development during restoration, approximately one to five cross sections of each selected remnant channel will be surveyed. Figure 4 shows the pond channels recommended for survey, although the exact location and number of cross sections may be modified depending on how the restoration project is implemented (e.g., phasing) or adaptively managed as the site evolves. Longitudinal profiles will also be collected along the main interior channels identified in Figure 4. "Cut-off berms" will be visually inspected to evaluate whether they are performing adequately (not undermined by excessive erosion) and whether any maintenance is required. One cross section will be collected from a borrow ditch adjacent to each of the primary pond channels. Additionally, aerial photography collected for habitat mapping will be used to assess the evolution of the interior pond drainage system.

2. Marshplain Evolution. Tracking the development of the restored marshplain will be a key monitoring element, given the overall goals of the restoration project. Sedimentation plates/pins will be installed prior to breaching and inspected after restoration to determine rates of estuarine deposition. Stations will be installed throughout Outer, Middle and Inner Bair islands to determine how sedimentation rates vary with distance from levee breaches and among the three ponds. Additionally, vegetation-elevation transects approximately 500 – 1,000 feet long will be surveyed to verify sedimentation rates and further characterize marshplain evolution, particularly the natural levee formation behind the interior pond channels.

3. Breaches. Since Middle and Outer Bair Islands will be below natural marshplain elevations at the time they are breached, a greater amount of tidal prism will initially pass through the levee breaches relative to long-term conditions. Therefore, there may be a tendency for the breaches to scour and enlarge, since they were sized based on the expected long-term conditions. Cross sections of each of the nine levee breaches included in the Recommended Alternative will be measured to determine the rate of breach widening and deepening.

4. Remnant Levee. Although some levees on Middle and Outer Bair will be lowered to provide a source of fill for construction, outboard and interior levees will largely be left in place to serve as wave breaks to promote marshplain evolution and provide upland refugia for marsh wildlife. Levees will be inspected for evidence of wind-wave erosion by aerial photography, and the linear distance of intact levees will be estimated.

Tidal-Current Velocities. The potential for increased tidal-current velocities at Pete's Harbor was identified as a significant project constraint early in the restoration design development. Specific elements were included in the design to facilitate tidal restoration without raising peak

velocities at the harbor. Point-current meters will be used to measure tidal currents before and following tidal restoration to confirm velocities are not significantly higher following restoration. Additional current meters will be deployed along Steinberger and Corkscrew Sloughs to correlate velocities with rates of erosion and downcutting. Figure 3 shows the locations of each tidal-current station. Tidal-currents will be measured over a complete spring neap cycle and timed to coincide with measurements of water level elevations.

Infrastructure. Flow-control structures along Smith and Corkscrew Sloughs will be visually inspected to assess structural integrity and to confirm that these elements are functioning as expected. The structural integrity and hydraulic performance of the flow-control structures are essential to project success, since the structures limit sedimentation along the Redwood Creek Shipping Channel and enhance the supply of sediment-laden water to Middle and Outer Bair islands. The armored breach along the historic meander of Smith Slough (IB1) will also be inspected at the same time as the flow control structures. As described in the Restoration and Management Plan (HTH & PWA 2003), adjustments to the flow control structures and armored breach will be made as part of an adaptive management program to ensure the restoration plan does not adversely affect flood hazards or the shipping channel. Trails will also be visually inspected to assess their structural integrity.

Monitoring Schedule. Monitoring of physical elements should follow the schedule summarized in Table 1 in Section 4. Note that some of the monitoring elements can be discontinued early, if data indicate that performance is satisfactory.

2.3 BIOLOGICAL ELEMENTS

Habitat Mapping. To determine ratios of intertidal habitats to each other and to open water, satellite imagery (*e.g.* IKONOS) will be obtained for the project area. The image will be collected in June or July, during a low solar angle, and minus tide. To ensure comparisons across years, all image capture will occur at a similar tidal elevation. The monitoring schedule and frequency are described in Table 1 of Section 4. It is essential that the type of image and parameters of the images stay essentially the same both within and across years to spatially analyze the data. The imaging for the first five years will primarily be used to help monitor physical changes on the marsh plains, as little vegetation colonization is expected in that period.

Habitats will be mapped on a dominant species basis, primarily to detect colonization by native cordgrass and pickleweed. Non-native cordgrass will also be mapped, where it can be detected on the satellite images. The images will be interpreted and mapped preliminarily, then ground truthed from levee locations and by boat.

Vegetation. More detailed plant sampling will occur along the established transects only after the aerial mapping has detected the beginning of colonization. Specifically, when habitat mapping indicates that the percent cover of vegetation on the marsh plain in a given pond (Inner, Middle East, Middle West, or Outer Bair) equals or exceeds 10%, then more detailed sampling will be conducted. That sampling will occur thereafter every 5 years until successful colonization of each pond by CCR and SMHM is confirmed. Plant-species composition and relative abundance will be determined in minimum one square meter quadrats arranged along the vegetation/elevation transects shown on Figure 4. Quadrat sampling will correspond with elevational data points collected on the transects.

The best timing for vegetation sampling is July or August, however this period conflicts with protections afforded to the California Clapper Rail during the breeding season. Therefore, it is understood that sampling may not occur until September of each year. The monitoring schedule and frequency are described in Table 1 of Section 4.

Invasive Cordgrass. The San Francisco Estuary Invasive *Spartina* Control Program proposes to implement a coordinated, region-wide eradication program, comprising a number of on-the-ground treatment techniques to stave off invasion of non-native cordgrass from the eastern United States. The Control Program would be focused within the nearly 40,000 acres of tidal marsh and 29,000 acres of tidal flats that comprise the shoreline areas of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, Sonoma, and Sacramento counties. One of the initial targets of the program includes Bair Island. It is assumed that all invasive cordgrass monitoring and eradication will be coordinated through this control program.

However, if invasive cordgrass is suspected and/or identified along an established vegetation transect or during general site reconnaissance, the location of the invasive cordgrass will be mapped and reported to the Control Program. The project proponents are working closely with the San Francisco Bay Invasive *Spartina* Control Program to ensure that any activities at Bair Island are consistent with the goals and procedures of the bay-wide eradication program.

Adaptive Management. Three years after tidal influence has been restored to Bair Island the extent of the invasive smooth cordgrass (*Spartina alterniflora* and its hybrids) infestation will be re-evaluated and the challenge and feasibility of eradicating the introduced cordgrass will be re-assessed in relation to conditions in the South Bay and Control Program's regional efforts of smooth cordgrass control. At this time it may be deemed infeasible to eradicate the invasive species in perpetuity. If this is the case, efforts may focus on controlling smooth cordgrass spread, maintaining areas of open mudflat and insuring that it is not encroaching on higher marsh habitat.

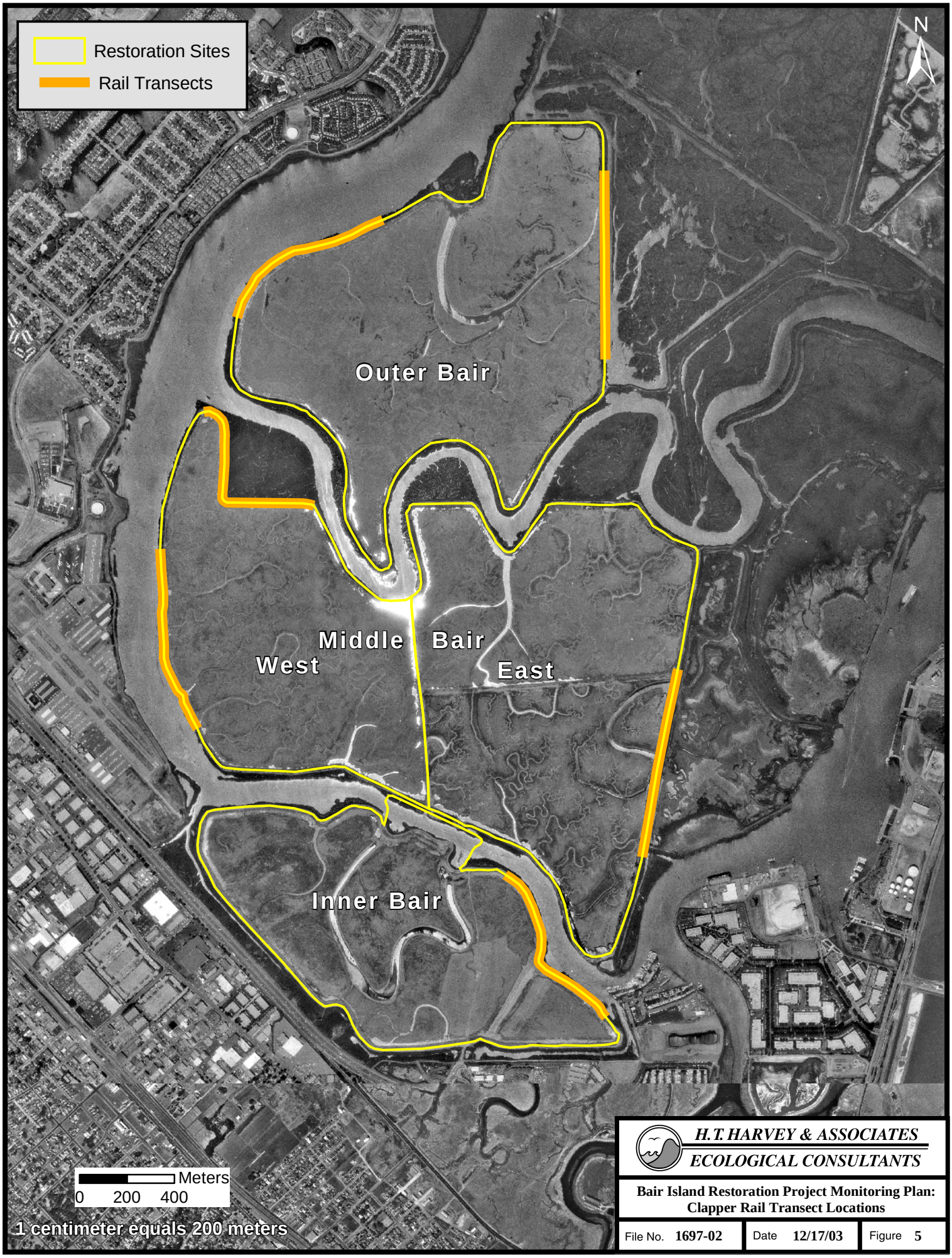
California Clapper Rail. A primary goal of the restoration of Bair Island is the creation of habitat for California Clapper Rails. Clapper Rails currently breed on the restored portion of Outer Bair Island. Clapper Rails also breed on nearby Greco Island.

Studies of radio-tagged individuals representing three other subspecies, including the Louisiana, Light-footed, and Yuma Clapper rails (*R. l. saturatus*, *R. l. levipes*, and *R. l. yumanensis*, respectively; Roth et al. 1972, Zembal et al. 1989, Conway et al. 1993) have shown that these rails have relatively small home ranges ("territories" - 0.04 – 1.66 ha), but that their territories change seasonally, being significantly larger during the nonbreeding period than during the breeding season. These rails are most vocally active during the early breeding season (March to May) and least active during winter (Conway et al. 1993). The latter is the only study that we are aware of that examines seasonal vocalizations of this species, but the seasonality noted by these authors is consistent with that of another species, the California Black Rail (*Rallus jamaciensis corturniculus*; Spear et al. 1999). In addition, detection probability in the California Black Rail, and likely the Clapper Rail as well, is related to several environmental factors including time of day, air temperature, cloud cover, tide height, moon phase, and season (Spear et al. 1999). Except for time of day (see below), we are not aware of such studies having been conducted for the Clapper Rail.

The objective of the Clapper Rail surveys at Bair Island is to determine presence and estimate densities. Breeding season surveys will be conducted every five years beginning when vegetation monitoring detects 30% cover and continue until the USFWS determines that a sustainable population of Clapper Rails breeds in the restored areas. A target breeding season density can be 0.33 rails per hectare of marsh habitat, a mean density derived from an extensive study of breeding California Clapper Rails conducted in 13 marshes in the South Bay in 1989 (H. T. Harvey and Associates 1989). The USFWS will also use the monitoring data to track the rail population in the restored habitats and implement adaptive management as determined necessary by the Service. Once the USFWS determines that a sufficiently robust breeding population of California Clapper Rails is established in the restored areas, the Service will continue monitoring the areas via winter high-tide surveys. Breeding season surveys should be conducted between February 15 and April 15. As noted above, this period coincides with the first part of the breeding season when rails are most vocal and detectability rates are likely at a maximum which, in turn, maximizes the accuracy of density estimates derived from survey data.

Clapper Rails will be surveyed at Outer, Middle-east, Middle-west and Inner Bair Island using 800 m long (0.5 miles) transects positioned on the diked levees (Figure 5). Each transect will consist of 5 stations at 200 m intervals. Each of the 30 stations will be marked with a flagged rebar post with the transect and station numbers labeled on the flagging. Placement of transects within each survey area will be determined based on optimum habitat quality at that time. Surveys will be conducted on each transect three times, with surveys at least one week apart. During each survey session, multiple observers can survey more than one transect simultaneously, as long as: 1) there is not more than one observer assigned to any given section and, 2) they are spaced far enough apart so that call-broadcasts (details below) cannot be detected by any of the other observers involved. Thus, it is likely that a total of three observers could conduct surveys simultaneously. In the past we have found that the problem of an observer mistaking the other's recorded calls for a rail can be avoided by choosing transects separated by distances >2000 feet (about 0.4 miles).

Surveys will be conducted using pre-recorded "duet" calls of the California Clapper Rail. Each observer will need an ESA section 10a1A "recovery permit" to broadcast rail vocalizations, as the activity constitutes "harassment" of a Federally-listed species. These permits are available from the U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office, 2800 Cottage Way, Room W-2605, Sacramento, CA 95825. Obtaining these permits well before survey implementation will be very important because without the use of broadcasts, considerably more time will be required for "listening" at each station and rail densities are more likely to be underestimated. Even more critical would be the unrecoverable loss of the standardized survey protocol (a must for population trends analyses) that will occur if broadcasts are used in some years but not others.



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Bair Island Restoration Project Monitoring Plan: Clapper Rail Transect Locations

File No. 1697-02	Date 12/17/03	Figure 5

The calls will be broadcast at each station for one minute, with four sequences of duet or clapper calls repeated during the playback minute. Each observer will require a high-quality cassette (or CD or MP3) player equipped with a stereo-amplified speaker system capable of broadcasting between 80-90 dB at 1-meter in front of the speaker, and a high quality recording to broadcast rail calls. The same audio setup played at a standardized decibel rating will be used on every survey. For each survey, starting points at either end of all transects will be alternated. Morning surveys should not be initiated earlier than 0.75 hours before sunrise or end more than 1.25 hrs thereafter, and evening surveys should begin no earlier than 1.5 hrs before sunset and end no later than 0.75 hours following sunset (Zembal et al. 1989, Spear et al. 1999). An hour should be adequate to complete the survey along each transect if observers spend no more than 10 minutes at each station.

Following Kepler and Scott (1981), observers will be trained to estimate detection distance. These training sessions will be conducted prior to surveys using a recorder playing rail vocalizations at various distances from the observers. Each detected Clapper Rail will be counted and the distance to each bird will be estimated. The distance from observers at which rail detection probabilities decrease will be established using standard equations. This information will then be used to calculated Clapper Rail densities. Thus, both direct-count and density data will exist for each area surveyed.

Weather conditions, including wind speed and direction, air temperature and cloud cover will be recorded at the beginning of each survey. Surveys should be discontinued when winds are >15 knots. Surveys will not be conducted when tides are greater than 4.5 feet NGVD as measured at the Golden Gate. Except for wind speed, it will not be possible to control for the effects of other environmental variables that affect rail detection probability (e.g., tide height, air temperature, cloud cover, and moon phase) due to logistic constraints imposed on the scheduling of rail surveys. But by recording these variables during surveys, it will be possible to make the required adjustments during the analyses of Clapper Rail density (see below).

When a Clapper Rail is detected during surveys, data recorded will include date, time, station number, type of call, compass bearing and estimated distance to the calling bird. Distance estimates will pertain to the first call elicited by a rail. Simultaneous vocalizations and distances between call locations will be used to distinguish individuals.

Post restoration, monitoring will begin at any one of the four subsections only after the vegetation targets area reached. They will continue at the specific transect until CCR densities reach the target level (Table 1, Section 4)

Salt Marsh Harvest Mouse. The objective of the SMHM monitoring is to achieve a consistency in catch within each restored pond so that we can reasonably assume that SMHM are establishing a viable population within the restored portions of Bair Island. We considered a variety of trapping programs and techniques while designing the monitoring element for the SMHM. For example, protocols collected by SFEI (2002) included both random and non-random protocols for monitoring salt marsh harvest mice; the former, with its random assignment of trapping locations, allows for detailed statistical analysis of such parameters as microhabitat use but requires large numbers of trap nights and is time, effort and cost intensive. The latter protocol, i.e., using non-random techniques such as grids and/or lines of traps, can be used to ascertain presence and absence of salt marsh harvest mice and provide qualitative data as

to relative usage of various areas by the mouse. Non-random techniques, however, are not amenable to most statistical analyses but require fewer trap nights, and less time, effort and cost.

We propose to use the non-random method because of the number of areas and trap nights to be monitored, the concentration of traps needed to trap this species when it is present in low numbers, and the narrow time window available for trapping (i.e., when Clapper Rails are not nesting and nighttime tides are low). Therefore, the trapping protocol is designed to detect the colonization of the restored marsh by SMHM, and the establishment of a population within the restored area. A population will be considered established when relative densities, as judged by capture efficiency (capture per unit effort, CPUE), approximate other marshes in the south bay area. Data collected by Shellhammer and Duke (in preparation) indicates that 3 captures per 100 trap nights would be a reasonable indication that a population had established itself on the restored marsh plain.

Monitoring will commence when pickleweed cover reaches at least 75% cover over at least 10% of the developing marshplains within any subsection (i.e., Inner, East and West Middle, Outer) of Bair Island (see Vegetation monitoring element). While dense patches of pickleweed over 10% of any given pond is far less than its projected final distribution, this represents 30 to 140 acres, depending upon the pond. Trapping will occur initially only in the section with the best potential habitat and will be conducted on the marsh plain. Special precautions need to be observed in order to trap on the marsh plain. Trapping will have to occur in a neap tide window in the fall when the marsh plain supporting pickleweed will not be inundated for the 4-day window of trapping.

Because these sites are large and there is likely considerable spatial variation in mouse abundance, two grids (lines) of 50 traps (spaced 10 m apart, 100 total traps) will be established within each pond, within the best available habitat. If possible, the grids will overlap with vegetation/elevation transects established on the marsh plain. Each grid will be trapped for four nights. Trapping will continue every five years until SMHM are captured on the restored marsh plain and in sufficient numbers (see below) to conclude that the population is established.

All trapping will be conducted using Sherman live-traps. Live traps will be supplied with nesting material and baited, and each trap will be placed on a small wooden board to shield nesting material (cotton batting) from wicking moisture from the substrate. A second board should be placed on top of any trap not sufficiently covered by vegetation. Trapping dates will be selected to avoid inclement weather, and be based on periods when overnight tides will be least likely to inundate set traps. Traps will be checked each morning at dawn, closed and removed (if necessary) during the day, and reset one hour before sunset.

Trapping will be conducted by trained and permitted biologists following all federal and state permitting guidelines. All small mammal species will be identified and sexed while salt marsh harvest mice will also be weighed and marked to allow assessment of recapture on subsequent trap-nights during the trap session. Methods described in Shellhammer (1984), and the Don Edwards San Francisco Bay NWR protocol will be used to identify *Reithrodontomys* mice to species whenever possible.

Each trap will be marked with the transect and trap number and GPS units will be used to record the location for each trap. Each time a mouse is trapped the transect and trap number will also be

recorded. Vegetation data will be recorded at each trap site within each grid. Minimum vegetation data collected will be species present, percent plant cover by species, maximum plant height by species. All vegetation data will be collected within a 1-m^2 quadrant. The southeast corner of the quadrat will be located on the trap site.

Introduced Predators. Introduced predators such as the non-native red fox (*Vulpes vulpes regalis*) can have significant negative effects on nesting birds, including California Clapper Rails. Restoration of Clapper Rails cannot occur without concurrent management of non-native predators, thus red foxes and other mammalian predators will continue to be trapped at Bair Island following guidelines in the USFWS (1991) Predator Management Plan and Final EA. Although no formal monitoring will be established for introduced predators, if Clapper Rail surveys or other anecdotal evidence suggests that introduced predators are present at Bair Island, a monitoring program should be established following the methods of Albertson (1995).

3.0 DATA ANALYSIS

3.1 ANALYSIS OF PHYSICAL DATA

Analysis of field data collected during each monitoring event will be conducted as soon as possible to allow for further sampling if discrepancies in the original data set are encountered. Data analysis will include preparation of graphs and tables, and comparisons with previous monitoring events to evaluate site progress. Specifically, analysis of the physical data will include the tasks described below.

Tidal Circulation. Data from the tide gauges will be presented graphically and compared with tides in San Francisco Bay to assess the degree of tidal muting throughout the slough system and ponds. In particular, the low-water elevation during spring and neap tides will be examined at the monitoring locations. Tide signals from the gauges installed inside the restored ponds will be compared to marshplain elevations to determine frequency, duration, and depth of flooding. An assessment regarding the adequacy of site drainage in relation to habitat development will be made.

Slough Morphology. Measured cross-sections will be presented graphically, and the rates of downcutting and widening will be documented. Data collected from the point current meters will be compared to rates of erosion/sedimentation along the sloughs. The amount of slough expansion following tidal restoration will be important in assessing the risk of flooding along Pulgas and Cordilleras Creeks (briefly discussed below and detailed in the EIR/S).

Marsh Morphology. Marshplain sedimentation rates collected from the sedimentation plates/pins will be used to assess if the site is evolving as expected, and to estimate the time required to reach a mature marshplain elevation. Data will be tabulated for each of the monitoring locations to document the variability in sedimentation rates throughout the site. Transect data will be presented graphically and compared to elevations required for vegetation colonization.

Data for breach cross-sections will be presented graphically, and rates of widening and downcutting will be determined. Data from tide gauges installed in the restored sites will also be examined to explain adjustments in breach geometry.

Tidal-Current Velocities. Data from the point-current meters will be presented graphically, and peak spring and neap velocities will be noted. Peak tidal current velocities collected at Pete's Harbor will be compared to pre-project conditions to assess whether tidal restoration at Bair Island has resulted in higher tidal currents and more difficult navigation conditions.

Current velocities along Redwood Creek will also be compared to pre-project conditions to determine if more sediment-laden Bay water is being drawn through the shipping channel. Some natural variability is expected due to differences in tidal forcing at the time of monitoring and timing of dredging activity, and surveyed cross sections along Redwood Creek will supplement the assessment of increased shoaling in the shipping channel.

Since monitoring of velocities at Pete's Harbor and along Redwood Creek will be carried out to

document the need for mitigation, a more detailed description of the data analysis is provided in the EIR/S documents.

Peak tidal current velocities collected along Steinberger and Corkscrew sloughs will be documented and compared to the observed rates of erosion/deposition to help define erosion thresholds.

Performance of Hydraulic Structures. Measured tidal currents collected from Pete's Harbor, Redwood Creek, and Corkscrew Slough (east of the flow control structure) will be compared to pre-project conditions to determine if flow-control structures are functioning properly. Specifically, measured tidal currents and surveyed cross sections will be used to assess the effectiveness of flow-control structures in limiting tidal flows through Redwood Creek and routing the additional tidal prism through Steinberger Slough.

Flood-Risk Assessment. An annual flood-risk assessment will be conducted by examining the low water drainage along Steinberger Slough and supplemented by numerical modeling. Although bed erosion is expected to improve low-water drainage and conveyance, the initially undersized cross sections of Steinberger Slough are expected to increase flood hazards in the short-term. Since the annual flood assessment will be carried out to monitor for mitigation of increased flood hazards, the assessment is detailed in the EIR/S documents.

Trail Assessment. Visual inspections of the constructed trails will be used to assess: (1) if trail cover is appropriate for the level of traffic, (2) if public safety and access have been maintained, and (3) how off-trail use is adversely affecting wildlife habitat and the possible need for trail re-alignment.

3.2 ANALYSIS OF BIOLOGICAL DATA

Habitat Mapping. Habitat mapping data will be analyzed in GIS to determine the area of each habitat type and changes in habitats through time. The percent change in habitats through time will be analyzed using a spatial analysis program. This analysis will allow project managers to track the development of habitats.

Vegetative Cover. The sampling unit to be analyzed will be a species' relative cover value, by transect. These data will be used to trigger sampling for SMHM and CCR.

Invasive Cordgrass Monitoring. Non-native cordgrass stands identified during sampling will be reported directly to the San Francisco Bay Invasive *Spartina* Control Program.

California Clapper Rail. Estimating abundance of rails from call playback surveys requires the determination of the maximum range within which rails are detected with equal probability (see Buckland et al. 1993). The expected number of detections increases in proportion with πr^2, where r is the distance between the observer broadcasting the calls and the outer edge of the survey zone (i.e., the radius of the circular survey zone), and π is the constant, 3.1416. Conformance in the number of rail detections with this relationship as r is increased indicates that rails are being detected at the farther distances as well as they are at closer ones. Conversely, a breakdown in the relationship caused by a decrease in rail detections at larger distances indicates that detection probability is being negatively affected by the increase in r,

either because the observer is hearing fewer of the responding rails, or because fewer rails at those greater distances are responding to the broadcasts.

An example of avian density calculations is given below, assuming that the detection range cutoff is 50 m. The density for each transect survey will be calculated from the equation:

$$d = \frac{n}{(\pi)\,(50^2)\,(5)},$$

where d = the number of birds of species a per meter^2, n = number of detections within 50 m, π = 3.1416, and 5 is the number of stations per transect. Annual mean density of species a $\pm$ the standard error can then be calculated by averaging density across x transects conducted per year. An abundance estimate, then, is the density times the surface area of the marsh for which an estimate is desired.

Salt Marsh Harvest Mouse. The sampling unit will be catch per unit effort (CPUE) per grid. CPUE will be compared among the different subsections of Bair Island, and with other historic and current data from South San Francisco Bay, but 3% CPUE is the initial target. Changes in mouse densities between sampling years will be analyzed qualitatively. Relative plant abundance and plant height will also be qualitatively compared to SMHM densities. Due to sampling design limitations, no statistical tests are planned for SMHM density estimates.

Introduced Predators. No analyses are planned for predator observations.

4.0 MONITORING TIMELINE

All monitoring elements described in Section 2 should occur at the frequency listed in Table 1. Selected monitoring can be discontinued if data indicate that site evolution and/or the hydraulic structures are performing as expected, as discussed below. Efforts will be made to coordinate and consolidate monitoring effort once the monitoring triggers have been attained.

Table 1. Monitoring Frequency of Physical Elements

ELEMENT	FREQUENCY	NUMBER OF STATIONS/GAUGES/TRANSECTS*
Tidal Circulation	Years 0, 1, 2, 5, 10, 15, 20***	7 tide gauges in the slough system and 5 gauges in the Outer, Middle and Inner Bair Islands.
Slough Morphology**	Years 0, 1, 2, 5, 10, 15, 20.	18 cross sections throughout slough network.
Targeted Survey of Steinberger Slough	Annually, to be discontinued once flood assessment indicates that conveyance has been restored (see text)	3 tide gauges and 9 cross sections along Steinberger Slough (to assess changes in flood conveyance).
Marsh Morphology	Years 0, 1, 5, 10, 15, and 20	9 levee breaches, 6 transects, and 7 sedimentation plates/pins.
Current Velocities	Years 0, 1, 2, 5, 10, 15, 20 ***	5 current meters.
Infrastructure	Flow control structures and armored breach immediately after construction and significant rainfall events during the first year, then twice a year (before and after the rainy season). Trail annually.	2 flow control structures, 1 armored breach, and trails along Inner Bair Island.
Habitat Mapping	Years 0, 1, 5, every 5 years until CCR and SMHM monitoring criteria are met	Satellite imagery, field-truthed and produced in GIS
Vegetation	Variable depending upon site evolution. Begins when habitat mapping detects 10% cover, then every 5 years thereafter until CCR and SMHM monitoring criteria are met	6 transects, corresponding to marsh morphology transects.
Invasive Cordgrass	See Vegetation (above)	N/A
California Clapper Rail	Breeding season surveys initiated when vegetation cover in restored areas	Call playback surveys will be conducted along transects on the levees of the restoration site.

ELEMENT	FREQUENCY	NUMBER OF STATIONS/GAUGES/TRANSECTS*
	reaches 30%. Then once every five years until breeding densities reach 0.33 rails/hectare, or the USFWS determines that an adequate breeding population has been established. Thereafter, winter high-tide surveys will be conducted.	
Salt Marsh Harvest Mouse	Begins when dense pickleweed covers 10% in any given pond. Then every 5 years until CPUE = 3%	Two grids on Inner and Outer Bair; four grids on Middle Bair.

* Approximate numbers only. The precise number of monitoring stations may vary depending on data collected during the previous monitoring events.
** See also targeted surveys of Steinberger Slough.
*** See text for discussion of performance criteria for early termination of these surveys.

Low-water drainage is expected to improve as tidal scour deepens Steinberger Slough and a channel drainage networks are established inside the Outer and Middle Bair Islands. Therefore, monitoring of water surface elevations can be discontinued once the full tidal range is developed.

Monitoring of current velocities at Pete's Harbor and Redwood Creek can be discontinued after Outer, Middle, and Inner Bair Islands have been breached, once the data indicate that peak tidal currents to do not significantly exceed pre-project conditions. Monitoring of velocities along Steinberger Slough should continue as long as morphological changes of the slough are observed.

As discussed in the EIR/S, assessments of conveyance of flood flows from Pulgas and Cordilleras Creeks will be carried out every year. Targeted surveys along Steinberger Slough will not be needed once these annual flood assessments demonstrate that scour along this reach of the slough network has increased flood conveyance to pre-project levels.

Note that more detailed descriptions of the flood and Pete's Harbor assessments are provided in the EIR/S.

5.0 PERFORMANCE EXPECTATIONS

Measuring performance of the restoration relative to expectations will increase the likelihood that long-term habitat goals will be met through adaptive management. Since Bair Island is not a mitigation site, it does not need to strictly conform to a particular set of standards. However, the expectations listed in Table 3 will be used to guide evaluation of site evolution. Expectations for meeting non-habitat related mitigation requirements are documented in the EIR/S and are not included here.

Table 2. Performance Expectations

MONITORING ELEMENT	PERFORMANCE EXPECTATIONS (HYPOTHESES)
Tidal circulation and Slough Morphology	Inner Bair, Middle Bair, and the upstream reach of Steinberger Slough are not expected to drain completely at low tide initially. However, drainage will improve as Steinberger Slough deepens and drainage systems inside the ponds develop. The range of high and low tides throughout the site will be similar to those in South San Francisco Bay by approximately Years 5 - 10. This expectation relies on engineering judgment based on rates of tidal slough scour in similar systems. Rates of tidal slough scour erosion are generally difficult to predict with certainty and no site-specific predictions have been prepared for Bair Island. We consider the time frame above (5-10 years) to be conservative, and the actual time for full tidal drainage may be less.
Marsh morphology	The ponds will evolve to more closely resemble a natural marsh. However, rates of colonization of emergent marsh vegetation will vary due to spatial differences in suspended sediment concentration, initial muting of the tide range, and differences in existing elevations within the ponds. Expected habitats and site evolution are described more fully in Section 7.2 of the Restoration and Management Plan.
Current Velocities	Pre- and post-project velocities are expected to be similar east of the flow control structures. Velocities west of the structures are expected to increase.
Tidal marsh vegetation	Inner Bair will rapidly colonize with cordgrass and pickleweed (*Salicornia* sp.), with substantial areas of vegetated marsh forming by the end of Year 5. Inner Bair will likely transition into a perennial pickleweed (*Salicornia virginica*) dominated marsh by the end of Year 15. Outer Bair will be mostly vegetated in 10 to 25 years. Plant establishment at Middle Bair will take longer, with a vegetated marsh forming in 25 to 50 years.
Transition/Upland vegetation	In order to provide high-tide refugia for the salt marsh harvest mouse, the transition and upland vegetation should evolve to provide adequate plant cover. The total acreage of these habitats will depend upon the amount of area created in Inner Bair by the beneficial use of dredge material and by differential subsidence of levees and berms throughout the restoration areas.

MONITORING ELEMENT	PERFORMANCE EXPECTATIONS (HYPOTHESES)
California Clapper Rail	It is anticipated that Clapper Rails will be present in all restored areas of Bair Island once appropriate habitat becomes established. Densities should reach levels comparable to those of known Clapper Rail populations in other marshes on San Francisco Bay (0.33 rails/hectare during the breeding season; after H. T. Harvey and Associates 1990). We anticipate that these levels would be achieved within 20 years of the establishment of appropriate habitat.
Salt Marsh Harvest Mouse	It is anticipated that salt marsh harvest mice will be present in all restored areas of Bair Island once appropriate habitat becomes established. CPUE is expected to exceed 3% within 20 years of the establishment of appropriate habitat.

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H.T. HARVEY & ASSOCIATES

ECOLOGICAL CONSULTANTS

APPENDIX B-2

Bair Island USFWS Biological Opinion

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

IN REPLY REFER TO:
1-1-05-F-0121

Memorandum

To: Project Leader, San Francisco Bay National Wildlife Refuge Complex, Newark, California

From: Field Supervisor, Sacramento Fish and Wildlife Office, Sacramento, California

Subject: Endangered Species Consultation for the Proposed Bair Island Restoration and Management Plan, Don Edwards San Francisco Bay National Wildlife Refuge, San Mateo County, California

This memorandum is in response to your March 14, 2005 request that the Sacramento Fish and Wildlife Office (SFWO) concur with your determination that the proposed restoration and management activities (proposed project) outlined in the Biological Evaluation and draft EIS/EIR for Bair Island, Don Edwards San Francisco Bay National Wildlife Refuge (Refuge) in San Mateo County, California, are not likely to adversely affect the endangered California clapper rail (*Rallus longirostris obsoletus*) (clapper rail) and the endangered salt marsh harvest mouse (*Reithrodontomys raviventris*) (harvest mouse), and will have no effect on the endangered California brown pelican (*Pelecanus occidentalis californicus*), the endangered California least tern (*Sterna antillarum browni*), and the threatened western snowy plover (*Charadrius alexandrinus nivosus*). This response is in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S. C. 1531 *et seq*.). Your request was received in our office on March 16, 2005, and additional information was provided to the SFWO through meetings and correspondence subsequent to that date.

Your analysis identifies initial short-term adverse effects to the clapper rail and harvest mouse that will occur while implementing the early stages of restoration that will create long-term benefits to both species and their habitats. Therefore, the SFWO is issuing this biological opinion (opinion) for those two species. The SFWO recognizes that you have determined that the proposed action will have no effect upon the California brown pelican, the California least tern, and the western snowy plover, and therefore these species will not be addressed further.

This opinion is based on information provided in the following documents: (1) the Refuge's March 14, 2005 Biological Evaluation and January 12, 2006 action description; (2) the Refuge's August 2004 Bair Island Restoration and Management Plan (Draft EIS/EIR); and (3) meeting notes, correspondence, and electronic mail concerning the proposed action between the SFWO, the Refuge, and interested or involved parties. This opinion also is based on other relevant published and unpublished studies, and communications on the distribution and abundance of the clapper rail and harvest mouse, and information available to the SFWO.

Consultation History

November 2004-February 2005:	The Refuge and the SFWO negotiated the Bair Island Trail alignment and defined points of agreement.
March 16, 2005:	The Refuge requested informal consultation for the proposed action.
May 18, 2005:	Staff from the SFWO met with Refuge staff to discuss the proposed action and conduct a site visit of Bair Island.
June 15, 2005:	SFWO staff met with Refuge staff to clarify several outstanding questions regarding modifications to the original proposed action.
June 27, 2005:	The Refuge provided an updated map of the revised proposed action on Inner Bair Island.
July 27, 2005:	The SFWO requested a meeting to discuss details of the proposed action.
August 24, 2005:	The SFWO, Refuge, and consultants met to discuss information needed to initiate consultation, including details of the proposed action and species occurrences. Action items were generated and a follow-up meeting to collaboratively write the description of the action was scheduled.
September 20, 2005:	SFWO staff and Refuge staff developed a draft description of the proposed action.
October 17, 2005:	SFWO submitted draft description of the action to the Refuge and consultants for final review.
December 6, 2005:	SFWO, Refuge, and consultants met at the refuge to discuss contaminants issues and to receive draft comments.
December 13, 2005:	SFWO and Refuge reached concensus on contaminants criteria.
January 12, 2006:	Refuge submitted final description of the action to the SFWO.

BIOLOGICAL OPINION

Description of Proposed Action

The Refuge is proposing adoption of a restoration and management plan to restore approximately 1,400 acres of former salt evaporators on the Bair Island complex to tidal salt marsh (Figure 1). Following restoration, Bair Island will become an integral part of the extensive wetland complex within south San Francisco Bay. The purpose of the restoration activities proposed is to restore high quality tidal marsh habitat to Inner, Middle, and Outer Bair Island, thereby enhancing habitat for special status species, migratory waterfowl, and shorebirds.

The following tasks will be performed to prepare Bair Island for restoration, after *Spartina alterniflora* control is deemed successful by the Refuge in the project vicinity:

1. Phase 1. Breach Outer Bair Island to Steinberger Slough at OB1 (fall 2006).

2. Phase 2. Inner Bair Island elevation increase (fall 2006-fall 2009).

3. Phase 3. Build flow restrictors/blocks in Corkscrew and Smith Sloughs (summer 2010). Breach Outer, Middle, and Inner Bair Islands (fall 2010).

4. Phase 4. Public Access improvements on Inner Bair Island (late summer 2006 and late fall 2010).

Phase 1: Outer Bair Levee Breach

Beginning in September 2006 (or 2007 if *Spartina* control requires another year) excavation will begin at OB1 to remove material in preparation for breaching the levee. Under the guidance of a qualified biologist, a maximum of 1.54 acres of existing pickleweed plants will be hand-removed with a weed-eater prior to mechanical ground disturbance. The weed-eater will start in the middle and work outward to avoid trapping mice in the last remaining area to be removed. An amphibious excavator or bulldozer (transported by raft or helicopter) will be used to excavate material from the salt marsh outside of the levee to create the new channel for tidal flows. The excavated substrate will be used to create two ditch blocks in the borrow ditches at OB1 and in the eastern borrow ditch of Outer Bair Island. If additional material is required to block the borrow ditches, up to 12,000 linear feet (0.55 acres) of the levee on the western edge of Outer Bair Island along Steinberger Slough may be graded to a height no lower than +6 feet NGVD (after pickleweed removal). The new tidal channel will be excavated through the existing pickleweed mass from Steinberger Slough towards the levee with the last block left in place until low tide to ease excavation and minimize sediment transport. This process is anticipated to require two weeks to a month, however, a larger block of time has been allocated. Phase 1 will be completed by the end of January 2007 (or 2008). Outer Bair Island will be exposed to tidal action at OB1; the northeast cell will remain diked salt marsh, and additional breaches (OB3 and OB4) will occur in phase 3.

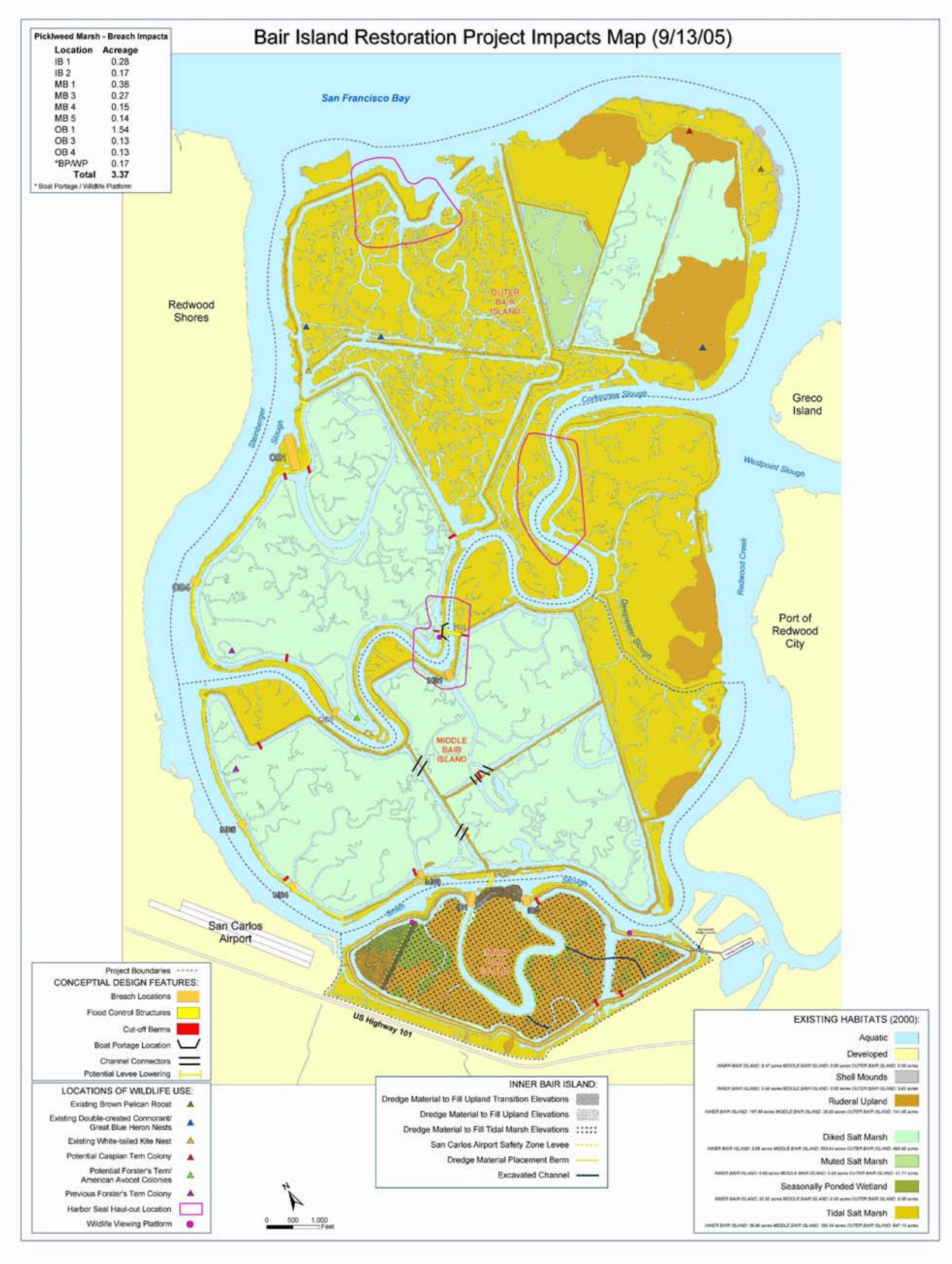

Figure 1. Bair Island Restoration Plan. (Map provided courtesy H.T. Harvey & Associates)

Phase 2: Inner Bair Elevation Increase

Beginning in August 2006, Inner Bair Island will be prepared to receive dredge material. Most, if not all, fill material will come from maintenance dredging of the Redwood Creek Shipping Channel (SFWO file #1-1-04-F-0199). Corps dredging will occur in three separate cycles, June-December 2007, 2008, and 2009, assuming that three cycles will provide enough material to raise Inner Bair to desired elevations (+6.6 feet NGVD at the airport safety zone with +8.6 feet NGVD levee and +2.5 feet NGVD on the remainder of Inner Bair Island with +4.5 feet NGVD berms). All dredged material proposed for upland and wetland placement at Bair Island will either 1) meet the qualifications set forth in the Regional Water Quality Control Board's (RWQCB) waste discharge requirements (Tentative Order), approved with respect to chemical and biological suitability for uplands and wetlands by the Dredged Material Management Office (DMMO), or 2) it will not exceed ambient conditions based upon the mean of samples taken at Steinberger Slough, the Bay near Outer Bair, and the Redwood Creek dredging location. If the above-mentioned thresholds are not attained and the material is approved for use by the RWQCB, consultation will be reinitiated to analyze the potential effects of the contaminated material to listed species.

Primarily bay muds dredged by the Corps of Engineers at Redwood Creek are anticipated to be used as bulk fill for the increase in surface elevation. In addition, dredged material could come from a variety of permitted non-Federal dredging operations, provided the material meets the above-listed criteria. Water quality standards will be specified in the waste discharge requirement stipulated by the RWQCB for water discharged from Bair Island into San Francisco Bay. The discharge standards for the decant water will have to meet RWQCB's standards for water quality parameters such as total suspended solids before the water could be discharged to San Francisco Bay. Evaluating impacts associated with dredging and transporting material to the off-loader will be the responsibility of the sponsor of each dredging project.

The preparation work for Phase 2 will include the following stages:

1. Widening the existing levee on the south side of Inner Bair Island to prevent future resource impacts from South Bay System Authority forced main line (sewer pipeline) maintenance activities. Trucks with fill material will access the levee via the Whipple Avenue entrance. Fill material that meets contaminants criteria will be obtained from outside sources or from scraping surface material from the ruderal upland area of Inner Bair Island. The material will be placed along the existing levee to widen it an additional 10-20 feet. Wave action along the borrow ditch will be buffered by a bench-step design (similar to that at San Pablo Bay NWR) or a very gradual slope creating a wide transition zone. A three foot berm (of fill material) or symbolic fence (posts with single-line cable) will be placed along the inside edge of the new levee surface to serve as a barrier to public access.

2. Building a levee to separate the San Carlos Airport Safety Zone from the rest of Inner Bair Island. The Safety Zone levee will be constructed with a +8.6 foot NGVD crest and design width of 16' and 5:1 slope. Using a bulldozer (or similar equipment), surface material will be scraped from the ruderal upland area of Inner Bair and

compacted to form the new levee structure. Additional material (meeting contaminants criteria) may be obtained from outside sources. A three foot berm (of fill material) or symbolic fence (posts with single-line cable) will be placed along both edges of the new levee surface to serve as barriers for public use.

3. Building a berm along both sides of the former Smith Slough channel, creating pilot channels, and placing ditch blocks. Using a bulldozer (or similar equipment), pilot channels for future channels will be excavated across the ruderal upland from the historic Smith Slough channel to the borrow ditch. Additional surface material from the ruderal upland of Inner Bair Island will be scraped and pushed to form small berms at approximately +4.5 feet NGVD along the edges of the historic Smith Slough channel. Three ditch blocks will be placed in borrow ditches. The berms will serve to capture fill material for surface elevation and the pilot channels and ditch blocks will facilitate channel development upon breaching. Surface contours will be graded to create upland refugia and transitional habitat (at least 10:1 slope). This stage will be completed before the rainy season begins in October or November.

4. Crossing the levee with the dredge pipeline and creating three or four temporary wiers to decant the fill material. Pipes (8”-22” diameter) will be installed beginning June 15 of 2007 to transport dredge material from the Redwood Creek shipping channel. Locations for pipe crossings will be chosen based upon existing levee conditions and fill needs and will be constructed simultaneously with the weirs using a backhoe (or similar equipment). Up to 0.002 acres of pickleweed habitat could be impacted, so plants will be hand-removed (as described above) prior to ground disturbing activities. Decant weirs will either be of compacted levee material (a gradual dip in the surface), or of vertical pipe design.

The placement of shipping channel dredge material from Redwood Creek is anticipated to begin in the summer of 2007. Approximately 7-8 feet of dredge material will be placed in the Airport Safety Zone first, to achieve a design elevation of +6.6 feet NGVD. Material will be placed in two lifts (2007 and 2008) to allow proper compaction and settling. If the available material is limited, more than two lifts may be required. After the Airport Safety Zone fill is settling, 2-3 feet of dredge material will be added to the Refuge portion of Inner Bair Island to achieve the design elevation of +2.5 feet NGVD. A layer of water, as a constituent of the dredged material slurry, will be maintained on top of the dredged material at all times to prevent undesirable compaction and acidification of the material until the outboard levees are breached. The number of dredging cycles needed to raise the elevation will depend upon the quantity of material available. At the end of each dredging cycle, transfer pipes will be removed and weirs will be modified to accommodate winter rains and tidal flows.

Phase 3: Flow Restrictors and Breaches

Beginning in mid-June of 2010, flow restrictors (in Corkscrew Slough and at IB2) and a flow block (in Smith Slough) will be constructed using water- and land-based heavy equipment. The Corkscrew Slough structure will be approximately 300 feet long, 30 feet wide, and will crest at +5.1 with a 30 foot notch in the center to allow a limited flow of water and small boat passage at

high tide. Corkscrew Slough will be posted as a 5 mph no wake zone to further minimize impacts from recreational boating. The flow restrictor berm will be constructed of quarry stone or of linked cellular coffers. If quarry stone is used, it will be placed directly into the channel. Linked cellular coffers will be driven into the slough with a vibrator mounted on a barge and then the cells will be filled with dirt/rock after cell placement. Adjacent to the flow restrictor structure, a portage will be built on the existing Outer Bair levee to facilitate small boat passage at low tide. A 15 x 15 foot wooden observation platform and interpretive signs will be placed at levee-level extending west from the levee surface, over the existing borrow ditch. A ditch block will be placed across the Outer Bair Island borrow ditch at the flow restrictor site, as well as in the borrow ditch between OB3 and OB4.

The flow block at Smith Slough will also be approximately 300 feet long of either quarry stone or linked cellular coffers, but will not have the notch to allow flow at high tides. This block, in concert with breaches at IB1 and IB2, will force water to flow through the historical Smith Slough channel, presently a part of Inner Bair Island. To prevent unacceptable velocity or widening in the newly-opened Smith Slough channel, a flow restrictor will be placed at the IB2 breach location. This flow restrictor will be of a design that does not provide habitat or access for terrestrial predators. A predator resistant fence will also be installed at the channel block. The levee between IB1 and the western observation platform will be lowered to approximately +2.5 NGVD. Under the guidance of a qualified biologist, a maximum of 0.02 acres of existing pickleweed plants will be hand-removed with a weed-eater prior to mechanical ground disturbance.

Using an amphibious excavator (or similar equipment), four ditch blocks will be placed in borrow ditches and four channel connectors will be excavated across internal levees of Middle Bair Island. Material for the ditch blocks may be obtained after pickleweed removal from the levee along Steinberger Slough, if needed (up to 0.55 acres, not to fall below +6 feet NGVD).

Beginning in mid-June 2010 and subsequent to flow restrictor/block installation, ditch block installation, and internal levee breaching, the remaining breaches will be excavated using amphibious excavators (or similar equipment). These breaches include: OB4, OB3, MB1, MB3, MB4, MB5. Clapper rail counts will be conducted prior to construction following Service protocols.

Phase 4: Public Access Improvements on Inner Bair Island

As early as July 2006, an ADA pedestrian bridge will be constructed at the eastern edge of Inner Bair Island at Pete's Harbor. At the present time the bridge design is in development; however, the Refuge will coordinate with the SFWO regarding a "predator resistant" design and monitoring strategy. The trail is presently a 3-mile loop; at completion it will be a shorter out-and-back trail with no public access along most of Smith Slough. The trail base will be upgraded to meet ADA standards and the parking lot at Pete's Harbor will be expanded to accommodate school buses. Interpretive signs will be installed along the trail and two 30x15 foot observation platforms will be constructed on the levee overlooking Smith Slough. It is likely that trail improvements along the western side of Inner Bair Island will not occur until 2010 due to the sequence of actions that must occur to prepare the area for restored tidal flows.

Beginning in 2006, dog walkers will be required to use a 6-foot leash. If compliance standards are not met during a three month trial period, dog use will be eliminated. Although the Whipple Avenue access point will remain available for emergency use, the main entry point to Inner Bair Island will be the new pedestrian bridge at Pete's Harbor.

Motorized and non-motorized recreational boat use will continue in Smith Slough, but with a new 5 mph speed limit "no wake zone" restriction.

Sometime in the near future, the City of Redwood City is planning to construct a second bridge connecting the San Carlos Airport Safety Zone to the northern end of Inner Bair Island. Upon completion, bicycle use will be eliminated on the Inner Bair Island trail.

Future Habitat Conditions

The main habitat type targeted for restoration on Bair Island is tidal wetland. It is anticipated that approximately 1400 acres of tidal marsh will be created with deep primary channels and smaller denser channels in about 30 years after the outboard levees are breached. Fill elevations are planned to be 1 to 1.5 feet below marsh plain elevations to allow sediments borne on the tides to naturally accrete, completing the filling of the tidal wetland area and the final development of tidal channels. Site preparation, including the placement and consolidation of dredged material, is estimated to require five to eight years to complete and will terminate with the breaching of the outboard levees. The minimum amount of time that any fill material will consolidate will be one year before breaching of the outboard levee. Prior to breaching and lowering the outboard levee, the dredged material will be kept wet to prevent excessive consolidation and allow suitable tidal channel development after the levee is breached. Tidal channel formation will be monitored after the levee is breached and corrective measures will be implemented if necessary to ensure adequate channel formation. The specific measures to be undertaken will be developed in the preparation of the monitoring and adaptive management plan for the proposed action and may include mechanically dredging in areas where inadequate channel formation occurs.

When the restoration project reaches maturity, the restored tidal marsh is anticipated to have elevations between mean sea level and extreme high tide and features similar to nearby tidal marshes such as at Greco Island. Existing salt marsh is expected to remain in place. Primary tidal channels will have a mud bottom with a natural equilibrium and depth determined by the tidal prism. The edges of the channels will be colonized and vegetated with Pacific cordgrass (*Spartina foliosa*), pickleweed (*Salicornia virginica*), and gumplant (*Grindelia stricta* var. *angustifolia*). The restored tidal marsh area will receive natural tidal action from San Francisco Bay through the primary channels. Dendritic intertidal channels are anticipated to form naturally and be interspersed with expanses of pickleweed. The edges of the tidal channels will support native cordgrass, as well as gumplant. The mature restored marsh is expected to support low, middle and high marsh areas, and tidal mudflats.

Tidal ponds, which are shallow (less than one foot in depth) and receive water from rainfall and monthly extreme tides, are natural, unvegetated ponds which form within tidal marsh plains. These ponds are not connected with tidal channels, so the water evaporates and can become

hypersaline during the summer and fall. Tidal ponds are expected to form as a feature of the mature restored tidal marsh. The project design does not include plans to specifically construct these features, but due to the underlying site topography, they are likely to form within 50 years and add habitat diversity to the tidal marsh area.

Proposed Conservation Measures

The following conservation measures are proposed as part of the proposed action to directly or indirectly minimize or eliminate potential adverse effects to clapper rails and/or harvest mice:

1. Operation of construction equipment within tidal marsh areas will be avoided during the clapper rail breeding season from February 1 through August 31 each year (except potentially at OB3 and FC1). If breeding rails are determined to be present at OB3 or FC1, construction will not occur within 700 feet of an identified calling center. If the intervening distance across a major slough channel or across a substantial barrier between the rail calling center and OB3 or FC1 is greater than 200 feet, then construction may proceed at that location within the breeding season.

2. To minimize or avoid the loss of individual harvest mice from construction activities in the tidal marsh areas, pickleweed vegetation will be hand-removed with a weed-eater (moving from the center outward) prior to excavation activities. A qualified biologist will be present during pickleweed removal activities. Silt fences will be erected adjacent to construction areas to define and isolate potential mouse habitat.

3. A qualified botanist will conduct an assessment of areas subject to construction activities and recommend specific measures to control the spread of non-native plant species.

4. The restored wetland areas will be monitored for infestation by non-native cordgrasses (*Spartina* spp.), perennial pepperweed (*Lepidium latifolium*), and other invasive, non-native plant species. All infestations occurring within the wetlands will be controlled and removed to the extent feasible without substantially hindering or harming the establishment of native vegetation in the restoring wetlands. A long-term monitoring plan will be developed and remain in effect until tidal marsh habitat is established. The plan will be developed in coordination with the SFWO.

5. The Refuge, in consultation with the SFWO and wetland restoration experts outside the Service, will develop and implement a monitoring and adaptive management program to determine the rate of tidal wetland restoration and quantity and quality of the wetlands established. A monitoring program will be designed to determine whether tidal marsh is developing at the estimated rate of development. Monitoring of the development of the restored areas is intended to enable the Refuge, in coordination with the SFWO, to assess the success of

habitat development and, if necessary, make decisions regarding corrective measures. Key elements of the plan will include:

a. measuring the extent of tidal marsh habitat development to ensure that sufficient habitat is restored to replace the amount of tidal marsh habitat lost by the proposed action at a minimum 2:1 ratio;
b. monitoring habitat parameters such as tidal current at Pete's Harbor, wave characteristics, suspended sediment concentrations, sediment rates and distribution, marsh elevations, mudflat elevations, extent and location of tidal marsh vegetation, composition and density of vegetation, characteristics of subtidal channel and marsh surface sediments, and San Francisco Bay shoreline characteristics;
c. monitoring locations, including the interior and perimeter of the restored tidal wetlands, subtidal channels, and sloughs;
d. comparing predicted and measured restoration development;
e. analyzing monitoring data to identify possible reasons for differences between predicted and measured or observed conditions; and
f. recommending remedial actions to be implemented if restoration does not proceed as designed.

Action Area

The action area is defined in 50 CFR § 402.02, as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For the proposed action, the action area encompasses the Bair Island complex (Inner, Middle, and Outer Bair Islands), Smith Slough, Corkscrew Slough, Steinberger Slough, and Redwood Creek in the vicinity of Pete's Harbor. The action area also includes the parking lot and access point at the southeast end of Inner Bair Island near Pete's Harbor, and the Whipple Avenue emergency vehicle access point.

Status of the Species

California Clapper Rail

The clapper rail was federally listed as endangered in 1970 (35 **FR** 16047). Critical habitat has not been proposed or designated. This subspecies is one of three subspecies in California listed as endangered under the Act. The other subspecies include the light-footed clapper rail (*R. l. levipes*) which is found in tidal marshes in southern California and northwestern Baja California, and the Yuma clapper rail (*R. l. yumanensis*) which is restricted to the Colorado River basin. A detailed account of the taxonomy, ecology, and biology of the clapper rail is presented in the *Salt Marsh Harvest Mouse & California Clapper Rail Recovery Plan* (Service 1984) (Recovery Plan) and the references cited therein. The clapper rail is a fully protected species under California law (See California Fish and Game Code Section 3511).

The clapper rail is endemic to tidally influenced salt and brackish marshes of California. Historically, the clapper rail occurred in tidal marshes along California's coast from Morro Bay,

San Luis Obispo County, to Humboldt Bay, Humboldt County. Currently, clapper rails are known to occur in tidal marshes in the San Francisco Estuary (San Francisco, San Pablo, Grizzly, Suisun and Honker bays).

The California clapper rail is distinguishable from other rails by its large body size of 13-19 inches from bill to tail, and weighs approximately 8.8-12.3 ounces. It has an orange bill, a rufous breast, black and white barred flanks, and white under tail coverts (Albertson and Evens 2000). Clapper rails are sexually dimorphic; the males are slightly larger than females (Garcia 1995). Juveniles have a pale bill and dark plumage. Clapper rails are capable of producing several vocalizations, most common of which is a series of keks or claps.

Clapper rails are typically found in the intertidal zone and sloughs of salt and brackish marshes dominated by pickleweed, Pacific cord grass, gumplant, saltgrass (*Distichlis spicata*), jaumea (*Jaumea carnosa*), and adjacent upland refugia. They may also occupy habitats with other vegetative components, which include, but are not limited to bulrush *(Scirpus americanus* and *S. maritimus*), cattails (*Typha* spp.), and Baltic rush (*Juncus balticus*).

Evens and Page (1983) concluded from research in a northern San Francisco Bay marsh that the clapper rail breeding season, including pair bonding and nest construction, may begin as early as February. Field observations in south San Francisco Bay marshes suggest that pair formation also occurs in February in some areas (J. Takekawa, pers. comm.). The end of the breeding season is typically defined as the end of August, which corresponds with the time when eggs laid during renesting attempts have hatched and young are mobile. Harvey (1988) and Foerster *et al.* (1990) reported mean clutch sizes of 7.27 and 7.47 for clapper rails, respectively. The clapper rail builds a bowl shaped platform nest of marsh vegetation and detritus (DeGroot 1927, Foerster *et al.* 1990, Garcia 1995). The clapper rail typically feeds on benthic invertebrates, but its diet is wide ranging, and includes seeds, and occasionally small mammals such as the salt marsh harvest mouse.

An estimated 40,191 acres of tidal marshes remained in 1988 of the 189,931 acres of tidal marsh that historically occurred in the Estuary; this represents a 79 percent reduction from historical conditions (Goals Project 1999). Furthermore, a number of factors influencing remaining tidal marshes limit their habitat values for clapper rails. Much of the east San Francisco Bay shoreline from San Leandro to Dumbarton Bridge is rapidly eroding, and many marshes along this shoreline could lose their clapper rail populations in the future, if they have not already. In addition, an estimated 600 acres of former salt marsh along Coyote Creek, Alviso Slough, and Guadalupe Slough, has been converted to fresh- and brackish-water vegetation due to freshwater discharge from wastewater facilities in the southern part of San Francisco Bay and is of lower quality for clapper rails. This conversion has at least temporarily stabilized as a result of the drought since the early 1990s. The introduction of non-native, invasive plant species such as smooth cordgrass (*Spartina alterniflora*) and its hybrids into tidal wetlands within the Estuary is potentially impacting clapper rails by reducing the amount of foraging habitat within tidal channels. The suitability of many marshes for clapper rails is further limited, and in some cases precluded, by their small size, fragmentation, and lack of tidal channel systems and other micro-habitat features. These limitations render much of the remaining tidal marsh acreage unsuitable or of low value for the species.

Throughout the San Francisco Estuary, the remaining clapper rail population is impacted by a suite of mammalian and avian predators. At least 12 native and 3 non-native predator species are known to prey on various life stages of the clapper rail (Albertson 1995). Artificially high local populations of native predators, especially raccoons (*Procyon lotor*) and skunks (*Mephitis mephitis*), result as development occur in the habitat of these predators around the San Pablo and San Francisco bay margins (J. Takekawa, pers. comm.). Encroaching development not only displaces lower order predators from their natural habitat, but also adversely affects higher order predators, such as coyotes, which would normally limit population levels of lower order native and non-native predators, especially red foxes (Albertson 1995). Hunting intensity and efficiency by raptors on clapper rails also is increased by electric power transmission lines, which cris-cross tidal marshes and provide otherwise-limited hunting perches and nesting opportunities (J. Takekawa, pers. comm.). Non-native Norway rats (*Rattus norvegicus*) long have been known to be effective predators of clapper rail nests (DeGroot 1927, Harvey 1988, Foerster *et al*. 1990). Placement of shoreline riprap, levees, buildings, and landfills favor rat populations, which results in greater predation pressure on clapper rails in certain marshes. Raven (*Corvus corax*) populations have recently increased dramatically within the Estuary and evidence of egg predation by this species has been detected (Joy Albertson, pers. comm.). Feral cats also represent another predation threat on adult and young clapper rails near residential areas and landfills (Joy Albertson, pers. comm.). These predation impacts are exacerbated by a reduction in high marsh and natural high tide cover in marshes. DeGroot (1927) noted that rails were extremely vulnerable to predation by raptors during high tide events when they were forced to seek refuge in exposed locations. Similarly, Johnston (1956, 1957) and Fisler (1965) observed heightened predator activity in marshes coinciding with extreme high tides. Evens and Page (1986) also documented the susceptibility of black rails (*Laterallus jamaicensis coturniculus*) to predation during extreme high tides. More recently, rail predation was noted in west Marin during extreme high tides in 2005 (Giselle Downard, pers. comm.). Trails that run along the transition zone where marsh meets upland are a hazard to marsh species that depend on this habitat for refuge during high tides. Rails and other wildlife hide within any available cover in the transition zone, and as people approach, the birds flush and attract predators. There is an abundance of falcons, raptors, egrets, and herons during high tides that opportunistically take advantage of the flushed prey.

The proliferation of non-native red foxes into tidal marshes of southern San Francisco Bay since 1986 has had a profound effect on clapper rail populations. As a result of the rapid decline and almost complete elimination of clapper rail populations in certain marshes, the Refuge implemented a predator management plan in 1991 (Foerster and Takekawa 1991) with an ultimate goal of increasing rail population levels and nesting success through management of red fox predation. This program initially was successful in increasing the south San Francisco Bay populations from an all-time low (see below); however, it has been difficult to effectively conduct predator management over such a large area as the south San Francisco Bay, especially with the many constraints associated with conducting the work in urban environments (J. Takekawa, pers. comm.).

Mercury accumulation in eggs is perhaps the most significant contaminant problem affecting clapper rails in the Estuary, with south San Francisco Bay containing the highest mercury levels.

Mercury is extremely toxic to embryos and has a long biological half-life. The SFWO collected data from 1991 and 1992 on mercury concentrations in rail eggs in the southern portion of the estuary and found that the current accumulation of mercury in rail eggs occurs at potentially harmful levels. The percentage of non-viable eggs ranged from 24 to 38 percent (mean = 29 percent) (Service, unpubl. data).

The clapper rail was listed as endangered primarily as a result of habitat loss. The factors described above have contributed to the more recent population reduction, which has occurred since the mid-1980s. Although many factors are at work, predation by native and non-native predators, in conjunction with historic habitat loss and fragmentation, are the current known primary threats. With historic populations at Humboldt Bay, Elkhorn Slough, and Morro Bay now extirpated, the San Francisco Estuary represents the last stronghold and breeding population of this subspecies.

Although Gill (1978) may have overestimated the total clapper rail population in the mid-1970s at 4,200 to 5,900 birds, surveys conducted by the Department and the Service estimated that the clapper rail population approximated 1,500 birds in the mid-1980s (Harvey 1988). A conservative estimate of the population in north San Francisco, San Pablo, and Suisun bays, was 195 to 282 pairs based on a synoptic survey conducted in 1992-93 (Collins *et al.* 1994). In 2004, Avocet Research Associates conducted surveys within San Pablo Bay and estimated about 200 pairs of clapper rails in that area. These surveys did not include some marshes in north central San Francisco Bay and Suisun Bay that were surveyed in 1992-93. Between the surveys conducted in 1992-93 and 2004, several population centers in San Pablo Bay have declined precipitously. The population in the White Slough tidal marshes on the west side of the Napa River declined from an estimated 16-23 pairs as recent as 2000 to an estimated 2-5 pairs in 2002 and 3-5 pairs in 2004, while the population in the Sonoma Creek marshes declined from 13 pairs in 1992 to no pairs in 2001 and 2004 (Avocet Research Associates 2004).

In 1988, the total rail population was estimated to be 700 individuals, with 400 to 500 rails in south San Francisco Bay (Foerster 1989). The total rail population reached an estimated all-time historical low of about 500 birds in 1991, with about 300 rails in south San Francisco Bay (Service unpubl. data). In response to predator management, the south San Francisco Bay rail population rebounded from this lowest population estimate to an estimated 650 to 700 individuals in 1997-98 (Service unpubl. data). Subsequently, the south San Francisco Bay population declined again the following year to about 500 individuals and remained at that level through early 2002 (Service unpubl. data). However, the south San Francisco Bay population declined further in 2002-2003 and was estimated to be 400-500 individuals (Service unpubl. data), which represented the lowest estimated population level in this area since the late 1980's and early 1990’s. The south San Francisco Bay population apparently increased slightly in 2004 with the population estimated at 500 individuals (Service unpubl. data).

In the area immediately northwest of Bair Island, across Steinberger Slough on the Redwood Shores peninsula and Bird Island, clapper rails have been observed in low numbers since 1985 (Service unpublished data) (Figure 2). The tidal marsh complex made up of Bird Island, the shoreline marsh, and old lock remnants likely support a small, self-sustaining clapper rail population, with most observations occurring along an elevated portion of marsh habitat at the northeast end of the island.

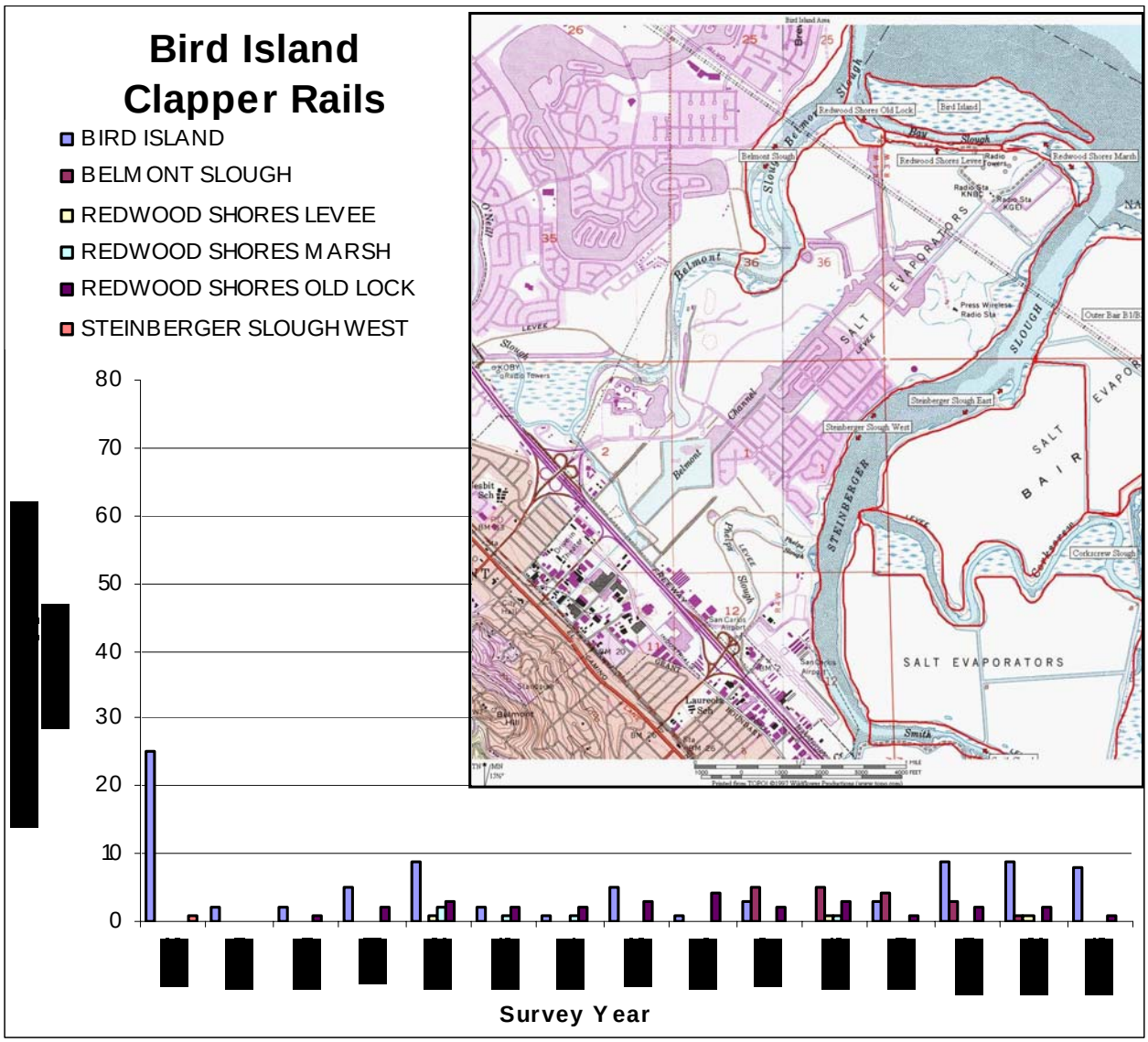

Figure 2. Survey data for clapper rails on Bird Island. Surveys were not conducted at each location every year.

Greco Island, east of Bair Island, maintains the greatest number of clapper rails in the Bair Island vicinity (J. Albertson, pers. comm.). Population numbers peaked in the early 1990s with the greatest number of observations at the Greco East Bulb and Greco South Arm (Figure 3).

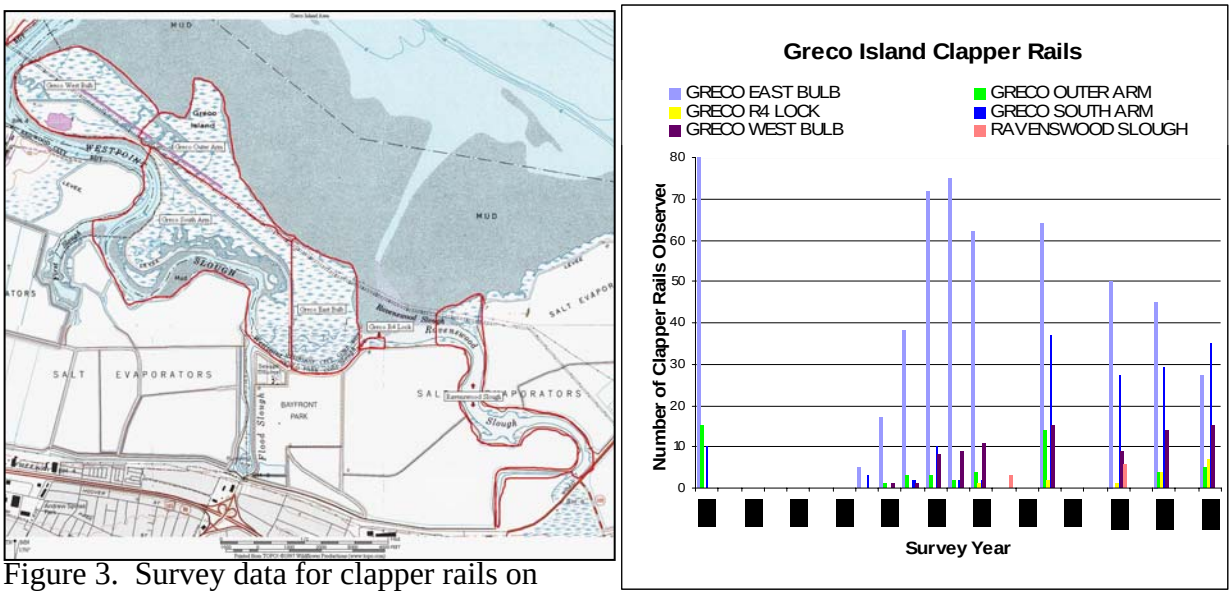

Figure 3. Survey data for clapper rails on Greco Island. Surveys were not conducted at each location every year.

Dispersal or movements by clapper rails in California occurs between and outside of marshes (Orr 1939; Zembal *et al*. 1985; San Francisco Bay Bird Observatory 1986; Page and Evens 1987; Albertson 1995). Eddleman (1989) identified movements by Yuma clapper rails outside of their territories as juvenile dispersal; dispersal by an unmated individual bird; and shifts in home ranges after the breeding, in the winter, and during high water periods; and attributed these movements to a search for more suitable habitat where territories, mates, food, or safe refuge were better available. Juvenile dispersal apparently constitutes the main type of long distance movements by light-footed clapper rails, while adult birds tend to stay within territories once they are established (Zembal and Massey 1988, Zembal *et al.* 1989, Ledig 1990; Zembal 1990, Zembal 1994, Zembal *et al.* 1996, Zembal *et al.* 1997, Zembal *et al.* 1998). Similarly, clapper rails tend to stay within established territories or home ranges year-round (San Francisco Bay Bird Observatory 1986; Albertson 1995). Zembal and Massey (1988) noted that three of six telemetered light-footed clapper rails that moved extensively were preyed upon within a relatively short period of time. By comparison, seven other birds that remained sedentary within established territories were not preyed upon during the telemetry period.

Clapper rails vary in their sensitivity to human disturbance, both individually and between marshes. Certain types of disturbances have occurred within or adjacent to some marsh areas for a long time and certain clapper rails appear to have habituated or become tolerant of these disturbances, while others appear to habituate over time or are unable to habituate to these disturbances at all. For example, certain clapper rails in Palo Alto Baylands Nature Preserve appear to be somewhat tolerant of the relatively common pedestrian traffic on the public boardwalk that dissects the marsh. Clapper rail nests have been documented within 10 feet of

trails in Elsie Romer and Cogswell marshes in Alameda County, and within 65 feet of a busy street near White Slough (Solano County). In contrast, Albertson (1995) documented a clapper rail abandoning its territory in Laumeister Marsh in south San Francisco Bay, shortly after a repair crew worked on a nearby transmission tower. The bird did not establish a stable territory within the duration of the breeding season, but eventually moved closer to its original home range several months after the disturbance. As a result of this territorial abandonment, the opportunity for successful reproduction during the breeding season was eliminated (J. Takekawa, pers. comm.). Clapper rails in Laumeister Marsh have little contact with people, and are apparently quite sensitive to human-related disturbance. On numerous occasions at the Corte Madera Ecological Preserve, rails have been observed seeking refuge from unrestrained dogs entering tidal marshes from adjacent levees with public access (J. Garcia, pers. comm. 1994). These disturbances have occurred despite the presence of signs notifying users that they are entering sensitive wildlife species areas and that pets must be under restraint while in the preserve area. Similarly, along the Redwood Shores Peninsula in San Mateo County, fences and signs installed to prevent access into areas with endangered species habitat have been repeatedly vandalized and people continue to enter the prohibited areas beyond the fences and signs (Popper and Bennett 2005).

Evens and Page (1983) documented 4 rail breeding territories along the Greenbrae boardwalk in the Corte Madera Ecological Preserve. In 1993, no rail breeding territories were discovered along the boardwalk even though rail habitat conditions remained unchanged (J. Garcia, pers. comm.). This territorial abandonment is attributed to an increase in domestic and feral dogs and cats along the boardwalk resulting from new residents moving into nearby residential areas since 1983 (J. Garcia, pers. comm.). According to Harvey (1980) and Foerster et al. (1990), predators, especially rats, accounted for nest losses of 24 to 29 percent in certain South Bay marshes.

Clapper rail reactions to disturbance may vary with season, however both breeding and non-breeding seasons are critical times. Disturbance during the nonbreeding season may primarily affect survival of adult and subadult rails. Adult clapper rail mortality is greatest during the winter (Albertson 1995; Eddleman 1989), and primarily due to predation (Albertson 1995). Human-related disturbance of clapper rails in the winter, particularly during high tide and storm events, may increase the birds' vulnerability to predators. The presence of people and their pets in the high marsh plain or near upland areas during winter high tides may prevent rails from leaving the lower marsh plain (Evens and Page 1983). Rails that remain in the marsh plain during inundation are vulnerable to predation due to minimal vegetative cover available (Evens and Page 1986). A population viability analysis under development for clapper rails identifies changes in adult survivorship as causing the greatest change in the population growth rate (M. Johnson, pers. comm). Another model also indicates that adult survivorship of clapper rails is the primary demographic variable for maintaining a stable population or causing the population to either increase or decline (Foin *et al*. 1997). These models indicate that survival of adult birds has the strongest effect on the perpetuation or extinction of the overall population.

Salt Marsh Harvest Mouse

The harvest mouse was federally listed as endangered in 1970 (35 **FR** 16047). Critical habitat has not been proposed or designated. A detailed account of the taxonomy, ecology, and biology of the harvest mouse is presented in the Recovery Plan (Service 1984) and the references cited therein. The harvest mouse is a fully protected species under California law (See California Fish and Game Code Section 4700).

The harvest mouse is a rodent endemic to the salt and brackish marshes of the San Francisco Estuary and adjacent tidally influenced areas. The harvest mouse closely resembles the western harvest mouse (*R. megalotis*). The harvest mouse typically weighs about 0.35 ounce, has a head and body length ranging from 2.7-2.9 inches, a tail length ranging from 2.6-3.2 inches, and a hind foot length of about 0.7 inch (Fisler 1965). As stated in the recovery plan, the harvest mouse, when compared to the western harvest mouse, have darker ears, belly and back, and a slightly thicker, less pointed and unicolored tail. The harvest mouse is further distinguished taxonomically into the northern and southern subspecies, *R. raviventris halicoetes* and *R. raviventris raviventris*, respectively. Of the two subspecies, *R. r. halicoetes* more closely resembles *R. megalotis*, and can be difficult to differentiate in the field; body color and color of ventral hairs as well as the thickness and shape of the tail have been used to distinguish the two.

The harvest mouse has evolved to a life in tidal marshes. Specifically, they have evolved to depend mainly on dense pickleweed as their primary cover and food source and may utilize a broader source of food and cover that includes saltgrass (*Distichlis spicata*) and other vegetation typically found in the salt and brackish marshes of this region. In natural systems, harvest mice can be found in the middle tidal marsh and upland transition zones. Upland refugia is an essential habitat component during high tide events. Harvest mice are highly dependent on cover, and open areas as small as 10 meters wide may act as barriers to movement (Shellhammer 1978, as cited in Service 1984). The harvest mouse does not burrow. It has been noted that the northern subspecies may build nests of loose grasses.

As described by Fisler (1965), male harvest mice are reproductively active from April through September, but may appear active throughout the year. Females are reproductively active from March to November, and have a mean litter size of approximately four offspring.

The historic range of the species included tidal marshes within the San Francisco and San Pablo bays, east to the Collinsville-Antioch areas. Agriculture and urbanization has claimed much of the former historic tidal marshes, resulting in a 79 percent reduction in the amount of tidal marshes in these areas (Goals Project 1999). At present, the distribution of the northern subspecies occurs along Suisun and San Pablo Bays north of Point Pinole in Contra Costa County and Point Pedro in Marin County. The southern subspecies is found in marshes in Corte Madera, Richmond, and South San Francisco Bay mostly south of the San Mateo Bridge (Highway 92).

Harvest mice may be affected by mercury and PCBs in the intertidal zone. Clark *et al*. (1992) found that harvest mice were captured only at sites where concentrations of mercury or PCBs were below specific levels in house mice (*Mus musculus*). Their results seem to suggest a

southern source of mercury contamination, with mercury an order of magnitude higher in livers of house mice at Calveras Point than at any other point measured in San Francisco Bay.

Environmental Baseline

Historically, Bair Island was part of a large complex of tidal marshes and mudflats within the drainage of the San Francisco Bay and Belmont Sloughs. Bair Island was diked in the late 1800s and early 1900s for agricultural uses, including cattle grazing, and subsequently converted to salt evaporation ponds starting in 1946. Following the end of salt production in 1965, the lands were drained and sold to a series of real estate development companies until the City of Redwood City halted all development plans for Bair Island. The levees on Middle and Outer Bair Islands have not been maintained since 1965 and several natural breaches occurred approximately 20 years ago resulting in a return of some areas to cordgrass tidal marsh. The Refuge and the CDFG both acquired portions of Bair Island over time. A Memorandum of Understanding (MOU) was signed in 1997 by CDFG and the Refuge agreeing that all CDFG lands on Bair Island would be operated and managed by the Refuge as a part of the Don Edwards San Francisco Bay National Wildlife Refuge. The Refuge coordinates annually with the US Department of Agriculture, Animal and Plant Health Inspection Service (USDA APHIS) California Wildlife Services to maximize effectiveness of the predator control program on refuge lands (Interagency Agreement #11640-3-H-002A). Presently, USDA APHIS California Wildlife Services actively scouts for predators on Outer Bair Island and at potential source population sites. They work with refuge personnel to ensure that predator control efforts are prioritized for listed species protection. Small parcels of land on Middle Bair Island along Redwood Creek remain in private ownership. A small area of the bayward mudflat of Outer Bair Island is privately owned. Two parcels on the east side of Middle Bair are held in private interest, as well as the southeast corner across from Pete's Harbor. The San Carlos Airport also retains a portion of Inner Bair Island as a flight safety zone. In addition, two easements exist on Bair Island: (1) for the PG&E towers and transmission lines that run throughout the site, and (2) for the South Bayside System Authority (SBSA) sanitary sewer force main that runs underneath most of the southern part of the levee on Inner Bair Island.

The Bair Island complex is divided into three distinct areas separated by slough channels: Inner, Middle, and Outer Bair Islands. Inner Bair Island is connected to the mainland by an emergency vehicle access road at Whipple Avenue. Inner Bair Island is separated from Middle Bair Island by Smith Slough, which in turn is separated from Outer Bair Island by Corkscrew Slough. Smith Slough no longer follows its historical meandering channel; it has been cut off to flow a shorter distance between Inner and Middle Bair islands. Redwood Creek and Steinberger Slough are the major tidal channels adjacent to the Bair Island complex. Redwood Creek has sufficient capacity for frequent motorized boat traffic, particularly with respect to the high industrial use at the Port of Redwood City. Redwood Creek is a deepwater port, dredged to 40' and used by large recreational boats, motor boats, sailboats, and commercial ships entering the industrial warfs at Westpoint Slough. Steinberger Slough experiences recreational boat traffic, although not at low tide when the channel is not navigable. Smaller recreational watercraft regularly traverse Corkscrew Slough and Smith Slough to travel between Steinberger Slough and Redwood Creek.

The levees on Inner Bair Island are maintained and the 3.3 mile perimeter loop levee trail is currently open to bicyclists and pedestrians with dogs under voice control. In the dry season, a cross-pond trail from the Whipple Avenue trailhead to the levee along Smith Slough is traversable. Until June 2003, pedestrians and bicyclists reached the trailhead to the Inner Bair levees from an unpaved area used for parking at the end of Whipple Avenue. Because Caltrans has closed this area to parking and a commuter bicycle trail has been completed along US Highway 101, visitors are now directed to park at the existing Refuge parking lot along Bair Island Road and walk the connector trail to the trailhead at the end of Whipple Avenue.

Baseline noise conditions at Bair Island vary greatly with respect to sources and timing. Because of the nature of the land uses in the area and volume and diversity of vehicular traffic they attract, the area along US Highway 101 is a generally noisy urban area (Figure 4). Major noise sources are numerous, including railroad, small aircraft from San Carlos airport, commercial aircraft approaching and departing San Francisco International Airport, local commercial and industrial activities, and the automobile and truck traffic they generate (County of San Mateo 2002).

San Francisco International Airport is the world's seventh busiest airport and the majority of arriving and departing jets are directed over the waters of San Francisco Bay. Different weather conditions impact flight paths and clouds or fog can trap noise that on a clear day would more easily disperse. The San Carlos airport serves smaller, lower-flying aircraft and is located immediately west of Middle Bair Island with Inner Bair Island directly under the runway flight path. Arrival and departure flight paths, based upon air traffic control radar data, frequently loop directly over Bair Island. Departure, when the aircraft mass must be lifted, takes the most power overall and is the noisiest (San Mateo County 2002). Maximum noise contribution from flight departures ranges from 94.6 dB at 200' to 59.6 dB at 10,000' (San Mateo County 2002).

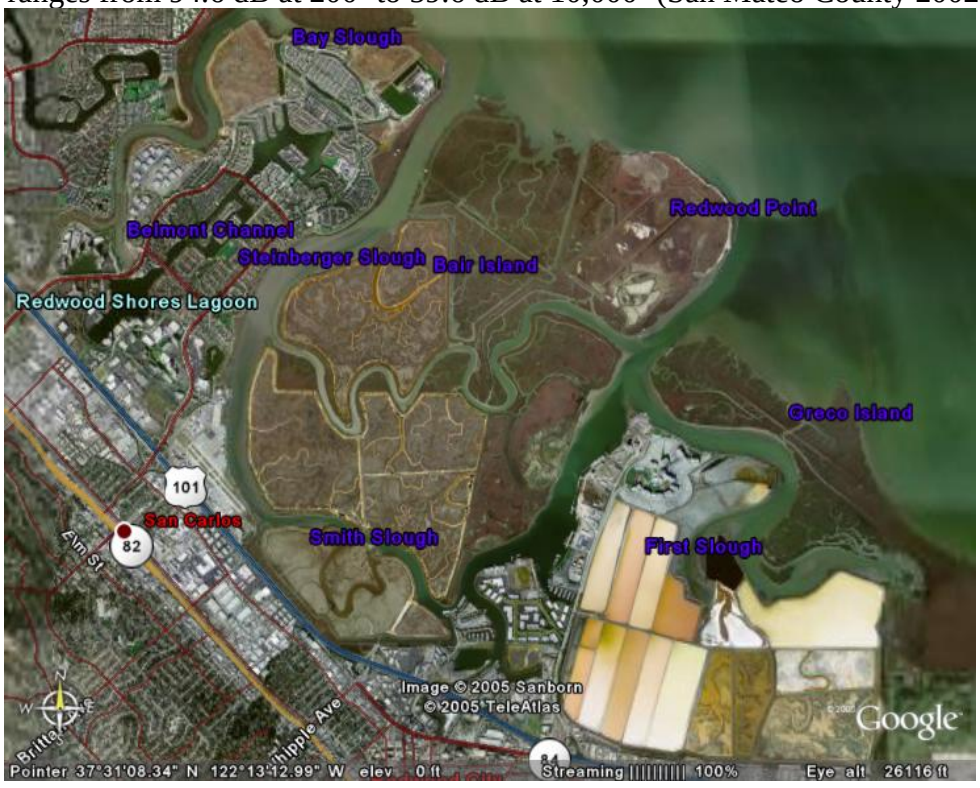

Figure 4. Land use in the Bair Island vicinity results in a relatively noisy urban environment.

The City of Redwood City calculated Community Noise Equivalent Levels (CNEL) at Pete's Harbor, just southeast of Bair Island, in January 2002 (City of Redwood City 2003). The average CNEL during a 24 hour period was <60 dB. Construction activities proposed for the Marina Shores Village project were estimated to range from 65-105 dB at 50' and included earth moving, materials handling, and impact equipment (City of Redwood City 2003).

US Highway 101 is within 500 feet of Inner Bair Island and is the source of constant vehicular traffic noise, peaking at weekday rush hours and all day on Saturday and Sunday. Traffic helicopters patrol the US Highway 101 corridor by Bair Island. Recreational and commercial boat use contributes to the noise load experienced at Bair Island as well as periodic dredging activities in Redwood Creek to maintain the shipping channel. When prevailing winds from the northwest are strong, anthropogenic noise is buffered in a southeasterly direction.

California Clapper Rail

California clapper rails are known to occur in the tidal marshes along Outer Bair Island in south San Francisco Bay. Surveys conducted periodically since 1985 have documented clapper rail presence on Bair Island (Figure 5). Most observations occurred in the tidal marshes along Corkscrew Slough and Outer Bair B1/B2 restoration. A high of 21 clapper rails were observed on Outer Bair B1/B2 restoration in 1999 and 2004, however in 2005 the number observed was seven. Across ten years of surveys, the average number of clapper rails observed at Outer Bair B1/B2 Restoration was 7.3. Clapper rails were observed in the 72 acres of tidal marsh habitat along Corkscrew Slough in surveys between 1992 and 1999, but have not been observed there recently, despite suitable habitat conditions in the undiked marsh thumbs. It is possible that clapper rails still use the area for foraging or juvenile dispersal, but species presence could not be confirmed on survey days. More recently, clapper rails appear to have shifted away from Corkscrew Slough to the central portion (B1/B2 Restoration) of Outer Bair Island. At the present time, clapper rails are using the marsh habitat that has become vegetated cordgrass marsh due to the levee breaching events of twenty years ago. Because the B1/B2 Restoration cell of Outer Bair Island is exposed to tidal influence, tidal channels and cordgrass marsh developed within ten years of the breach event. Juvenile clapper rails are known to disperse several miles from that area to both Bird and Greco islands, and the birds move back and forth fairly regularly (J. Albertson, pers. comm.).

The Recovery Plan (Service 1984) identifies the recovery objectives or conservation needs of the clapper rail. The fundamental tenet of the Recovery Plan is to preserve and increase existing populations of the clapper rail to assure the survival of this species. To accomplish this, the Recovery Plan identifies the preservation and restoration of essential habitat areas throughout the Estuary that are important in meeting the recovery objectives for this species. Inner, Middle, and Outer Bair islands have been identified as habitat essential to the survival and recovery of the clapper rail. This designation represents the area's highest potential for habitat restoration, as well as existing habitat value on about 1,380 acres of tidal marsh and non-tidal wetlands managed by the Refuge or CDFG. The Recovery Plan (Service 1984) designates Inner Bair

Island and parts of Middle and Outer Bair islands as a “Priority 1” area for restoration as habitat essential for the survival and recovery of the clapper rail (Recovery Task 1224). As defined in

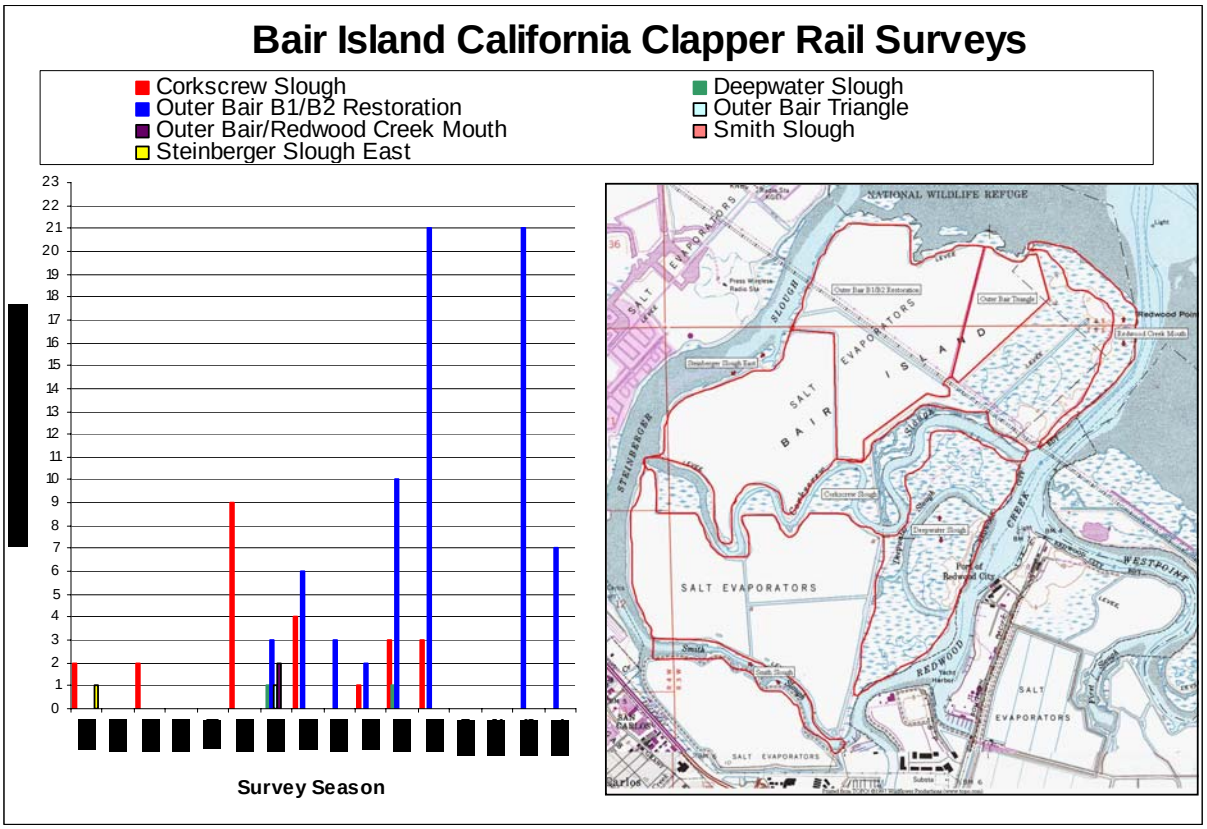

Figure 5. California Clapper Rail survey results on Bair Island, 1985-2004 (Service unpubl. data).

the Recovery Plan, “Priority 1” actions must be completed to avert an irreversible population decline or extinction of the clapper rail. Because of the continuing threats to clapper rails and the current low population levels rangewide, maintaining existing tidal marsh habitat and restoring additional optimal habitat on or adjacent to Bair Island are important elements to ensuring the survival and recovery of this species.

Salt Marsh Harvest Mouse

Although no surveys for harvest mice have been conducted within the action area, the naturally restored areas dominated by pickleweed provide approximately 1000 acres of low quality and approximately 1500 acres of suitable habitat for this species (C. Morris, pers. comm.). This is especially true of the naturally restored tidal marsh areas on the eastern portion of Outer Bair and southern portion of Middle Bair islands. The diked former salt ponds B3, A9, A10, and A11 on Outer Bair and Middle Bair contain patchier cover, less dense pickleweed, and are entirely flooded during winter rain events. Flooding forces mice to the higher elevation levees where they are exposed to extreme levels of predation, and therefore, it is unlikely that the diked marsh supports substantial numbers of mice, except along the high marsh edges. The large cell that makes up Inner Bair Island contains little suitable habitat, except along waterways and standing water. At this time, harvest mice are not assumed to be present in the central part of the island

due to poor habitat conditions and pickleweed absence. However, suitable tidal marsh habitat occurs at the Inner Bair Island bridge crossing, along a small area outboard of the airport levee along Steinberger Slough, and along the outboard side of Inner Bair Island, where harvest mouse presence is assumed. Suitable tidal marsh habitat also occurs around the periphery of Inner Bair Island (San Mateo County Bay Trail Route Access Improvement Project Biological Assessment 1996).

Live trapping studies in 1992 determined the presence of harvest mice in the vicinity of Redwood Shores (San Mateo County Bay Trail Route Access Improvement Project Biological Assessment 1996). Suitable habitat for the harvest mouse occurs on Bird Island, in tidal marshes along the levee, and within a diked non-tidal wetland inboard of the exterior levee in the northwest corner of the Redwood Shores peninsula. Harvest mice are likely to use levees to cross between outboard tidal marshes and inboard non-tidal wetlands, especially during extreme high tides (San Mateo County Bay Trail Route Access Improvement Project Biological Assessment 1996).

Similar to the clapper rail, the preservation and growth of existing populations of the harvest mouse is considered important to assuring the survival of this species. The Recovery Plan (Service 1984) identifies Bair Island as essential habitat area to be preserved or restored throughout the Estuary to meet the recovery objectives for this species. Because of the continuing threats to harvest mice, maintaining existing tidal marsh habitat and restoring additional optimal habitat on or adjacent to Bair Island are important elements to ensuring the survival and recovery of this species.

Effects of the Proposed Action

The proposed action will: (1) eliminate up to 5 acres of suitable habitat available for clapper rails and harvest mice on Inner, Middle, and Outer Bair islands in the short-term and restore approximately 1400 acres of tidal marsh habitat over the long-term (50 years); (2) harass and displace clapper rails and harvest mice due to construction and maintenance activities; and (3) maintain or reduce disturbance to clapper rails and harvest mice as a result of public access.

Habitat Loss and Restoration

The proposed action will restore approximately 1400 acres of tidal marsh habitat on Inner, Middle, and Outer Bair islands to tidal action. To achieve this restoration, the proposed excavation of channels through levees at breach points will permanently eliminate up to 5 acres of suitable habitat currently available for clapper rails and harvest mice, depending on additional material needed to create ditch blocks. Approximately 600 acres of sparsely vegetated seasonal marsh habitat on Middle Bair Island and 500 acres on Outer Bair Island will become tidal marsh. Although the seasonal marsh habitat loss will be permanent, the establishment of tidal influence should result in restored tidal habitat over the entire 1400 acres for clapper rails and harvest mice.

Clapper rails and harvest mice could be harmed if the action area is colonized by non-native, invasive plant species, especially perennial pepperweed and non-native cordgrasses. If these

non-native plant species establish within the proposed tidal marsh restoration areas, they could reduce the habitat value for clapper rails and harvest mice by out-competing, and preventing or limiting, the establishment of native tidal marsh plant species. A key factor in the project's success will be the Refuge's ability to control invasive plant species prior to the breaching of the first levee at OB1. If non-native cordgrasses have not been controlled through the ongoing eradication program, breaching may be postponed until that time when the Refuge determines invasive species will not colonize the newly created habitat.

As Inner Bair Island progresses through the annual dredge material placement cycles, it is anticipated that pickleweed will begin to establish. By the second and third years of elevation increase, some pickleweed may be inundated by the new dredge material lift. Although this could be considered additional habitat loss for harvest mice, it is unlikely that the pickleweed will have reached a density suitable for mouse occupancy. To minimize the potential for effects related to contaminated dredge material placement, dredge material will meet qualifications set forth in the Regional Water Quality Control Board's waste discharge requirements approved with respect to chemical and biological suitability for uplands and wetlands by the Dredge Material Management Office, or the material will not exceed ambient conditions based upon the mean of samples taken at Steinberger Slough, the Bay near Outer Bair, and the Redwood Creek dredging location.

New access will be provided to Inner Bair Island via a new pedestrian bridge, but it is not anticipated that predators will benefit from this new access point due to design features deterring predator passage. Failure of the predator guards likely could result in easy access over the slough and borrow ditch for terrestrial predators of clapper rails and harvest mice. Regardless, predators may still swim the short distance to Inner Bair Island, and most of the perimeter levee will be maintained for trail and pipeline use. The new upland area (the airport safety zone) will provide a larger expanse of terrestrial habitat that could be used as refugia by predators. Predator access to Middle and Outer Bair islands will not be facilitated due to the proposed action. The flow restrictor design at IB2 will discourage terrestrial predator movement and will not include materials that may provide habitat for rats. As long as terrestrial predators cannot cross the IB2 structure, access to Middle and Outer Bair islands will be limited to only those animals willing to swim across the Smith and Corkscrew Slough channels (or those that can fly).

Suitable clapper rail habitat will increase as tidal channels develop and vegetation becomes established. Benefits to harvest mice will begin within the first few years as pickleweed encroaches into new areas under tidal influence. Successful implementation of the proposed action is expected to restore approximately 1400 acres of tidal marsh habitat within 50 years after initiation of construction work for the proposed action. Establishment of this habitat is likely to substantially benefit clapper rails and harvest mice, and to assist with their recovery within San Francisco Bay and rangewide.

Construction-related Effects

In addition to potential effects from habitat loss, the proposed action is likely to result in disturbance in several ways to clapper rails and harvest mice within tidal marsh habitat. These disturbances are likely to result from work activities associated with creating the channels to

provide tidal circulation into the restored tidal wetlands, breaching the outboard levees, and construction of other elements of the proposed action. Disturbances such as noise and excavation of habitat from construction, operational, and maintenance activities of the existing levee and pipeline on Inner Bair Island could also result in abandonment of habitat or direct mortality of clapper rails and harvest mice.

To avoid or minimize disturbance effects to breeding clapper rails during Phase 1 construction activities, the Refuge proposes to begin construction in September 2006 and complete activities by the end of January 2007 (avoiding operation of construction equipment during the February 1-August 31 breeding season). The OB1 breach will take two to four weeks of daytime operation of a weed-eater and excavator. If the amphibious excavator is brought to the site by helicopter, this disturbance would vary from ambient air traffic disturbance from the San Carlos Airport and helicopter activity along US Highway 101 by virtue of being directly over habitat at a low elevation. This disturbance would be very temporary in nature, limited to the unloading and loading of the excavator at the beginning and end of OB1 breaching. Because of baseline noise conditions, the sound from construction/excavation activities (not including the helicopter) is anticipated to attenuate at a distance no greater than approximately 0.25 miles, depending on weather (J. Bradley, pers. comm.). Backhoes, graders, and bulldozers operate at approximately 75-95 dB at 50' (less in intensity to intermittent flight departures from San Carlos Airport). Under common windy conditions, heavy equipment noise will be buffered and carried in a southeasterly direction, away from occupied clapper rail habitat (Figure 6).

Figure 6. Phase 1, OB1 breach site. Radius line represents 0.25 miles, estimated to be the area of sound impact from the OB1 breaching activity. Arrows represent prevailing wind direction.

Phase 2 activities take place on Inner Bair Island, at least 0.75 miles from the 1999 clapper rail observations in Corkscrew Slough and over 2.2 miles from the most recent observations on Outer Bair Island. Sound disturbances (large equipment work and dredge material placement) will be buffered by ambient noise, prevailing winds, and several levees between the source and the clapper rails.

Phase 3 activities will occur on the western cell of Outer Bair Island, in and around Corkscrew Slough, and throughout Middle Bair Island, beginning in mid-June 2010 (Figure 7). Although Phase 3 occurs near the 72 acres of previously occupied cordgrass habitat, observations have not been documented in this vicinity since 1999, and breeding is not presumed to be occurring within 1.5 miles of the nearest activity. The timing of this phase overlaps with the end of the clapper rail breeding season and that of juvenile clapper rail dispersal and foraging; therefore, it is possible that clapper rails may disperse to suitable habitat in the central area of Corkscrew Slough from Outer Bair breeding sites. However, it is more likely that young clapper rails would travel to Greco or Bird islands due to project activities in the central area.

Beginning in 2006, recreational boat disturbance in Corkscrew and Smith Sloughs will be reduced by posted speed limits and no wake zones. Through-traffic will be limited in 2010 by the flow restrictors. Upon completion of construction activities, boating disturbances in the Corkscrew and Smith Slough areas will be maintained at this reduced level. However, boating use in Steinberger Slough is anticipated to increase as the channel scours and a deeper channel provides navigable water. A wildlife viewing platform will be centrally located at FCI at a height no greater than that of the current levee, to reduce disturbance from recreational wildlife observers. If deemed necessary by the Refuge, the SFWO, or the Interagency restoration monitoring team, blinds may be added at a future date to further shield clapper rails from human disturbance. Safety railing on the viewing platform will be constructed in a manner that does not provide perching opportunities for predatory birds.

Figure 7. Areas of disturbance from Phase 3 construction activities. White circles represent 0.25 radius disturbance zones during the June-December 2010 construction period. The red circle represents the most recent documented clapper rail observations. Clapper rails were observed in Corkscrew Slough as recent as 1999.

Construction activities have, as much as possible, been scheduled to occur after the clapper rail breeding season. However, if modifications to the schedule are required (potentially at OB3 and FC1), construction activities and preconstruction surveys would be highly disruptive to rail breeding activities. Construction activities could cause short-term effects such as failure to breed, nest abandonment, lower numbers of eggs, juvenile abandonment, and overall lower juvenile survivorship. Nest surveys could cause moderate to extensive destruction of habitat. If individuals and/or nests are not located within 700 feet of the limits of construction, construction will proceed. If individuals and/or nests are located within 700 feet of the limits of construction, the Refuge will consult with the SFWO to determine what, if any, additional measures may be needed to allow construction to proceed. Because clapper rail nests are not easy to detect within marsh vegetation and surveys to detect them can be disruptive and destructive, current survey protocols to detect presence or absence of rails breeding within tidal marshes involve the establishment and use of listening stations adjacent to or in habitat areas. These survey methods have no effect to habitat, while providing information on locating clapper rail breeding territories within tidal marsh habitat. A high sensitivity to disturbance could exist with clapper rails within the Outer Bair tidal marsh where human access activity is presently limited. Successful reproduction may not occur during the construction years, but may resume after construction is completed.

Construction activities conducted during the clapper rail non-breeding season could also result in harassment, harm, or mortality of clapper rails that occur in Corkscrew Slough and the Outer Bair tidal marsh. Clapper rails could be forced to adjust the boundaries of their territories or to disperse to other habitat areas within this area or to other nearby or distant tidal marshes. The Refuge will conduct construction activities in Corkscrew Slough and the tidal marsh during the end of the breeding season (from June 15 through August 31) when completing Phase 3. Although surveys will be conducted and certain precautions will be followed, survey and construction activities still could result in harassment, injury, or mortality of clapper rails. Disturbances from these activities could cause individual clapper rails to abandon their nests or reduce the ability of adults to properly care for their eggs (less likely at this late date) or young. Displaced individuals and their eggs or young could be subjected to injury or mortality from starvation, physiological stress, and increased predation. Clapper rails disturbed by work activities also could be subjected to predation if they increase their movements within the Bair Island tidal marsh or disperse to other nearby or distant tidal wetlands.

The Refuge's proposal to minimize construction activities in the tidal marsh during the breeding season does not assure that clapper rails dispersed within or away from this area would establish new breeding territories and successfully breed. Clapper rails forced to disperse as a result would need to either maintain existing pair bonds or develop new pair bonds and establish new breeding territories in other suitable habitat areas. The ability of these rails to reestablish new breeding territories would be hampered by the fact that clapper rails maintain year-round home ranges and defend established breeding territories from intrusions by other clapper rails. As observed in the Laumeister Marsh example, clapper rails could be forced to move considerable distances in search of unoccupied suitable habitat. Such movement by rails from established territories is likely to significantly increase the risk of predation and mortality. The farther rails must range in search of other suitable habitat outside of the Bair Island tidal marsh, the more vulnerable they are to predation.

Survivorship of clapper rails displaced from the Bair Island tidal marsh would be less than if they are allowed to remain in established and familiar territories within this area. Increased movements by clapper rails would result in lower survivorship through increased exposure to predators (Zembal and Massey 1988; Eddleman 1989; Albertson 1995). Loss of any female rails would be compounded by the loss of potential future progeny. Reduced survival of adult clapper rails would impact the long-term viability of the population.

Based on the distance from proposed activities to the nearest known occupied habitat, and the number of rails observed at the most recent survey, the SFWO anticipates that all clapper rails located in the 72 acres
of suitable habitat along Corkscrew Slough may be disturbed by construction noise. The likelihood that rails will be forced to disperse away from the Bair Island tidal marsh or along the outboard levee is low, therefore reducing the likelihood that they would be harmed or killed. Because nearby suitable habitat patches (Bird and Greco islands) are presently available along the south bay margins, dispersing juvenile birds should move away from the action area, not towards it, where habitat is not suitable.

Construction and maintenance activities within the tidal marsh and along the outboard levee could affect individual harvest mice through habitat removal, increased disturbance, and temporary habitat destruction. Increased levels of disturbance to harvest mice will result from noise, vibrations from equipment, and construction activities. Operation of construction equipment and associated loss of habitat will result in displacement of harvest mice from protective cover and their territories/home ranges (through noise and vibrations) and/or direct injury or mortality (through crushing). These disturbances are likely to disrupt normal behavior patterns of breeding, foraging, sheltering, and dispersal, and are likely to result in the displacement of harvest mice from their territory/home range in the areas where their habitat is destroyed. Displaced harvest mice may have to compete for resources in occupied habitat, and may be more vulnerable to predators. Disturbance to females during the period of March through November may mean abandonment or failure of the current litter. Thus, displaced harvest mice may suffer from increased predation, competition, mortality, and reduced reproductive success. The Refuge proposes to minimize direct mortality of individual harvest mice from project activities by hand-removing pickleweed with a weed-eater from the center-outward, in the presence of a qualified biologist, and placing a barrier fence to identify sensitive species habitat for construction workers 20 feet from the construction boundaries in and adjacent to the tidal marsh after the vegetation is removed. Up to 5.0 acres of suitable harvest mouse habitat will be removed during the implementation of the action, and all mice in that area will be displaced. Individual mice may be harmed by significantly impairing essential behavior patterns including breeding, feeding, or sheltering. Additionally, as Inner Bair Island receives dredge material to increase elevation, pickleweed may become established between lift cycles. This picklweed will then be inundated by successive dredge material lifts; however it is not anticipated to achieve adequate density in one year to become suitable harvest mouse habitat.

Disturbance and Predation Effects from Public Access

Human activity and associated pet use will be funneled onto the trail from Pete's Harbor and the Whipple Avenue access point and should decrease from current levels, because the trail will no longer be a loop. Interpretive displays will inform the public about the potential to disturb listed species and their habitat. The ability to manage or control potential disturbances in adjacent habitat areas from recreational human activity may not be effectively regulated or controlled, even with the measures proposed by the Refuge to maintain public use and activities along the developed trail.

Visual and physical barriers along the periphery of the trail may have limited effect in deterring human or pet disturbance because they can be easily crossed. Continued dog use will be dependent upon compliance with new leash restrictions; non-compliance will result in the Refuge removing dog-walking from Bair Island recreational use. During the non-compliant period, harvest mice could be harmed, harassed, or killed by dogs, and pickleweed habitat could be trampled.

If the new pedestrian bridge successfully deters predators, the public access trail should not result in an increase in predator pressure on clapper rails and harvest mice in restored and existing tidal marshes. Predator access is presently facilitated by the right-of-way access point at Whipple Avenue although efforts are underway to minimize predator access there (restrictive

fencing and gate). Small predatory mammals, including rats, feral and domestic cats, skunks, and raccoons, likely will continue to emanate from nearby residential and commercial development, and can swim across the borrow ditch to reach Inner Bair Island; however, except for rats, it is unlikely that predators would swim across Smith Slough or Corkscrew Slough (each approximately 300' wide) to reach Middle and Outer Bair Islands. Increases in the number of domestic and feral animals could cause territorial abandonment by clapper rails in adjacent tidal marshes.

Rats and cats entering the action area could become prey for higher order predators such as red foxes and raccoons, as well as becoming predators to endangered species. Therefore, the carrying capacities for higher and lower order predators in the action area could increase above current levels.

The effects described above could be most problematic after suitable habitat is established on Inner Bair Island and if the flow restrictors provide terrestrial connectivity that presently does not exist. Although new terrestrial connectivity will be created between Inner and Middle Bair islands, this path is in a location that was historically connected to Middle Bair Island. The opening of the historic Smith Slough channel will isolate that path from Inner Bair Island. A total of nine levee breaches will serve to disconnect many terrestrial pathways for predators, and annual coordination with USDA APHIS California Wildlife Services will maintain priority predator control.

Human disturbance from recreation use will be reduced through no wake, 5 mph limits in Corkscrew and Smith Sloughs. Flow restrictors and blocks will deter through-boating traffic. The new boat portage and observation deck at Corkscrew Slough will provide a new public access point, however effects from human disturbance will be limited by clear boundaries and interpretive displays to educate the public on endangered species and their habitat. Current public use is not controlled in Corkscrew Slough, and therefore the net effect should result in less human disturbance across the entire area.

Recreational trail use on Inner Bair could result in the flushing of birds at high tides, increasing predator success (once clapper rails become established in the new tidal marsh habitat). Currently, clapper rails are not present in this area, and therefore, trail use is not affecting predator success. As the tidal marsh develops over the long-term, clapper rails are anticipated to colonize the restoring habitat, and the net effect would be consistent with recovery goals for the species. Clapper rails moving into the Inner Bair tidal marsh would be exposed to baseline recreational trail use, and by design, large expanses of suitable habitat will be available for refugia.

Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local, or private actions affecting listed species and their critical habitat that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The SFWO is aware of three non-Federal actions which may result in cumulative effects to clapper rails or harvest mice within the action area considered in this opinion:

1. The City of Redwood City plans to construct a pedestrian bridge from the city to the San Carlos Airport safety zone on Inner Bair Island and connect to the Refuge's pedestrian trail. Potential effects that could occur to clapper rails or harvest mice would include increased predator access, increased human disturbance, and loss of suitable habitat within the project footprint. It will be the responsibility of the City to ensure that their action does not result in conditions that may jeopardize the continued existence of clapper rails or harvest mice.
2. PG&E tower and transmission line and their related maintenance activities will continue to occur in the PG&E right-of-way. Such disturbances have been known to result in territory abandonment by clapper rails. Boardwalks can be used as pathways by terrestrial predators, and transmission towers are used by avian predators as perches.
3. The Southside Bay System Authority (SBSA) will continue its sanitary sewer force main maintenance activities on Inner Bair Island. Modifications to the southern levee on Inner Bair Island have been designed to reduce SBSA maintenance needs (excavating or repairing erosion), however the levee will continue to provide upland habitat refugia for Norway rats and terrestrial connectivity for predators near the airport.

Conclusion

After reviewing the current status of the clapper rail and harvest mouse, the environmental baseline for the action area, the effects of the proposed action and cumulative effects, it is the SFWO's biological opinion that the Bair Island restoration project, as proposed, is not likely to jeopardize the continued existence of the California clapper rail and salt marsh harvest mouse. We base this determination on the following: (1) the relatively limited amount of habitat for these species that will be permanently lost; (2) the relatively low number of clapper rails and harvest mice that may be harassed, harmed, or killed; and (3) the large amount of habitat that will be restored with successful implementation of the proposed action. No critical habitat has been proposed or designated for either species, therefore none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9(a)(1) of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened fish and wildlife species without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity.

Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this incidental take statement.

The incidental take statement accompanying this opinion exempts take of clapper rails and harvest mice, carried out in accordance with the following reasonable and prudent measures and terms and conditions, from the prohibitions contained in section 9 of the Act. It does not address the restrictions or requirements of other applicable laws. Since the clapper rail and harvest mouse are fully protected species under California law (California Fish and Game Code Sections 3511 and 4700, respectively), the exemption from section 9 of the Act provided by this incidental take statement for these two species does not exempt the Refuge or its contractors from complying with State law.

The measures described below are non-discretionary, and must be implemented by the Refuge. If the RefugeB (1) fails to require to adhere to the terms and conditions of the incidental take statement, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

Amount or Extent of Take

Conservation measures proposed by the Refuge and described above in the "Description of the Proposed Action" section will reduce, but do not eliminate, the potential for incidental taking of clapper rails and harvest mice. The SFWO expects that incidental take of the clapper rail will be difficult to detect or quantify because of the reclusive nature of this species. Similarly, the SFWO anticipates incidental take of individual harvest mice will be difficult to detect because of the variable, unknown size of any resident population over time, and the difficulty of finding killed or injured small mammals. In such instances, acres of habitat lost or impacted are used to quantify take. Therefore, the SFWO anticipates the following levels of take as a result of implementation of the proposed action.

Incidental take of clapper rails is expected in the form of:

> harassment, harm, or mortality of all California clapper rails within 72 acres of suitable habitat due to disturbance from construction-related activities (creating tidal channels, ditch blocks, lowering and breaching of levees, helicopter overflight, constructing flood control structures, boat portage and viewing platforms) and predation between the years 2006 and 2010.

Incidental take of harvest mice is expected in the form of:

harassment, harm, or mortality of all salt marsh harvest mice inhabiting 5.0 acres of suitable tidal marsh habitat due to loss of this habitat during construction activities occurring from 2006 to 2010.

Reasonable and Prudent Measures

The SFWO believes the following reasonable and prudent measures are necessary and appropriate to minimize the impact of take on the clapper rail and harvest mouse:

1. Minimize the potential for harm, harassment, or killing of clapper rails and harvest mice.

2. Minimize the effects of permanent loss and degradation of habitat on clapper rails and harvest mice by habitat restoration and protection.

3. The Refuge shall ensure their compliance with this opinion.

Terms and Conditions

To be exempt from the prohibitions of section 9 of Act, the Refuge must comply with the following terms and conditions, which implement the reasonable prudent measures described above. These terms and conditions are nondiscretionary.

The following terms and conditions implement all of the reasonable and prudent measures:

a. The Refuge shall conduct an employee education program prior to the initiation of construction or maintenance activities within the tidal marsh or along any portion of the outboard levee. The program shall consist of a brief presentation by persons knowledgeable in clapper rail and harvest mouse biology and legislative protection to explain endangered species concerns to contractors and their employees. The program shall include the following: a description of the clapper rail and harvest mouse and their habitat needs; a report of the occurrence of clapper rail and harvest mouse in the project area; an explanation of the status of this species and its protection under the Act; and a list of measures being taken to reduce impacts to these species during project construction and implementation. A fact sheet conveying this information shall be prepared for distribution to the above mentioned people and anyone else who enters the project site.

b. A representative(s) shall be appointed by the Refuge who will be the contact source for any employee or contractor who might inadvertently kill or injure a clapper rail or harvest mouse or who finds a dead, injured, or entrapped individual. The representative(s) shall be identified during the employee education program. The representative’s name and telephone number shall be

provided to the SFWO prior to the initiation of any construction or maintenance activities on Bair Island.

c. The Refuge shall conduct baseline and annual clapper rail surveys in order to quantify the response of the species to the restoration effort. Prior to initiation of the planned work activities, the proposed survey protocol(s) shall be provided to the SFWO for review and approval, and surveys shall be conducted. After the surveys are completed and prior to initiation of the planned work activities, the results of the surveys shall be provided to the SFWO for review to evaluate the appropriateness of work being proposed by the Refuge. Work activities shall not be initiated until after the SFWO has approved the planned work based on the review of the survey results.

d. The Refuge shall conduct predator monitoring, including a strategy to detect the effectiveness of the predator barriers at the new pedestrian bridge and the Whipple Avenue access point. If Norway rats are detected at any location on Bair Island, the Refuge shall immediately conduct rat eradication efforts.

e. The Refuge will submit the name and qualifications of a biologist for approval by the SFWO to be present on-site for any construction or maintenance activities within the tidal marsh or along the crown and bayside slope of the outboard levees. The biologist shall have oversight over implementation of all Terms and Conditions in this opinion, and shall have the authority to stop project activities if any of the requirements associated with these Terms and Conditions are not being fulfilled. If the biologist requests to stop work due to take of any listed species, the SFWO and the Refuge will be notified within one (1) working day via electronic mail or telephone. If requested, during and/or upon completion of construction activities, the biologist and/or representative from the Refuge shall accompany SFWO personnel on an on-site inspection of the action area to review project effects to clapper rails and harvest mice.

f. The Refuge shall prepare and implement an adequate plan that describes how the public access, including restrictions and prohibitions, designed and planned for the action area will be effectively enforced and maintained. This plan shall be subject to review and approval by the SFWO prior to the construction of any segment of the proposed trail.

g. The Refuge shall provide final design drawings of the flow control structures, wildlife viewing platforms, and pedestrian bridge to the SFWO for review and approval to confirm consistency with these criteria prior to their construction.

h. Chemical concentrations and associated sampling plans and activity of dredged material or site soils planned for use on-site shall be reviewed and approved by the SFWO. The data for dredged material proposed for use in the action area shall be provided to the SFWO for review and approval at least 60 calendar days prior to the proposed date of placement of the material.

Reporting Requirements

The Refuge shall provide reports to the SFWO annually (by the end of February for the previous year) to demonstrate the response of clapper rails and pickleweed habitat to the restoration efforts. The SFWO and the Refuge must be notified within 24 hours of the finding of any injured or dead clapper rail or harvest mouse, or any unanticipated damage to clapper rail or harvest mouse habitat associated with the proposed action. Any injured clapper rails and harvest mice must be cared for by a licensed veterinarian or other qualified person such as the biological monitor; any dead individuals should be preserved according to standard museum techniques and held in a secure location. Notification must include the date, time, and precise location of the specimen/incident, and any other pertinent information. The SFWO contact persons are Chris Nagano, Chief, Deputy Assistant Field Supervisor of the SFWO at (916) 414-6648, and Scott Heard, Resident Agent-in-Charge of the SFWO's Law Enforcement Division in Sacramento, California, at (916) 414-6660.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purpose of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities that can be implemented to further the purposes of the Act, such as preservation of endangered species habitat, implementation of recovery actions, or development of information and databases. In order for the SFWO to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the SFWO requests notification of the implementation of any conservation recommendations. We propose the following conservation recommendations:

1. Assist the SFWO in implementing other recovery actions identified within most current recovery plans for the clapper rail and harvest mouse.

2. Encourage or require the use of appropriate California native plant species in revegetation and habitat enhancement efforts associated with projects authorized by the Refuge.

3. Encourage participation of prospective permittees in a program being developed by Federal and State resource agencies to limit and reverse the spread on non-native cordgrass within the San Francisco Bay Estuary.

REINITIATION STATEMENT

This concludes formal consultation on the proposed Bair Island Restoration Project. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, the Refuge must immediately request reinitiation of consultation.

If you have any questions regarding this opinion on the proposed Bair Island Restoration Project, please contact Janice Engle or Ryan Olah of this office at the letterhead address or at (916) 414-6625.

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PERSONAL COMMUNICATIONS

Ms. Joy Albertson. San Francisco Bay National Wildlife Refuge, California.

Mr. John Bradley. San Francisco Bay National Wildlife Refuge, California.

Dr. Mike Johnson. Ecotoxicology Lead Campus Program. University of California, Davis.

Ms. Jean Takekawa. Nisqually National Wildlife Refuge, Washington. Formerly with San Francisco Bay National Wildlife Refuge, Newark, California.

Ms. Giselle Downard. San Pablo Bay National Wildlife Refuge, California.

APPENDIX B-3

Bair Island Mitigation Monitoring and Reporting Program

MITIGATION MONITORING AND REPORTING PROGRAM

BAIR ISLAND RESTORATION
AND
MANAGEMENT PLAN

DON EDWARDS SAN FRANCISCO BAY
NATIONAL WILDLIFE REFUGE
BAIR ISLAND ECOLOGICAL RESERVE

U.S. FISH & WILDLIFE SERVICE
CALIFORNIA DEPARTMENT OF FISH & GAME

June 2006

P R E F A C E

Section 21081 of the California Environmental Quality Act (CEQA) requires a Lead Agency to adopt a Mitigation Monitoring and Reporting Program whenever it approves a project for which measures have been required to mitigate or avoid significant effects on the environment. The purpose of the monitoring and reporting program is to ensure compliance with the mitigation measures during project implementation.

The Final Environmental Impact Report/Statement for the Bair Island Restoration and Management Plan concluded that the implementation of the project could result in significant effects on the environment and mitigation measures were incorporated into the proposed project. This Mitigation Monitoring and Reporting Program addresses those measures in terms of how and when they will be implemented.

MITIGATION MONITORING AND REPORTING PROGRAM BAIR ISLAND RESTORATION AND MANAGEMENT PLAN				
Impact	**Mitigation Measures**	**Timeframe and Responsibility for Implementation**	**Method of Compliance**	**Oversight of Implementation**
CULTURAL RESOURCES				
Implementation of any of the Alternatives could result in a significant impact to buried cultural resources that could be present on the site. (Significant Impact)	Should any cultural deposits be encountered during any phase of the project, work shall halt and the Refuge Manager notified. If human bones are found, the appropriate County authority (Coroner, Sheriff, or Medical Examiner), the Native American Heritage Commission, and the Service's Regional Archaeologist would be contacted immediately. An assessment of the deposits would be made by the Regional Archaeologist, or other similarly qualified individual, before work may resume in the area of discovery. (Less Than Significant Impact with Mitigation)	To be implemented if any significant cultural resources are encountered. Contractors shall stop work, in the immediate area of the findings, and notify the Refuge Manager.	If cultural resources are encountered a report will be submitted by qualified archaeologist to the Refuge Manager.	Refuge Manager U.S. Fish & Wildlife Service California Dept. of Fish & Game
CONSTRUCTION IMPACTS (AIR QUALITY)				
Construction could result in significant air quality impacts associated with dust generation. (Significant Impact)	The Bay Area Air Quality Management District (BAAQMD) has prepared a list of feasible construction dust control measures that can reduce construction impacts to a level that is less than significant. Except when it is raining, the following construction practices would be implemented during construction of any of the alternatives: • Sweep streets daily (preferably with water sweepers) if visible soil material is carried onto adjacent public streets; • Limit traffic speeds on unpaved areas to 15 mph; • Replant vegetation in disturbed areas; • Water or cover all stockpiles of soil that can be blown by the wind;	To be implemented during all phases of construction by the contractors.	All measures are on all construction documents, contracts, and project plans.	Refuge Manager U.S. Fish & Wildlife Service California Dept. of Fish & Game

MITIGATION MONITORING AND REPORTING PROGRAM BAIR ISLAND RESTORATION AND MANAGEMENT PLAN				
Impact	**Mitigation Measures**	**Timeframe and Responsibility for Implementation**	**Method of Compliance**	**Oversight of Implementation**
	• Sweep daily (with water sweepers) the paved access roads, parking areas, and staging areas at construction site. (Less Than Significant Impact with Mitigation)			
CUMULATIVE IMPACTS				
All of the alternatives (including No Action Alternative), along with other tidal restoration projects, could contribute to the creation of additional habitat in the Bay Area that would be susceptible to invasion by Atlantic cordgrass. (Significant Cumulative Impact)	All of the Alternatives including the No Action include controls for non-native *Spartina* species within the Bair Island restoration site and follows many of the suggestions and methods contained within the *Spartina* Control Program. The Bair Island Restoration and Management Plan would be reviewed by California State Coastal Conservancy and the US Fish and Wildlife Service for its consistency with the *Spartina* Control Program. If necessary, the control methods in the Bair Island Restoration and Management Plan would be modified to remain consistent with the final approved version of the San Francisco Estuary Invasive *Spartina* Control Program EIS/EIR. (Less Than Significant Impact with Mitigation)	Implementation is on-going, and will continue after all phases of construction by the San Francisco Estuary Invasive *Spartina* Control Program and/or the Refuge.	Compliance will be consistent with the final approved version of the San Francisco Estuary Invasive *Spartina* Control Program EIS/EIR.	Refuge Manager U.S. Fish & Wildlife Service California Dept. of Fish & Game California State Coastal Conservancy

SOURCE

U.S Fish & Wildlife Service and California Department of Fish & Game, **Bair Island Restoration and Management Plan FEIR,** June 2006.