APPENDIX B

ARAMBURU ISLAND CLEAN UP, RESTORATION, AND ENHANCEMENT PROJECT

Project Proponent: Richardson Bay Audubon Sanctuary

Total Project Budget: $1,290,000

1.0 Introduction

Richardson Bay Audubon Sanctuary (Audubon Sanctuary) has proposed to restore wildlife habitat and cleanup and abate past and ongoing discharges of sediments and debris from 17-acre Aramburu Island in Richardson Bay. This island served as a disposal site in the late 1950s and early 1960s for dredge spoils, upland fill, and construction debris from residential development in the Strawberry Point area. Sediment discharges from the island degrade water quality in Richardson Bay, where they adversely impact fish, aquatic mammals, eelgrass beds, and estuarine habitat. The need to restore and enhance the island became apparent during the 2007 Cosco Busan Oil spill and the 2008 avian cholera outbreak when Audubon Sanctuary staff found sick and dying birds seeking refuge on the island.

The fact that the proposed restoration site is an island makes it a highly desirable target for habitat restoration in the heavily urbanized Richardson Bay area as it is relatively isolated from surrounding human disturbances and terrestrial predators. The unique position of the island within Richardson Bay, and its topographic and substrate variability, offer a rare opportunity to restore a variety of habitats that will have great biological value while maintaining resiliency to rising sea levels.

This document presents the current preliminary conceptual plans developed by the Audubon Sanctuary for the Aramburu Island Clean Up, Restoration, and Enhancement Project (Aramburu Island project). The total budget for the Aramburu Island project is **$1,290,000** and will be accomplished in two phases. The budget for Phase 1 is **$285,000** and the budget for Phase 2 is **$1,005,000**. Phase 1 of the project has been proposed as a Supplemental Environmental Project (SEP) under a Settlement Agreement for Administrative Civil Liberty Complaint No. R8-2008-0070 against the Sewerage Agency of Southern Marin (SASM). Under the agreement, SASM would contribute **$200,000** toward the implementation of Phase 1. The Audubon Sanctuary is requesting **$965,000** from the Regional Water Board's Cleanup and Abatement Funds to support Phase 2 of the project. Audubon will continue to seek project funding from additional sources, potentially reducing the total amount funded from the Cleanup and Abatement Account.

1.1 Project Environmental Benefits

The primary goals of this project are to:

1. **Rehabilitate existing tidal marsh, tidal flat, shoreline, and grassland habitats and establish gradual transition zones (ecotones) that support diverse native vegetation types and optimum wildlife habitats** for shorebirds, waterfowl, marine mammals, and special-status native plant species.

2. **Expand existing sand and gravel spit shorebird roosting habitats**, **and reduce wave erosion and shoreline retreat**, by selective placement (replenishment) of bay sand and gravel beach sediments with appropriate grain sizes for incident wave energy.

3. **Maintain topographic heterogeneity on the island** to facilitate gradual transgression of resilient tidal wetlands during sea level rise (submergence of uplands)

4. **Establish additional roost habitat** for herons and egrets by placement of persistent large woody debris in storm drift-lines, and creating snags on the island.

The Aramburu Island project will improve habitat for resident and migratory birds, such as the San Pablo song sparrow, the salt marsh yellowthroat, shorebirds and terns, as well as mammals such as the harbor seal. The replacement of eroded, steep, rubble-dominated retreating, artificial shorelines by gradually sloping sand beaches, sand flats, and gravel/shell/sand berms, would be likely to provide high tide roosts for shorebirds, terns, and gulls, and may potentially facilitate re-use of the island as a seal haul-out. The island's terrestrial sediments exposed in the high salt marsh edge provide highly suitable conditions for the regionally rare salt marsh annuals, Point Reyes bird's-beak, salt marsh owl's-clover, and smooth goldfields. In addition, erosion reduction measures may have indirect benefits for adjacent subtidal habitats, including native eelgrass that is likely to be limited by turbidity due to locally resuspended fine sediment.

The project will contribute to the regional restoration effort presented in the Baylands Ecosystem Habitat Goals Report, which specifically identified the following recommended restoration and management actions for "Strawberry Spit" (of which Aramburu Island was formerly a part) and Richardson Bay (Goals Report, p. 117 and Appendix D) that are incorporated in the preliminary conceptual project design:

- Protect and enhance harbor seal haul-out sites at Strawberry Spit
- In Richardson Bay, restore and enhance fringing marsh along northwest edge for Point Reyes bird's-beak
- Restore and enhance tidal marsh
- Restore high marsh near populations of rare and uncommon salt marsh plants to enable their expansion

2.0 Project Description

This section describes the preliminary conceptual restoration alternative that is currently preferred. Its ecological engineering design concepts are based on initial qualitative assessments of field conditions of the site and its setting within Richardson Bay, and preliminary evaluation of opportunities and constraints. These concepts will be developed in further detail in a subsequent Conceptual Restoration and Enhancement Plan, incorporating the results of data collection and community outreach activities. This description however, should provide basic information on the proposed restoration/enhancement components, planning and construction timelines, and overall project budget to allow the funding and regulatory agencies to make an informed decision on the suitability of this project for funding.

2.1 Site Description

Richardson Bay is a sensitive water body that historically provided a rich assortment of ecological benefits to wildlife and human communities. Intense urbanization of the surrounding area has significantly degraded these benefits. Native fish, waterfowl, shorebird and plant populations have declined precipitously over several decades. Urbanization has also increased flooding of developed areas and degraded human recreation opportunities by polluting the waters and privatizing the shoreline. Historic U.S. Coast Survey maps of Richardson Bay prepared in the 1850s represented fringing salt marshes, small pockets of bay-head salt marsh and tidal creek systems, wide tidal flats, and pockets of barrier beaches.

Aramburu Island is located in the northwest region of Richardson Bay on the east side of the Strawberry Point (Figure 1). The island was initially a peninsula off the mainland created by deposition of dredge spoils and hillslope fill in the early 1960s during the construction of residential housing on Strawberry Point/Spit. The undeveloped portion of the peninsula offered attractive habitats for shorebirds, waterfowl, and harbor seals and these species began using the area shortly after its construction. In 1987 a channel was cut between the developed and undeveloped portions of the peninsula, forming what is now the 17-acre Aramburu Island (Figure 2). This cut was made to provide a buffer between the wildlife that had begun using the island and the human community on Strawberry Point. In addition, a new beach area was constructed on the north end of the island to improve harbor seal haul-out habitat. Despite these improvements, the island was slowly abandoned by the seals. The island is currently owned by Marin County and managed as part of the Richardson Bay Audubon Sanctuary. In its current configuration, the island offers marginal habitat for wildlife, but presents several distinct opportunities for enhancing these habitat values.

An overview of current conditions on Aramburu Island is displayed in Figure 3. The island currently supports mostly weedy upland plant communities (primarily non-native grassland) on artificial fill soils. A large swath of this upland habitat is heavily goose-grazed to a low turf (Photo 1), while other areas are dominated by bunch grasses and invasive species such as

French broom and Italian thistle, which are unpalatable to geese (Photo 2). Small oak groves also exist on the northern end of the island (Photo 3). Fringing tidal marsh is present along some of the island's margin.

The eastern shore of the island is subject to high wave energy and a steep, wave-cut erosional shoreline has developed (Photo 4). As the compacted upland fill shorelines facing the bay retreat, a rough, rocky intertidal shelf expands in the footprint of the original fill. The fill contains insufficient sand and gravel sediments to form substantial bay beaches in response to waves. Two coves partially sheltered by gravel point bars (Photo 5)were constructed as harbor seal haul-out sites (subsequently abandoned by the seals) along the eastern shoreline and support back-barrier tidal marshes and mudflats. A steep engineered boulder (rock rip-rap) revetment stabilizes the banks facing the channel that isolates the island from Strawberry Spit.

2.2 Restoration/Enhancement Design Opportunities

The artificial terrestrial fill substrates of Aramburu Island, and its exposure to episodes of high wave energy during storms, are currently liabilities for its unmanaged habitat structure and geomorphic evolution: they have resulted in dominance by weeds, erosional scarps with poor access for harbor seals, and poor development of salt marsh and mudflats. The same physical characteristics, however, can potentially be modified to become assets and opportunities to rehabilitate distinctive shoreline and wetland habitats representing lost habitat types and ecological functions in Richardson Bay. Based on preliminary field assessments of the site, as well as reference sites in Richardson Bay and comparable sites in San Francisco Bay, the following habitat types and ecological functions appear to be feasible and appropriate for rehabilitation on the island:

2.2.1 Bay beach and sand flat

Richardson Bay formerly supported estuarine (bay) beaches associated with sheltered flats and marshes (including historic barrier beaches linking Belvedere to the mainland). Bay beaches form naturally where wind-waves from the open bay are supplied with erosional sources of sand or gravel, and a receptive shoreline for deposition. Such settings are mostly eliminated from Richardson Bay today. Modification of the wave-cut scarp (low cliff) shoreline configuration on the eastern (Bay) shore of Aramburu Island, combined with nourishment of imported natural bay sand, shell fragments, and gravels, has the potential to establish a beach shore profile over the existing erosional fill shelf.

Physically, beach nourishment would buffer wave erosion of the scarp, mantle the erosional shelf with upper intertidal sand flats, and naturally form emergent beach ridges and spits. With sufficient sediment supply, bay beaches can migrate landward and adjust in elevation to rising sea level. Naturally graded sands, shell, and gravel would esthetically replace eroded,

rocky upland fill (Photo 6).

Ecologically, extensive beach and sandy foreshore habitats at Aramburu Island – especially elongated sand and gravel spits – would be likely to function as high tide roosts for migratory shorebirds, intertidal foraging habitat for shorebirds, and roosts for terns (Forster's, Caspian, and possibly also endangered California Least Terns, which recently have opportunistically colonized artificial island-like sand deposits at Montezuma Wetlands in Suisun Marsh, Solano County). Western snowy plovers have also been observed at isolated bay beaches, and could potentially exploit extensive, isolated new beach habitats at Aramburu Island. The relatively high, unvegetated intertidal elevations of sandy foreshores (in the elevation range of tidal marsh) may provide valuable shorebird foraging habitat during higher tidal stages. In addition, the smooth, ramp-like profile of beaches at Aramburu Island may approximate other isolated bay beach shorelines that are attractive as haul-outs for seals, particularly where beach slopes are near deep water channels for rapid escape.

Beach ridges formed by the highest tides and waves would support scarce elements of San Francisco Bay's native estuarine beach flora, including beach-bur, western ragweed, cressa, poverty-weed, and Pacific dunegrass.

2.2.2 High tidal marsh

Richardson Bay supports some of the largest remaining populations of the northern subspecies of salt marsh bird's-beak (a.k.a. Point Reyes bird's-beak). This species has found refuge in sparse, short cover of pickleweed and sea-lavender growing on eroded artificial terrestrial sediments in the high tide lines north of Sausalito. Very similar soil and vegetation conditions exist at Aramburu Island. With suitable shallow grading and moderated exposure to wave erosion, substantial populations of salt marsh bird's-beak and associated regionally rare salt marsh annuals (such as salt marsh owl's-clover and smooth goldfields) could potentially be established at Aramburu Island, consistent with the Goals Project recommendations (Photo 7).

2.2.3 High tidal marsh-terrestrial grassland transition zones

There are few places in San Francisco Bay where natural slopes support transitions between native lowland grasslands, sedge-rush meadows, and thickets of native perennial forbs (Photo 8). One large colony of a creeping sedge native to salt marsh edges has established spontaneously in a clay soil pocket depression on the island, indicating the potential for the rest of its associated plant community to be established as well. Re-grading the soils, and redistributing a surface soil layer rich in clay and organic matter could support native perennial colonial grasses, sedges, rushes, and forbs that naturally form transition zones with salt marshes. These colonial species also provide relatively high long-term resistance to invasion by weeds. As sea level rises, this community could form a sloping platform for future tidal marsh, resulting in ecosystem resilience rather than tidal marsh drowning.

2.2.4 Seasonal nontidal pools and marsh

Within constructed lowland grasslands, depressions could be sculpted and capped with relatively impermeable clay soils to form rain-fed pools with a seasonal marsh flora including many vernal pool species of Marin County, including water-starwort, toad rush, spikerush, flowering-quillwort, and popcorn-flower (Photo 9). Other wet depressions could form seasonal marshes covered with low-growing creeping sedges. Seasonal wetlands can provide high tide roosts and foraging opportunities for migratory shorebirds and dabbling ducks, and may potentially support tree frogs (prey base for egrets, herons) and mallard nesting habitat.

2.2.5 Snag and large woody debris sub-habitats

San Francisco Bay's tributary streams and rivers have lost their supply of large decadent riparian trees that would have supplied tidal marshes with large woody debris. Egrets, herons, and tidal marsh subspecies of song sparrows use large woody debris (decaying persistent logs and limbs) in tidal marshes as perches and roosts (Photo 10). Importing large woody debris to the island would increase its structural habitat diversity and replace lost or deficient subhabitat elements of tidal marsh.

2.3 Preliminary Conceptual Enhancement Design

The preliminary conceptual enhancement design for Aramburu Island is displayed in Figure 4. We emphasize that the landscape configuration displayed in this figure is a preliminary draft based on our early site reconnaissance and data collection activities and input from various stakeholders. The locations, quantities, and dimensions of all enhancement elements may be changed based on the outcome of future investigations and deliberations.

The landscape and habitat design compresses several related marsh shoreline and terrestrial ecotone types (transition zones) known from modern and historic Marin County bayshores, with emphasis on Richardson Bay. They are adapted to the steep environmental gradients of the artificial island's setting in contemporary Richardson Bay. The individual enhancement elements are described below.

2.3.1 Bay beach and sand flat

As described above, the east-facing shore of the island is currently erosional and highly exposed to infrequent but energetic southerly storm waves from the Central Bay. Waves have eroded scarps (low cliffs) and a shelf of rock and mud in artificial terrestrial fill on the east shore.

We propose to address ongoing eastern shore erosion by nourishing the shoreline with natural sand and gravels from San Francisco Bay. Sand, shell, and gravel material will be imported to the site via barge and deposited in three beach enrichment locations along the eastern shoreline. Waves will rework coarser sand and gravel into narrow, steep beach ridges

and spits at the high tide line, while the gentler gradient of the low tide terrace will form protective intertidal sand flats.

Low retention barriers to longshore drift (rock micro-groins not exceeding beach height) will be constructed at intervals along the shoreline to aid in the development of beach cells and increase residence time. In addition, a high beach terrace will be constructed at the updrift (southern) end of the island. This feature will provide a re-nourishment (sand and gravel discharge) point for the fringing beach system. This feature is located near the position of historic seal haul-outs adjacent to deep water escape habitat in the navigational channel and therefore may encourage seal use.

This beach and sand flat matrix will reduce the rate of shoreline erosion and add significant habitat benefits for shorebirds and potentially harbor seals. We consider beach nourishment an environmentally superior and more sustainable approach compared to conventionally engineered armoring and stabilization of the shoreline.

2.3.2 Tidal marsh

Along the eastern shoreline, where the new beach ridges partially shelter areas behind them, fill will be excavated to appropriate elevations to form new high salt marsh. This area is proposed as a refuge for native salt marsh plant species diversity and recovery of rare plants. The exposure of dense, infertile rocky terrestrial soil to occasional wave scour would result in a relatively sparse, low, turf-like salt marsh vegetation types that typically support a high diversity of native plants, including rare salt marsh annuals such as Point Reyes bird's-beak.

The sheltered northwestern cove on the island has a pocket of salt marsh where bay mud settles, away from storm wave influence. This salt marsh, which supports more typical pickleweed and cordgrass vegetation, would be expanded by excavating surrounding upland soils, facilitating deposition of bay mud. Topsoil excavated from the southern end of the island during grassland and seasonal wetland enhancement activities may be deposited in this area to support productive salt marsh vegetation. Small tidal creeks would be excavated in resistant substrate to initiate tidal drainage patterns and marsh channel habitat structure for birds and fish.

Large woody debris structures (large tree trunks and branches) will be placed in random clusters along the high tide line of these new tidal marsh areas to offer high tide roosting habitat for shorebirds and other tidal marsh dependent avian species.

2.3.3 Sedge/rush meadow and seasonal wetland matrix

The central "upland" areas of the island would be mostly converted to a particular type of native grassland vegetation found along tidal marsh edges in alluvial, clayey soils in eastern Marin County. This area would consist of a mix of colonial, creeping, sod-forming perennial

grasses, sedges, and rushes, that would form dense and continuous cover over years. Accomplishing this goal will involve a process of vegetation removal, substrate re-conditioning to remove existing non-native seed banks and enhance suitability for target species, and replanting with native species.

Seasonal pond and wetland complexes will be constructed within the sedge/rush meadow. Depressions will be excavated and the underlying substrate compacted to reduce drainage. These wetland complexes will support variable wetland vegetation, ranging from uncommon local types of vernal marsh (spikerush, meadow sedge) and vernal pool species (dominated by native annuals).

3.0 Project Phasing

The Aramburu Island Restoration and Enhancement Project will be broken into two phases, which will be funded under separate contracts. In this SEP, we are requesting funds to complete Phase 1. We anticipate that funding for Phase 2 will be awarded in time so that both phases can be implemented simultaneously. However, should funding for Phase 2 be delayed, Phase 1 will still produce tangible environmental enhancement benefits in addition to completing the Conceptual Enhancement Plan and navigating the regulatory process.

3.1 Phase 1

The following tasks will be completed in Phase 1:

1. Perform a feasibility analysis for the proposed restoration and enhancement design
2. Create the Final Conceptual Enhancement Plan for the entire project
3. Complete CEQA analysis and obtain permits for the entire project
4. Complete the final design plans for bay beach and sand flat enhancement (see section 2.3.1 above)
5. Perform bay beach and sand flat enhancement activities

3.2 Phase 2

The following tasks will be completed in Phase 2:

1. Final design plans for tidal marsh, sedge/rush meadow, seasonal wetland enhancements (see sections 2.3.2 and 2.3.3 above)
2. Perform tidal marsh, sedge/rush meadow, and seasonal wetland enhancements
3. Post-construction habitat monitoring (3 years)

4.0 Project Budget

The budget detail is displayed in Table 1. The total project budget, which in addition to all of the above mentioned restoration activities, includes final design, planning, permitting, oversight, and monitoring, is estimated to be **$1,290,000.** This budget is further divided into Phase 1 and Phase 2. The Phase 1 budget is **$285,000** and the Phase 2 budget is **$1,005,000**.

5.0 Project Milestones

Project initiation shall begin within 40 days after approval of the project by the Regional Water Board or its Executive Officer. The project milestones and their anticipated dates of completion are as follows:

Phase 1:

- Complete feasibility analysis and Draft Conceptual Enhancement Plan for entire project: **Spring 2009 or within 3 months of project initiation**
- Complete Final Conceptual Enhancement Plan for entire project: **Summer 2009 or within six months of project initiation**
- Complete CEQA analysis: **Fall 2009 or within twelve months of project initiation**
- Submit permits: **Winter 2010 or within 12 months of project initiation**
- Complete the final design plans for bay beach and sand flat enhancement: **Spring 2010 or within 15 months of project initiation**
- Bay beach and sand flat enhancement construction*: **July – September 2010 or completion within 20 months of project initiation**
- Phase 1 final Project Report submitted by Audubon: **December 2010 or within or within 24 months of project initiation**

Phase 2:**

- Complete Phase 2 final design: **Spring 2010**
- Phase 2 construction*: **July – September 2010**
- Phase 2 final Project Report submitted by Audubon: **December 2010**
- Post-construction habitat monitoring: **December 2010 – January 2013**

***** construction schedule accommodates avoidance windows for harbor seals and nesting birds

** timeline assumes that funding through RWQCB CAA program is secured in spring-summer 2009

6.0 Project Management and Oversight

Richardson Bay Audubon Center, a program of the National Audubon Society, will serve as Project Manager. Richardson Bay Audubon Center has retained the services of Wetlands and Water Resources Inc. to design the project and to assist with regulatory compliance.

To ensure completion of commitments and appropriate expenditure of funds, oversight and audit of the project will be conducted by the San Francisco Estuary Project. SASM would file a final report to the Regional Water Board and the oversight/audit entity identified below. The report shall describe the work completed under this project no later than one month after the completion of the portion of the project funded by this SEP.

All reports must be sent to the following:

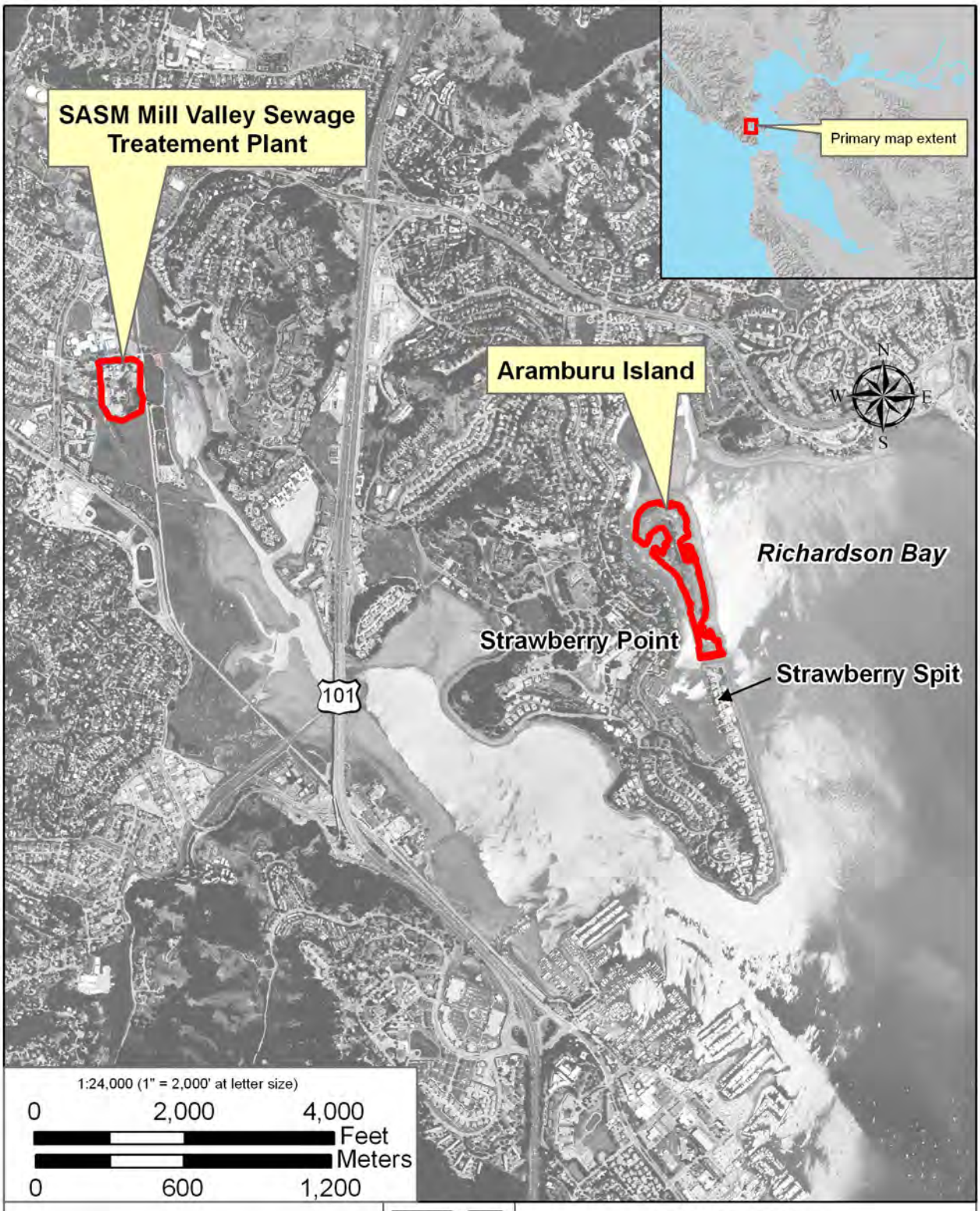
Marc Holmes, Restoration Consultant
San Francisco Estuary Project
1515 Clay Street, Suite 1400
Oakland, CA 94612
(510) 622-2419

Tables and Figures

Table 1. Budget Summary

Task	Total Budget	Budget Phasing		Secured or Requested Funding					
		Phase 1	Phase 2	Request SEP (Feb 2009)	Request CAA* (April 2009)	Secured Bechtel	Secured Toyota (Jun08-09)	Request Toyota (Jun09)	Total Secured or Requested
Conceptual Planning and Design									
1 Data collection/analysis and planning	**35,000**	35,000				35,000			35,000
2 Feasibility analysis and draft/final conceptual enhancement plan	**31,000**	31,000		31,000					31,000
Permitting/environmental compliance	**35,000**	35,000		35,000					35,000
Audubon Project Planning, Management, Implementation (see attached breakdown)	**288,610**	50,000	238,610		198,610		50,000	40,000	288,610
Final Design for Phase 1 construction	**9,000**	9,000		9,000					9,000
Final Design for Phase 2 construction	**31,000**		31,000		31,000				31,000
Construction, Phase 1									
1 Bay beach and sand flat enhancement									
Transport and deposit beach material	**90,000**	90,000		90,000					90,000
Construct beach micro groins	**10,000**	10,000		10,000					10,000
2 Construction monitoring	**5,000**	5,000		5,000					5,000
Construction, Phase 2									
3 Earthwork									
Equipment mobilization	**70,000**		70,000		70,000				70,000
Tidal marsh enhancement	**65,000**		65,000		65,000				65,000
Seasonal wetland creation	**20,000**		20,000		20,000				20,000
Grassland enhancement	**75,000**		75,000		75,000				75,000
4 Woody debris placement	**10,000**		10,000		10,000				10,000
5 Vegetation re-establishment	**20,000**		20,000		20,000				20,000
6 Construction monitoring	**20,000**		20,000		20,000				20,000
Construction Contingency (35%)	**134,750**		134,750		134,750				134,750
Post-construction habitat monitoring (3 years) (see attached breakdown)	**153,600**		153,600		153,600				153,600
Audubon Education/Outreach programs (see attached breakdown)	**41,600**		41,600		41,600				41,600
RWQCB/SF Estuary Project Oversight	**20,000**	20,000		20,000					20,000
RWQCB/SF Estuary Project CAA Oversight (15%)	**125,440**		125,440		125,440				125,440
TOTAL PROJECT BUDGET	**$1,290,000**	$285,000	$1,005,000	$200,000	$965,000	$35,000	$50,000	$40,000	$1,290,000

*Richardson Bay Audubon is actively pursuing additional funding for this project, potentially reducing the total amount requested from the Cleanup and Abatement F



Data sources: Photo (NAIP, 2005)
Produced by WWR, Feb 2009
Map file: vicinity-map_2009-0204dag.mxd

WETLANDS AND WATER RESOURCES

VICINITY MAP

Aramburu Island Enhancement Project
Richardson Bay Audubon Sanctuary

February 2009	Project 1145	Figure 1

1:3,600 (1" = 300' at letter size)

0 150 300 600 Feet

0 45 90 180 Meters

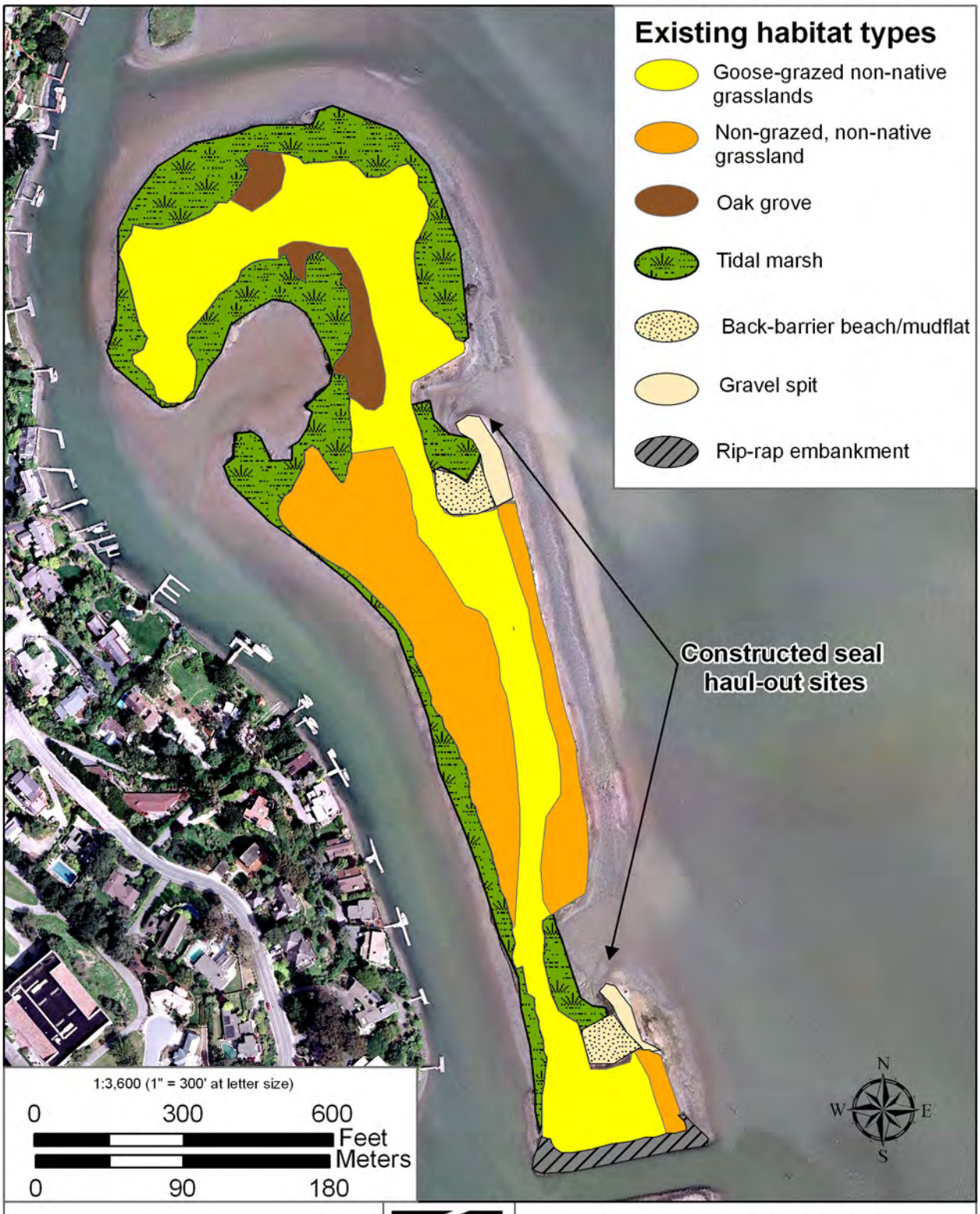
Air photo source: Marin County (2004)
Map file: aramburu-air-photo_2009-0205dag.mxd

WETLANDS AND WATER RESOURCES

AERIAL PHOTOGRAPH

Aramburu Island Enhancement Project
Richardson Bay Audubon Sanctuary

February 2009	Project No. 1145	Figure 2



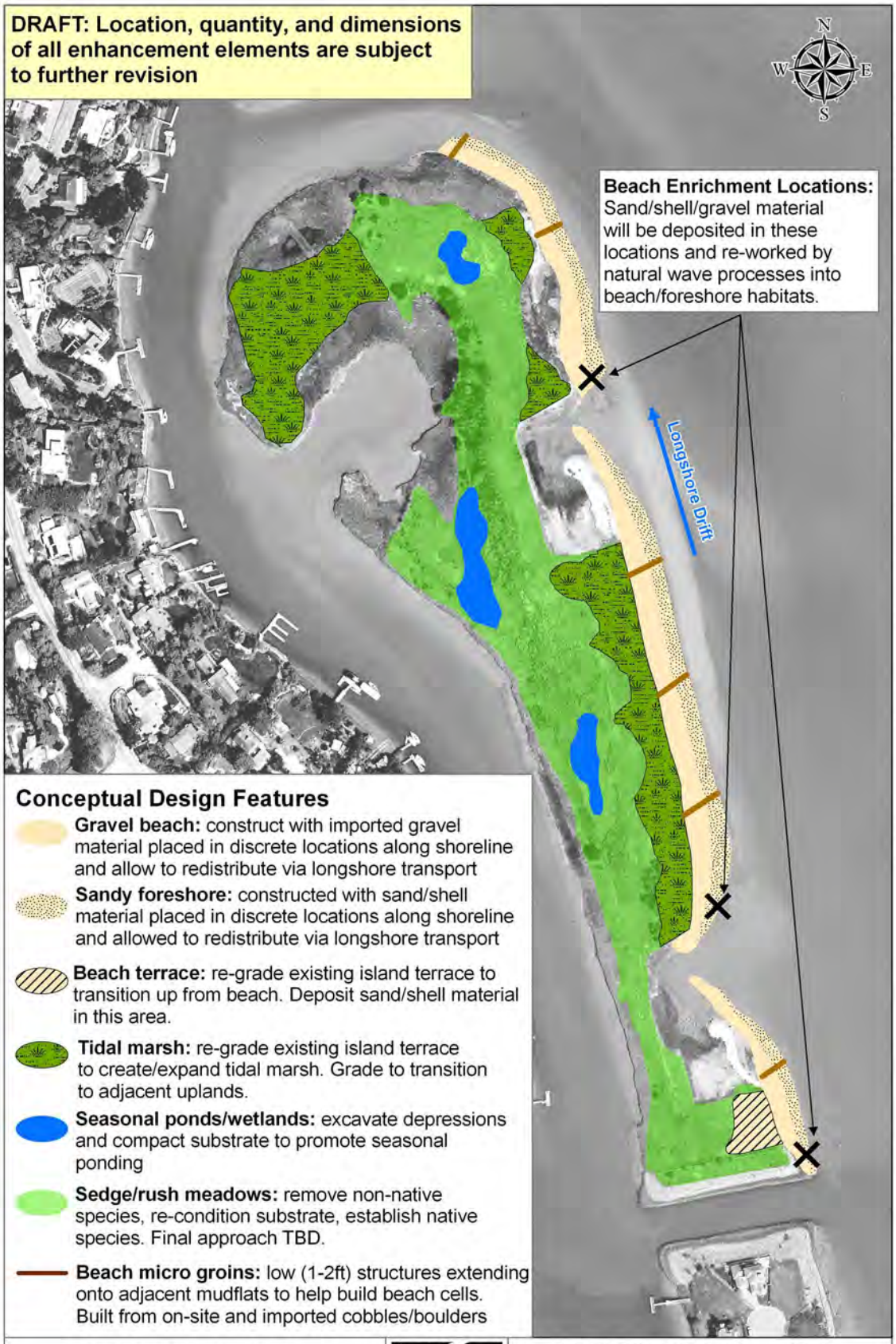
Data sources: habitats (WWR, 2009);
Photo (Marin County, 2004)
Produced by WWR, Feb2009
Map file: current-habitats_2009-0205dag.mxd

WETLANDS AND WATER RESOURCES

EXISTING HABITAT TYPES

Aramburu Island Enhancement Project
Richardson Bay Audubon Sanctuary

February 2009	Project 1145	Figure 3



1:2,400 (1" = 200' at tabloid size)

0 100 200 400 Feet

0 30 60 120 Meters

Air photo source: Marin County (2004)
Map file: aramburu-concept-design-draft_2009-0204dag.mxd

WETLANDS AND WATER RESOURCES

PRELIMINARY CONCEPTUAL ENHANCEMNT DESIGN ELEMENTS

Aramburu Island
Richardson Bay Audubon Sanctuary

February 2009	Project No. 1145	Figure 4

Photographs of Existing and Proposed Conditions

Section 1: Existing Site Conditions

Photo 1: heavily goose-grazed grasslands (photo by Dan Gillenwater, 1/12/2009)

Photo 2: non-grazed grasslands (photo by Christina Toms, 1/29/2009)

Photo 3: oak grove at north end of island (photo by Dan Gillenwater, 1/12/2009)

Photo 4: wave-cut, erosional eastern shoreline (photo by Peter Baye, 1/12/2009)

Photo 5: gravel point-bar and back barrier tidal marsh (photo by Peter Baye, 1/12/2009)

Section 2: Reference Sites for Proposed Conditions

Photo 6: small barrier beach composed of coarse-grained shell fragments and gravels eroded from artificial fill sources along the Bayshore Freeway. Location: Brisbane/Candlestick spit, San Mateo County. (photo by Peter Baye)

Photo 7: eroded, compacted, wave-scoured upland fill in the high tide line, exposing rubble and gravel embedded in heavy sandy clay, supports sparse pickleweed and abundant salt marsh bird's-beak. Location: Pohono St. Marsh, North Sausalito, Marin County. (photo by Peter Baye)

Photo 8: meadow sedge forms pure stands that grade down to tidal marsh edges of Point Pinole. One large colony has spontaneously established at Arumburu Island, indicating high feasibility of active establishment. Location: Point Pinole, Contra Costa County. (photo by Peter Baye)

Photo 9: seasonally flooded shallow pools form in depressions in consolidated, desalinized Bay Mud. Dabbling ducks, shorebirds, and egrets forage in them during flood periods when they produce many prey items, including tree frogs tadpoles, and other aquatic invertebrates. Location: Bahia wetlands, Novato. (photo by Peter Baye)

Photo 10: heron perched on large woody debris in tidal marsh. Location: Pickleweed Island (adjacent to Aramburu Island). (photo by Peter Baye)