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MARSH PLANT ASSOCIATIONS OF SOUTH SAN FRANCISCO BAY: 2010 COMPARATIVE STUDY

FINAL REPORT

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EXECUTIVE SUMMARY

This report documents the 2010 results of long-term monitoring of tidal marshes in South San Francisco Bay marshes. This monitoring began in 1989 as part of the discharge permit for the San Jose/Santa Clara Water Pollution Control Plant (WPCP) issued by the San Francisco Bay Regional Water Quality Control Board (RWQCB). It is designed to detect conversion of salt marsh to brackish marsh that that could potentially be influenced by the freshwater discharge from WPCP. Mapping is completed in the Main Study Area which is primarily along Coyote Creek and an adjoining Reference Area along Alviso Slough. This report documents 17 years of monitoring data compiled over a 21-year period and evaluates the marsh vegetation changes in the context of anthropogenic and natural factors

These tidal marshes support endangered animal species and changes in extent and structure of the wetlands could negatively impact these species. The dominant native plant species that support these endangered species are pickleweed (primarily *Sarcocornia pacifica*, formerly known as *Salicornia virginica*) and cordgrass (*Spartina foliosa*). Pickleweed and cordgrass-dominated salt marsh provides habitat for a unique assemblage of animals including the federally and state-endangered salt marsh harvest mouse (*Reithrodontomys raviventris*) and California clapper rail (*Rallus longirostris obsoletus*).

In 2010, the marsh plant community mapping was conducted using satellite imagery and field mapping by senior wetland ecologists. Maps were prepared based on the species and combinations of species observed (plant associations), then compiled based on the dominant plants at mapped locations (species dominance) and finally categorized as salt, brackish or freshwater marsh based on the ecology of the dominant species. Acreage calculations for specific plant associations, dominant species, and habitat types were produced using Geographic Information System (GIS) software (ArcView 10.0). Spatial analyses, specifically changes in plant species dominance and extent of habitat type area, were conducted by comparing data for the periods of 1989 – 2010, and 2008 – 2010.

The study area is in a region of high sediment deposition where marsh vegetation quickly colonizes newly deposited sediments. Total marsh habitat within the Main Study Area (including salt, brackish, and freshwater marsh) has increased 33% (437.5 ac) since 1989. Similarly, the Reference Area, total marsh habitat within the Reference Area has increased by 55% (90.2 ac) since 1989. The trend continued in the recent period (between 2008 and 2010), with 41.4 ac (2.3%) of new marsh in the Main Study Area and 1.9 ac (0.7%) in the Reference Area.

Another of the major findings of this long-term monitoring is that the distribution of salt and brackish marsh species is dynamic, especially in the Transition Reach of the Main Study area and the similar central portion of the Reference Area. When assessing the changes, only areas that are within the boundaries of the 1989 marshes are analyzed, not the newly accreted marshes. Figure 6 (from the report) below depicts these dynamic changes in acreage of salt marsh since 1989, and shows that there has been a net increase of 41 ac of salt marsh (converted from brackish marsh), in spite of a recent decline. Conversely, within the Reference Area, there has been a net decline of 22.2 ac of salt marsh (converted to brackish marsh).

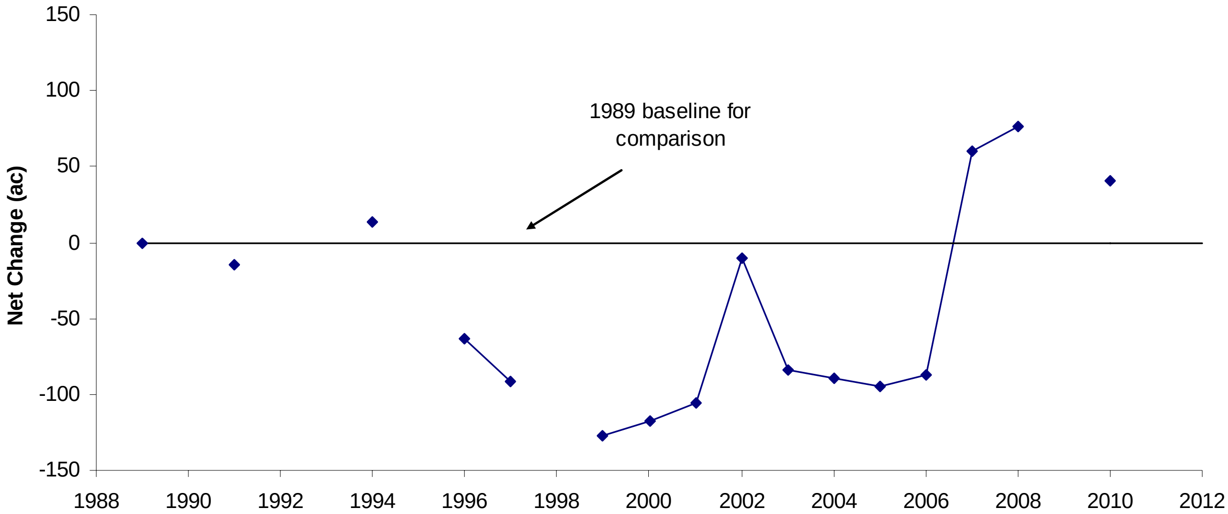

Figure 6. Net Acres of Brackish Marsh Converted to Salt Marsh within the Main Study Area since 1989.

The report analyzes trends in discharge from the WPCP (which has remained relatively constant through the period), precipitation, local stream-flow, flow from the Delta, Bay salinity, and average tides all as factors that contribute to the dynamic shifts. These factors can all affect marsh plain inundation and soil surface and interstitial salinities, which appear to be the primary drivers of the distribution of dominant plant species, and therefore the distribution of the type of marsh. The low rainfall (and associated stream-flows) from 2007-2008 corresponded with an apparent dieback of alkali bulrush and growth of pickleweed. This year (2009/2010) of normal rainfall reversed that trend and resulted in re-growth of much of the alkali bulrush. This rainfall effect, when combined with changes in the average tidal height seems to drive relatively large-scale changes in the distribution of salt, brackish and freshwater marsh dominant species in this system. The effects of the WPCP outflow appear to be localized in the vicinity of Artesian Slough.

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INTRODUCTION

The City of San Jose commissioned an in-depth study of marshes of the South San Francisco Bay that could potentially be affected by the freshwater discharge from the San Jose/Santa Clara Water Pollution Control Plant (WPCP) (H. T. Harvey & Associates 1990). This on-going work began in 1989 as part of a monitoring program required by the San Francisco Bay Regional Water Quality Control Board (RWQCB), and has continued with vegetation sampling in 2010. This report documents and evaluates the 2010 monitoring data and reviews the changes in vegetation in the context of historical data and other potentially explanatory factors.

The marshes of South San Francisco Bay support endangered animal species and changes in the extent and structure of these wetlands could negatively impact these species. The dominant plant species of the South Bay's tidal salt marshes are pickleweed (primarily *Sarcocornia pacifica*, formerly known as *Salicornia virginica*) and cordgrass (*Spartina foliosa*). Pickleweed and cordgrass-dominated salt marsh provides habitat for a unique assemblage of animals including the federally and state-endangered salt marsh harvest mouse (*Reithrodontomys raviventris*) and California clapper rail (*Rallus longirostris obsoletus*). Because these and other species depend on these wetlands, it is important to recognize vegetation change when it occurs and identify its causes.

Changes in the distributions of salt and brackish marsh plant species have been dynamic since 1989, and 2010 was no exception. The 2010 data presented here describe a shift towards more brackish marsh compared to 2008. This vegetation shift is discussed in the context of a number of factors including: 1) partial to near complete recovery of previous years' brackish marsh plant mortality/dormancy events, 2) continued increased vegetative cover, including colonization associated with the Island Ponds restoration site, 3) above average winter/spring rainfall and length of the wet season contributing to lower surface water and interstitial salinities in the marshes, 4) influence of the WPCP discharge on observed changes in marsh vegetation, and 5) fluctuations and in average sea level.

BACKGROUND

Reasons for the Study

Large-scale plant community changes in the marshes of South San Francisco Bay were first observed in the 1970s (H. T. Harvey & Associates 1984). At that time, brackish marsh species [e.g., alkali bulrush (*Schenoplectus robustus*)] were colonizing areas that previously had been vegetated with salt marsh species (e.g., pickleweed). A potential cause of the observed change was freshwater discharge from the San Jose/Santa Clara WPCP, but many other factors could cause and/or contribute to the plant community changes.

Subsequent studies confirmed the observed changes in plant species composition described in the 1970s (H. T. Harvey & Associates 1984). The extent of these changes over time was approximated by examining historical aerial photography (CH2M Hill 1989). These studies relied on aerial photographs of different scales, were not rectified and could not be field-validated. However, the historical photos did show that large-scale vegetation change (both marsh type conversion and new marsh formation) was occurring in South San Francisco Bay wetlands.

In 1989, the RWQCB instituted a dry-season flow cap of 120 million gallons per day (MGD) for the WPCP and required in-depth monitoring of the marshes in the vicinity of the outfall. Simultaneously, and at the behest of the RWQCB, the Sunnyvale WPCP commissioned a study of the vegetation of the marshes in Guadalupe and Alviso Sloughs. Both of these studies included obtaining new high resolution aerial photography and conducting detailed field-based mapping of dominant plant species. These data represent the baseline conditions for all subsequent analyses of change in plant species distributions. Additional mapping studies were conducted by the City of San Jose in 1991, 1994, and annually thereafter (CH2M Hill 1989, H. T. Harvey & Associates 1990, 1991, 1995, 1997, 1998, 1999, 2000, 2001, 2002a, 2003, 2004, 2005a, 2006b, 2007 and 2008).

Vegetation changes observed in the study area in early stages of mapping (1989-1991) were not part of larger basin-wide changes as evidenced by the lack of concomitant changes in the first reference area (Mowry Slough). However, the changes that did occur in the study area could not be unequivocally linked to WPCP discharge because the effects of freshwater flows in Coyote Creek could also be affecting the vegetation changes. Therefore, Alviso Slough, which has freshwater inflow from the Guadalupe River, was proposed as the new reference area. To be an effective reference area, one that is representative of local stream-flow fluctuations and regional large-scale change, the slough needed to be independent of WPCP flows. A dilution study found very little entrainment of WPCP waters into Alviso Slough, supporting Alviso Slough as the new Reference Area (CH2M Hill 1990).

Relationship of Water and Soil Salinity to Salt Marsh Plant Distribution

Numerous factors influence the distribution of plant species in coastal wetlands. Such factors include surface water and interstitial salinity, which are positively correlated with the distribution of estuarine wetland plants (Espinar et al. 2005, Reardon 1996, Callaway and Sabraw 1994, Allison 1992, Callaway et al. 1989, Zedler 1983, Zedler and Beare 1986). Zedler (1983) documented the conversion of a pickleweed-dominated salt marsh to a cattail-dominated (*Typha domingensis*) freshwater marsh along the San Diego River in southern California. She found the conversion was positively correlated with reservoir discharges that extended freshwater flows beyond what would result from normal wet season precipitation. Wetland macrophytes are sensitive to salinity change, particularly during seed germination and seedling establishment (Espinar 2005). In addition to salinity, the timing of fresh or saline pulses, coupled with the timing of inundation, also affect plant growth and the distribution of wetland plants (Espinar 2005). Other factors influence wetland plant species composition, such as depth and duration of marsh inundation (Webb and Mendelssohn 1996, Webb et al. 1995, Pennings and Callaway 1992, Mendelssohn and McKee 1988, Mall 1969), accumulation of soil-based phytotoxins (Webb and Mendelssohn 1996, Webb et al. 1995, Koch and Mendelssohn 1989, DeLaune et al. 1983, King et al. 1982), interstitial nutrient concentrations (Koch et al. 1990, Bradley and Morris 1980, Koch and Mendelssohn 1989, Morris 1980), and soil mineral and organic matter content (Nyman et al. 1990, DeLaune et al. 1979).

Natural variability in factors such as precipitation, tidal regime and evapotranspiration can individually and collectively influence wetland plant species composition. Anthropogenic changes to freshwater discharges and inflows, non-point source pollution (nutrients and sediments) and climate change (e.g., temperature and sea level fluctuation) are also important drivers of vegetation change in coastal wetlands. Alexander and Dunton (2002) found that timing and quantity of freshwater inputs strongly influenced halophyte response to precipitation in two marshes in Louisiana. Warren and Niering (1993) found that increased flooding frequency associated with sea level rise influenced plant species composition in wetlands in the northeastern United States. Visser et al. (2006) evaluated a suite of growth-related variables (e.g., flood duration, salinity, air temperature, precipitation, nutrient availability and cloud cover) in Louisiana salt marshes and found that when surface water and cloud cover were optimal, longer flood durations reduced peak wetland plant biomass.

Competitive interactions are highly influential in determining the distribution of wetland plant species with similar physiological tolerances (Grace and Wetzel 1981, Zedler 1982, Bertness 1991). Zedler (1982) studied competitive interactions among salt marsh species in southern California and concluded that pickleweed directly competes with cordgrass for light and nutrients. Leininger et al. (2006) used a model to examine precipitation, drought, disturbance and marsh condition at three sites in San Francisco Bay and concluded that the potential for invasion by perennial peppergrass (*Lepidium latifolium)* varies with disturbance and precipitation.

A localized factor influencing marsh formation and vegetation change in South San Francisco Bay is the restoration of the Island Ponds as part of the South Bay Salt Pond Restoration Project. A key aspect of the Island Ponds restoration was the effect restoration would have on the tidal prism (H. T. Harvey & Associates 2006a). The breaching of levees associated with the Island Ponds was expected to have significant but localized impacts on vegetation establishment within breached ponds and on plant species dominance along the Coyote Creek, in the vicinity of the breached levees.

METHODS

STUDY AREA

The study area consists of 28 segments as defined in the 1989 study (H. T. Harvey & Associates 1990; Figure 1). The study area was subdivided into four Reaches (Upper, Transition, Lower, and Alviso Slough or Reference) (Figure 1) (Table 1). The Upper, Transition and Lower Reaches are collectively called the Main Study Area and are located within the Coyote Creek watershed (Figure 1). The Reference Area is located along the lower Guadalupe River.

Table 1. Study Area Reach Designations, Names, Areas and Segment Numbers

REACH DESIGNATIONS	STUDY AREA NAMES	APPROXIMATE AREA (ACRES)	SEGMENT NUMBERS
Upper (Mouth of Coyote Creek)	Main Study Area	850	12, 13, 15-19, 21, 24-26
Transition (Drawbridge)		390	5, 9-11, 14, 20
Lower (Newby Island)		460	1-4, 8, 22 and 23
Alviso Slough	Reference Area	275	27-30

BASE IMAGERY

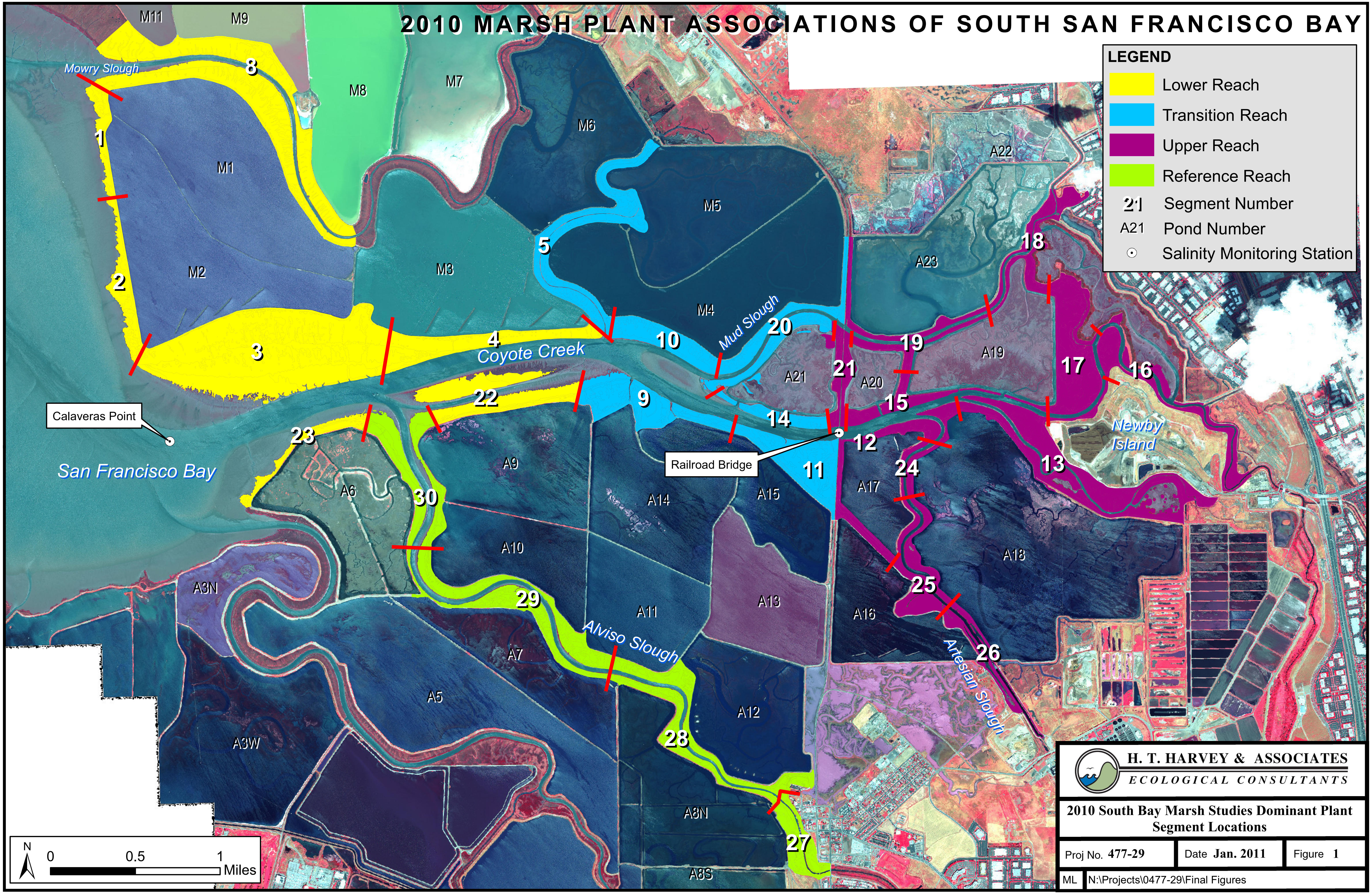
The City of San Jose acquired GeoEye-1® imagery from a satellite pass that occurred at 10:50 a.m. on 28 May 2010. The tidal elevation at this time was 0.2 feet (ft) Mean Lower Low Water (MLLW) near the Calaveras Point Station. The 1-meter multispectral (4-bands) color infrared (CIR) and true color orthorectified GeoEye-1® satellite imagery is projected in StatePlane NAD83 Zone III (ft).

VEGETATION ASSOCIATION MAPPING AND AREA CALCULATIONS

Habitat mapping was completed at the 1:2400 scale (1 inch = 200 ft) using the GeoEye-1® imagery as a base layer. Mapping was assisted using 2 laptop computers (Panasonic Toughbook 18) equipped with geographic information systems (GIS) software (ArcView 10.0). Topographic features, marsh boundaries and tentative habitat types (based on photographic signatures) were mapped in-house prior to field visits.

This preliminary in-house mapping was validated during site visits to the Study Area during July and August 2010.

Marsh vegetation was primarily observed from levee roadways, railroad beds, unimproved salt pond levees and Pacific Gas and Electric (PG&E) walkways, but boats were also used. Marsh vegetation observation methods were consistent with methods employed in previous years and complied with U.S. Fish and Wildlife Service (USFWS) guidelines and regulations (USFWS 1988). We surveyed the marsh edge by boat in all three reaches of the Main Study Area (Segments 1, 2, 11, 12, 13, 15, 21, 22, and 30). Only when necessary and allowed by USFWS


2010 MARSH PLANT ASSOCIATIONS OF SOUTH SAN FRANCISCO BAY
LEGEND
Lower Reach
Transition Reach
Upper Reach
Reference Reach
21 Segment Number
A21 Pond Number
Salinity Monitoring Station
Mowry Slough
Coyote Creek
Mud Slough
Alviso Slough
Artesian Slough
Newby Island
San Francisco Bay
Calaveras Point
Railroad Bridge
M11
M9
M8
M7
M6
M5
M4
M3
M2
M1
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2010 South Bay Marsh Studies Dominant Plant Segment Locations
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regulations did we verify vegetation associations by walking into marshes. Access to the study area was obtained from numerous parties including: the USFWS San Francisco Bay National Wildlife Refuge (Cheryl Strong 510.557.1271); Cargill Salt Division, Newark, CA (Pat Mapelli 510.790.8610); Tri-Cities Landfill (Terry Medeiros 510.624.5910); and the Newby Island Landfill (Chuck Sundberg 408.945.2813).

GIS software (ArcView 10.0) was used to process the marsh observation data, create color-coded maps of the Study Area, and to calculate plant association acreages. The digitized boundaries of habitat areas were reviewed for consistency and quality.

VEGETATION ASSOCIATION AND HABITAT CATEGORIZATION METHODS

Areas were assigned dominant species categories and vegetation associations, based on vegetation coverage (Table 2). Species occurring as dominant, co-dominant or sub-dominant as defined below were mapped. For the purposes of this study, a dominant species had a percent cover of over 85%, a dominant/subdominant category where cover by the dominant species is 51-100%, co-dominant species with roughly equal percent coverage and sub-dominant species between 15 and 49 percent cover. Each dominant species was then assigned to a vegetation association comprising one dominant, one dominant and one subdominant, or two co-dominant species.

Table 2. Criteria for Assigning Vegetation Associations, Based on Vegetation Coverage

VEGETATION AREA COVERAGE	DOMINANT SPECIES CATEGORY AND VEGETATION ASSOCIATION NAMING CONVENTION	EXAMPLE VEGETATION ASSOCIATION
One species comprising 85-100% total cover	Dominant, named exclusively for that species	A pickleweed designation constitutes from 85-100% pickleweed and less than 15% by other species.
One species comprosing 51-85% and another species comprising 15-49% of total cover	Dominant/sub-dominant, named for both species, with the more abundant species listed first	A pickleweed/alkali bulrush designation consists of 51-85% cover of pickleweed and 15-49% cover of alkali bulrush.
Two species with approximately equal coverage	Co-dominant[1]	Not applicable for 2010 analyses
Species not considered wetland indicators by the USFWS (1988)	Upland	An upland designation includes species such as black mustard (*Brassica nigra*), ripgut grass (*Bromus diandrus*), sweet fennel (*Foeniculum vulgare*) and coyote brush (*Baccharis pilularis*).
Numerous species that occur along salt marsh edges and levee slopes but no one species generally exceeds 15% of total cover	Peripheral halophyte	A peripheral halophyte designation includes species such as alkali heath (*Frankenia salina*), Australian saltbush (*Atriplex semibaccata*) and slender-leaved iceplant (*Mesembryanthemum nodiflorum*).

[1]Co-dominant associations have been used in previous years (e.g., 2008) but not this year.

Dominant species categories were then assigned to one of four habitat types: salt marsh, brackish marsh, freshwater marsh and upland. The initial categorization of dominant species into habitat types was based on relevant literature and substantiated by a study that established linkages between edaphic (soil) characteristics and patterns of plant zonation (H. T. Harvey & Associates 2002b).

AREA COMPARISONS

Analysis of marsh conversion within the Main Study and Reference Areas is a multi-step process beginning at the total marsh area level and proceeding to more specific, segment-level analyses. First, acreage changes in habitat type and dominant species categories are compared between years. Second, the current year's acreages are compared to those of the baseline year 1989. When a significant shift in marsh acreage is identified, the dominant species responsible for the shift are noted. Marsh habitat acreage data from 17 years (1989, 1991, 1994, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008 and 2010) were also compared by Reach.

Having determined the dominant species that account for marsh habitat shifts, the third and last analysis step compares the 1989 habitat maps with the current year's habitat maps, to determine the location and magnitude of the change(s). Habitats for the preceding monitoring year (i.e., 2008 in this report) are also compared to the current year's map to determine recent changes. Dominant species and habitat type maps are then produced for each of the four Reaches.

RESULTS

Detailed habitat maps and raw data are presented in the Appendices:

Appendix A. Vegetation and Marsh Habitat Maps from 2010 (Figures A1-A8)

Appendix B. Spatial Analysis (marsh conversion and gain/loss) from 1989 to 2010, and from 2008 to 2010 (Figures B1-B12)

Appendix C. Detailed Acreage Matrices by Segment and Species (Tables C1-C28)

Appendix D. Plant List of Species Observed During Vegetation Mapping

Appendix E. Dominant Species Categories, Marsh Type and Vegetation Associations for 1989 and 2010

SPECIES DISTRIBUTIONS, DOMINANT CATEGORIES AND HABITAT ACREAGES

Main Study Area

Fifty-nine (59) vegetation associations (e.g., alkali bulrush/peppergrass) were mapped as part of the 2010 monitoring efforts. Vegetation associations were then grouped by dominant species into 24 categories (e.g., alkali bulrush) (Figures A-1 to A-4). Maps indicating spatial distributions of dominant species and habitat types were created for the three reaches (see Appendix A for maps [scales vary], and Appendix E for habitat classifications). Habitat type and dominant species category acreages are provided in Table 3.

The dominant plant species is pickleweed, comprising 953.8 ac or 51.3% of the Main Study Area (Table 3). The second most prevalent species is alkali bulrush, comprising 259.9 ac or 13.9% of the Main Study Area (Table 3). Pickleweed is also the dominant species of the salt marsh habitat, comprising 953.8 ac or 77.1% of the area. Alkali bulrush, and to a lesser extent peppergrass, are the two most common species of the brackish marsh association, comprising 259.9 ac (or 48.2%) and 191.4 ac (or 35.5%) of the total area. For the freshwater habitat type, California bulrush (*Schenoplectus californicus*) and cattail (*Typha* spp.) are the two most prevalent species, comprising 56.2 ac (or 67.7%) and 26.3 ac (or 31.7%) of the total area.

Lower Reach. The segments within the Lower Reach (nearest San Francisco Bay; Figures A-1 and A-5) support primarily single-species stands or mixtures of pickleweed, and to a lesser extent cordgrass.

Transition Reach. The Transition Reach supports a diverse assemblage of salt and brackish marsh species (Figures A-2 and A-6). Although pickleweed is the dominant plant species in the Transition Reach, salt marsh species coverage in general decreased from 2008 to 2010. The decrease in the extent of dominant salt marsh species was offset by an increase in the prevalence of some (e.g., alkali bulrush), but not all [(e.g., peppergrass and *Atriplex triangularis* (spearscale)] brackish marsh species. Pickleweed still dominates much of the marsh north (e.g., Segment 10), and to a lesser extent south of Coyote Creek (e.g., Segments 9 and 11), but areas of pickleweed are interspersed with alkali bulrush, spearscale and peppergrass-dominated patches (Figure A-2). Cordgrass remains dominant along the northern and southern fringes of Coyote Creek within the Transition Reach (Figure A-2).

Upper Reach. The Upper Reach (Figures A-3 and A-7) is dominated by brackish marsh associations, consisting either of pure stands or mixtures of alkali bulrush, peppergrass, spearscale and pickleweed. The lower segments (Segments 19 and 21) of the Upper Reach are dominated by pure stands or mixtures of pickleweed, alkali bulrush and pepperweed. Cordgrass and pickleweed are significantly less common in the Upper compared to the Transition and Lower Reaches, but do occur in the farthest upstream segments, albeit in patches too small to map. As in previous years, the upper portion of Artesian Slough closest to the WPCP (Segments 25 and 26) is dominated by the freshwater marsh species California bulrush and cattail.

Table 3. Main Study Area Acreages by Dominant Species for Each Habitat Type in 2010.

HABITAT TYPE	DOMINANT SPECIES CATEGORY	AREA (ACRES)
Salt Marsh	Cordgrass	214.6
	Pickleweed	953.8
	Alkali Heath	15.1
	Gumplant	20.3
	Jaumea	1.2
	Saltgrass	0.6
	Peripheral Halophytes	31.8
	Sub-Total	**1237.4**
Brackish Marsh	Alkali Bulrush	259.9
	Peppergrass	191.4
	Spearscale	87.3
	Sub-Total	**538.6**
Freshwater Marsh	California Bulrush	56.2
	Cattail	26.3
	Grass-leaved goldenrod	0.5
	Misc. Others	<0.1
	Sub-Total	**83.1**
	TOTAL	**1859.1**

Reference Area

The diversity and distribution of plant species within the Reference Area (Table 4) vary over its length (Figure A-8). Salt marsh is dominant in Segment 30, brackish marsh is dominant in Segments 29 and 28, and freshwater marsh is dominant in Segment 27, the uppermost segment (Figure A-8). Segment 30 (nearest to the confluence with Coyote Creek) is comprised primarily of pickleweed and cordgrass associations. Segments 29 and 28 are dominated by alkali bulrush and peppergrass. Segment 27 is dominated by the freshwater marsh species cattail, peppergrass and California bulrush (Figures 1 and A-4).

Table 4. Reference Area Acreages by Dominant Species for Each Habitat Type in 2010.

HABITAT TYPE	DOMINANT SPECIES CATEGORY	AREA (ACRES)
Salt Marsh	Cordgrass	25.0
	Pickleweed	62.8
	Peripheral Halophytes	1.5
	Saltgrass	0.1
	Gumplant	<0.1
	Jaumea	4.2
	Alkali Heath	0.4
	Sub-Total	**94.1**
Brackish Marsh	Alkali Bulrush	84.9
	Peppergrass	68.3
	Spearscale	0.9
	Sub-Total	**154.1**
Freshwater Marsh	California Bulrush	15.0
	Cattail	18.6
	Grass-leaved goldenrod	<0.1
	Sub-Total	**33.7**
	TOTAL	**281.9**

Dominant Species Summary

The Main Study Area as a whole is dominated by salt marsh species (70%). Brackish (28%) and freshwater species (2%) are less prevalent. The distribution of salt, brackish and freshwater marsh species follows a longitudinal pattern. The Reference Area as a whole is dominated by brackish marsh species (58%); salt (36%) and freshwater species (6%) cover significantly less land area (Table 5). The distribution of salt, brackish and freshwater marsh species in the Reference Area exhibits a similar longitudinal pattern, with saline dominance in the lower segment near the confluence of Alviso Slough with Coyote Creek, brackish dominance in the middle segments and dominance by freshwater marsh in the uppermost segment near the Alviso Marina.

Table 5. Dominant Species Summary

STUDY AREA	REACH	MARSH SPECIES, % OF AREA		
		Salt	Brackish	Freshwater
Main Study Area	Upper	18	76	6
	Transition	66	34	negligible
	Lower	99	1	negligible
Reference Area	Alviso Slough	36	58	6

TEMPORAL AND SPATIAL CHANGES IN MARSH HABITAT: 2008–2010

The total amount of marsh habitat in the Main Study Area has increased by 41.4 ac or 2.3% since 2008 (Table 6), the last time this study was performed.

Table 6. Main Study Area[a] Acreages by Dominant Species for Each Habitat Type for 1989, 2008, 2010 and Percent Change from 1989-2010.

HABITAT TYPE	DOMINANT SPECIES CATEGORY	1989 (ACRES)	2008 (ACRES)	2010 (ACRES)	PERCENT CHANGE (1989-2010)
Salt Marsh	Cordgrass	84.2	185.3	214.5	155
	Pickleweed	669.1	883.4	952.8	42
	Pickleweed-Cordgrass mix[b]	-	91.3	-	-
	Alkali heath[c]	-	14.8	14.9	-
	Gumplant[c]	-	20.6	20.3	-
	Jaumea[c]	-	1.2	1.2	-
	Peripheral halophytes	25.6	26.5	31.3	22
	Misc. others	0.1	0.0	0.0	0
	Saltgrass	-	4.4	0.6	-
	Dead vegetation	-	15.8	-	-
	Sub-Total	**779.0**	**1243.3**	**1235.6**	**59**
Brackish Marsh	Alkali bulrush	489.6	102.7	246.9	-50
	Peppergrass	66.1	189.3	172.9	162
	Spearscale[c]	-	160.7	87.2	-
	Dead vegetation	-	4.0	-	-
	Sub-Total	**555.7**	**456.7**	**507.0**	**-9**
Freshwater Marsh	California bulrush	-	20.3	19.6	-
	Cattail	-	10.4	9.6	-
	Misc. others	-	<0.1	0.4	-
	Sub-Total	-	30.8	29.6	-
	TOTAL	**1334.7**	**1730.8**	**1772.2**	**33**

[a] Comparison consists of Segments 1-5 and 8-23 only, because Segments 24-26 were not mapped in 1989
[b] Not a dominant species category in 1989 or 2010; [c]Not a dominant species category in 1989.

Salt marsh habitat decreased by 7.7 ac or 0.6%. However, the areal extent of the salt marsh dominants cordgrass and pickleweed both increased (by 29.2 ac or 15.7% and 69.4 ac or 7.8%, respectively).

Brackish marsh increased by 51.0 ac or 11.1%. The areal extent of alkali bulrush increased by 144.2 ac or 140.4%. The prevalence of spearscale, and to a lesser extent peppergrass, decreased over this period (by 73.5 ac or 45.7% and 16.4 ac or 8.6%, respectively).

Freshwater marsh decreased by 1.2 ac (3.8%). The prevalence of the freshwater marsh dominants California bulrush and cattail both decreased (by 0.7 ac or 3.4%, and 0.8 ac or 7.6%, respectively).

The total amount of marsh habitat in the Reference Area has increased by 1.9 ac or 0.7% since 2008 (Table 7).

Salt marsh habitat decreased by 17.5 ac or 15.8%. Cordgrass decreased by 14.4 ac or 36.5%, while pickleweed decreased by 6.9 ac or 9.9%.

Brackish marsh increased by 24.9 ac or 19.8%. Alkali bulrush and peppergrass areas both exhibited notable increases (by 26.9 ac or 47.9% and 6.8 ac or 11.4%, respectively).

Freshwater marsh decreased by 5.5 ac or 24.8%. California bulrush decreased by 2.8 ac or 24.1%, whereas cattail increased by 4.3 ac or 122.8%. Grass-leaved goldenrod was much less common in 2010, decreasing by 6.8 ac or 98.5%.

Table 7. Reference Area[a] Acreages by Dominant Species for Each Habitat Type for 1989, 2008, 2010 and Percent Change from 1989-2010.

HABITAT TYPE	DOMINANT SPECIES CATEGORY	1989 (ACRES)	2008 (ACRES)	2010 (ACRES)	PERCENT CHANGE (1989-2010)
Salt Marsh	Cordgrass	28.3	39.4	25.0	-12
	Pickleweed	43.6	69.4	62.5	43
	Peripheral halophytes	3.1	1.2	1.2	-62
	Alkali heath[b]	-	-	0.4	-
	Gumplant[b]	-	-	0.0	-
	Jaumea[b]	-	-	4.2	-
	Misc. others	-	0.1	0.0	-
	Dead vegetation	-	0.0	0.0	-
	Sub-Total	**75.0**	**110.8**	**93.3**	**24**
Brackish marsh	Alkali bulrush	72.3	56.1	83.0	15
	Peppergrass	20.4	59.6	66.4	226
	Spearscale[b]	-	7.8	0.8	-
	Dead vegetation	-	1.9	0.0	-
	Sub-Total	**92.7**	**125.3**	**150.2**	**62**
Freshwater marsh	California bulrush	0.3	11.6	8.8	>1000
	Cattail	-	3.5	7.8	-
	Grass-leaved goldenrod	-	6.9	<0.1	-
	Misc. others	-	0.1	0.0	-
	Sub-Total	**0.3**	**22.1**	**16.6**	**>1000**
	TOTAL	**168.0**	**258.2**	**260.1**	**55**

[a] Comparison consists of Segments 28-30; [b]Not a dominant species category in 1989.

TEMPORAL AND SPATIAL CHANGES IN MARSH HABITAT: 1989–2010

Most data sets covering many years will have missing data or differences in data collection methods that could affect the data. This data set, based on 17 years of aerial photographs and field mapping performed over a 21-year period, also has a few notable characteristics:

- Data from Segments 24, 25 and 26 (Artesian Slough) of the Main Study Area and Segment 27 (vicinity of the Gold Street Bridge) of the Reference Area are not available because those segments were not mapped in 1989.

- The Reference Area was not mapped in 1994; therefore, only data from the Main Study Area in 1994 is included in the temporal and spatial evaluation.

- Data from 1991, 1994 and 1996–1999 are derived from images that were not orthorectified.

- In 2003, baseline (1989) data was digitized and rectified to the 2001 orthophotographs to improve area comparisons and precision of the baseline data (H. T. Harvey & Associates 2003).

New Marsh Formation (All Marsh Types)

Within the Main Study Area, marsh habitat has increased by 437.5 ac since 1989 (Table 6). During the same period, 92.1 ac of new marsh has formed in the Reference Area (Table 7). This equates to a 32% increase in marsh acreage in the Main Study Area and a 55% increase in marsh acreage in the Reference Area.

Lower Reach. The areal extent of marsh in the Lower Reach has increased by 338 ac since 1989 (Figure 2). Within the Lower Reach, the majority of new marsh formation continues to occur along Coyote Creek, immediately upstream of Calaveras Point on the north side and immediately upstream of the confluence with Alviso Slough on the south side.

Transition Reach. The areal extent of marsh in the Transition Reach has increased by 64 ac since 1989. In contrast to the Lower Reach, marsh area in the Transition Reach has increased at a much slower rate (Figure 2). The slight to moderate increase observed this year is primarily the result of new marsh establishment within the Island Ponds restoration site, notably Pond A21.

Upper Reach. The areal extent of marsh in the Upper Reach has also increased since 1989, in this case by 33 ac (Figure 2). As in the Transition Reach, the increase in marsh area in the Upper Reach can be attributed largely to vegetative growth within the Island Ponds restoration site (Pond A19 and A20).

Reference Area. As seen in other portions of the study area, marsh in the Reference Area has also increased since 1989, in this case by 97.1 ac (Figure 2). New marsh in the Reference Area is predominantly forming near the mouth of Alviso Slough.

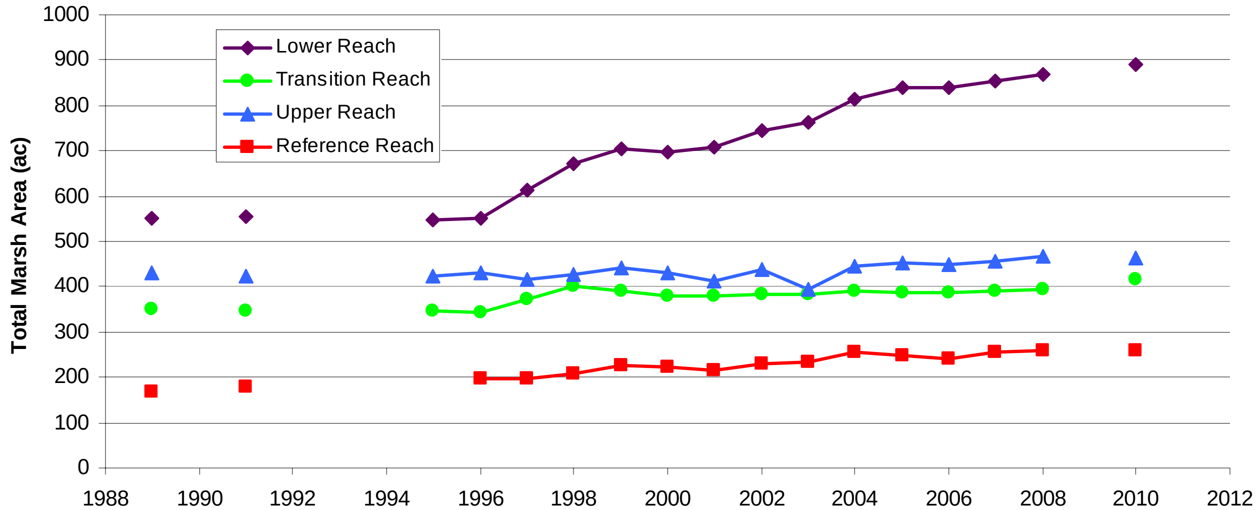


Figure 2. Total Marsh Acreage Comparison by Reach Between 1989 and 2010.

Changes in Habitat Type

The below sections discuss the overall changes in marsh habitat types in 2010 (compared to 1989 and 2008), including new marsh formation as well as marsh type conversion.

Salt Marsh. There has been a net gain of 456.6 ac of salt marsh within the Main Study Area since 1989 (Table 6; Figure 3). The trend since 2008, however, is of declining salt marsh habitat, with decreases observed in the Transition, Upper and Lower Reaches.

Lower Reach. Salt marsh has continually increased in areal extent in the Lower Reach since 1989. Salt marsh increased by 21.6 additional ac relative to what was mapped in 2008. Much of the increase can be attributed to new marsh formation along the portions of Segments 3 and 4 bordering Coyote Creek.

Transition Reach. The amount of salt marsh in the Transition Reach varies on an annual basis (Figure 3). Despite the potential for increased salt marsh habitat owing to colonization and growth by salt marsh vegetation in the recently restored Island Ponds, the areal extent of salt marsh in the Transition Reach decreased by 6.2 ac this year.

Upper Reach. Salt marsh area in the Upper Reach has generally increased since 1989. Over the past 2 years, however, the areal extent of salt marsh in the Upper Reach decreased by 4.9 ac.

Reference Reach. Similar to the Upper Reach, salt marsh habitat within the Reference Reach has generally increased since 1989. This year, however, is marked by a 17.6 ac decrease. The majority of change occurred in Segment 29, and to a lesser extent Segment 30.

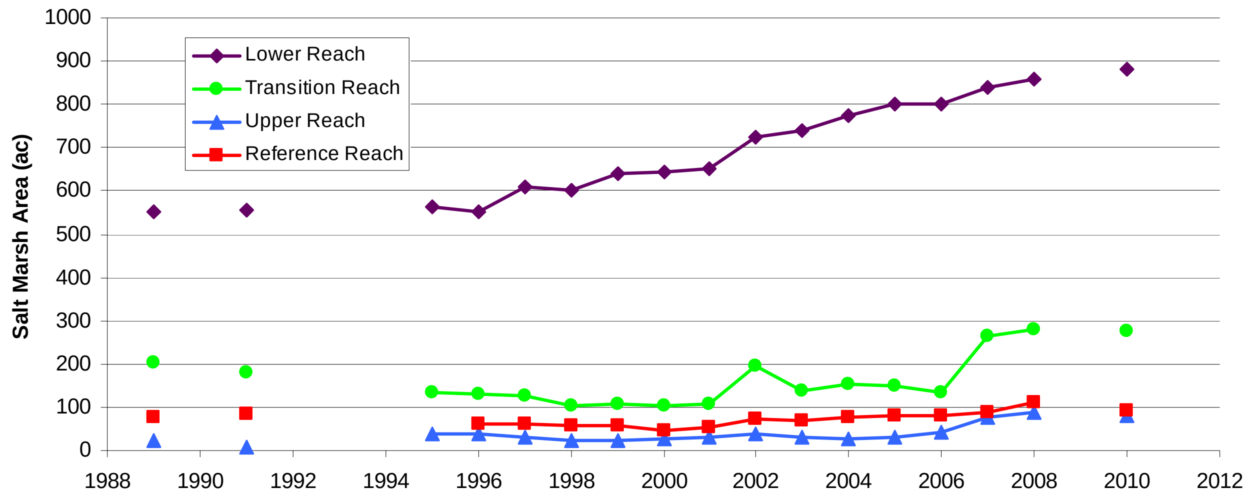


Figure 3. Salt Marsh Acreage Comparison by Reach: 1989–2010.

Brackish Marsh. There has been a net loss of 48.7 (9%) ac of brackish marsh in the Main Study Area since 1989 (Table 6; Figure 4). Over the past 2 years, however, brackish marsh has experienced a net increase of 53.1 ac. Over this same period, the prevalence of alkali bulrush increased by 139.9 ac. Alkali bulrush was the only brackish species to increase in area this year, as both peppergrass and spearscale decreased.

Lower Reach. Brackish marsh in the Lower Reach has generally declined since mapping began in 1989 (Figure 4). In 2010, however, an increase of 0.8 ac was observed.

Transition Reach. Brackish marsh in the Transition Reach of the Main Study Area, much like the pattern for salt marsh, has fluctuated considerably on an annual basis since 1989 (Figure 4). Since then, the extent of brackish marsh in the Reference Reach has decreased by 8.42 ac. In 2010, however, the extent of brackish marsh increased by 44.4 ac.

Upper Reach. There is an overall trend of decreasing brackish marsh in the Upper Reach of the Main Study Area since 1989 (Figure 4). Over this period, brackish marsh area decreased by 51.3 ac. Over the past 2 years, however, the extent of brackish marsh in the Upper Reach increased by 4.6 ac.

Reference Area. Brackish marsh in the Reference Area has increased by 57.6 ac (35%) since 1989 (Table 6). A large proportion of this increase (i.e., 26.9 ac) occurred over the past 2 years. Most of the increase in brackish marsh in the Reference Area occurred in Segments 29 and 28 (Figure B-8) as a result of salt marsh converting to brackish marsh.

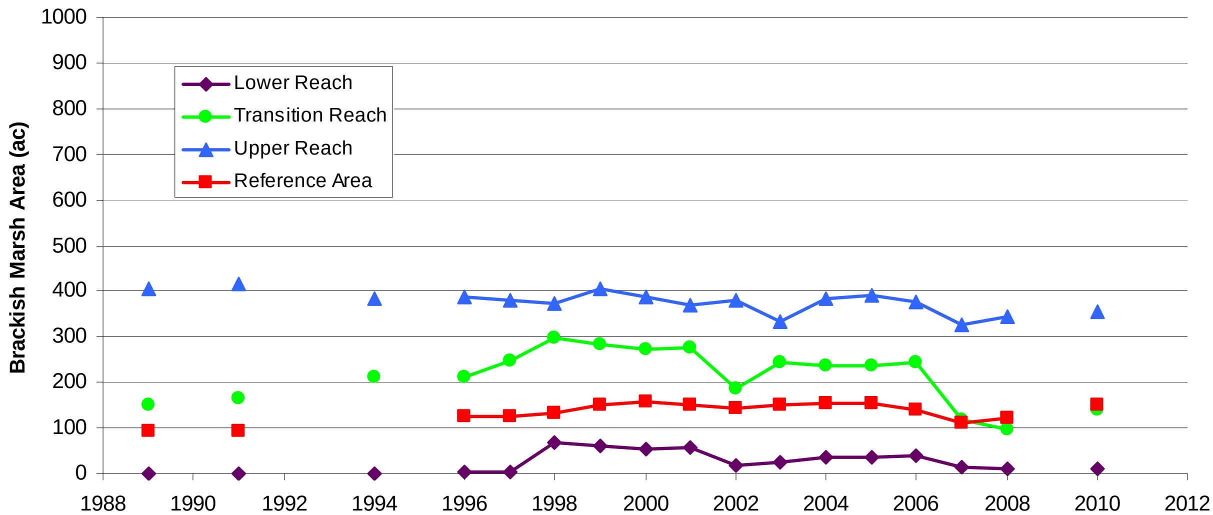


Figure 4. Brackish Marsh Acreage by Reach: 1989–2010.

Freshwater Marsh. Increases in freshwater marsh habitat since 1989 have occurred in the Upper Reach of the Main Study Area (Figure 5) and the Reference Area (Tables 6 and 7). Since 1989, freshwater marsh in the Upper Reach has increased by 29.5 ac, whereas in the Reference Reach it has increased by 16.2 ac. Over the past 2 years, however, freshwater marsh in the Upper and Reference Reaches has declined (by 1.2 and 5.5 ac, respectively).

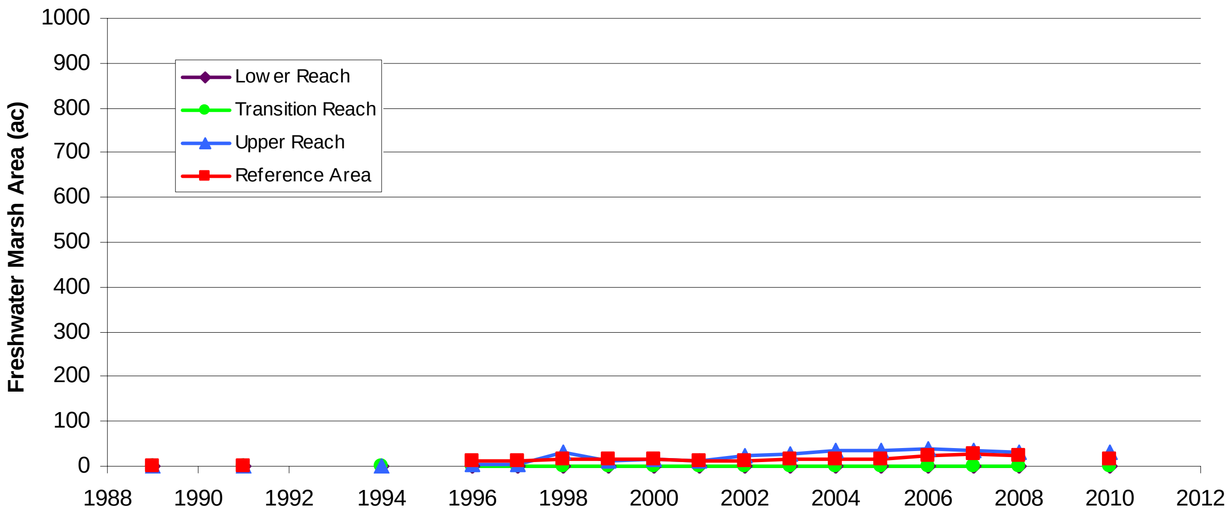


Figure 5. Freshwater Marsh Acreage by Reach: 1989–2010.

Habitat Type Conversion

Detailed comparisons of marsh habitats by segment were performed by comparing 1989 and 2010 data, using only the footprint of the marshes as they existed in 1989. Table 8 is a summary of the segment locations and shifts in acreages by habitat type since 1989. The area calculations in Table 8 were derived from a segment level analysis (by reach) for 1989-2010 (Appendix B).

Table 8. Habitat Type Conversion by Project Reach: 1989-2010.

PROJECT REACH	SALT TO BRACKISH OR FRESH (ACRES)	BRACKISH TO SALT (ACRES)	NET CONVERSION OF SALT TO BRACKISH (ACRES)	AMOUNT OF SALT MARSH CONVERTED (%)	AMOUNT OF TOTAL MARSH CONVERTED (%)
Lower	2.7	0.0	2.7	< 1	<1
Transition	54.9	68.9	-14.0	-5	-3
Upper	12.9	42.6	-29.7	-36	-6
Reference	31.2	9.0	22.2	23	8

Since 1989, 70.5 ac of marsh habitat converted from salt to brackish marsh habitat in the Main Study Area, and 31.2 ac of marsh habitat converted from salt to brackish marsh in the Reference Area. During the same time period, 111.5 ac of marsh converted from brackish to salt marsh in the Main Study Area, with much of this conversion occurring in the Transition Reach (Figures B-9 to B-12). Within the Main Study Area, 41.0 ac of net conversion from brackish to salt marsh habitat has occurred since 1989, with a noticeable decrease in 2010 after several years of successive increases (Figure 6). Also since 1989 but within the Reference Area, there has been a net conversion of 9.0 ac of brackish to salt marsh, and a 22.2 acre net conversion from salt to brackish marsh.

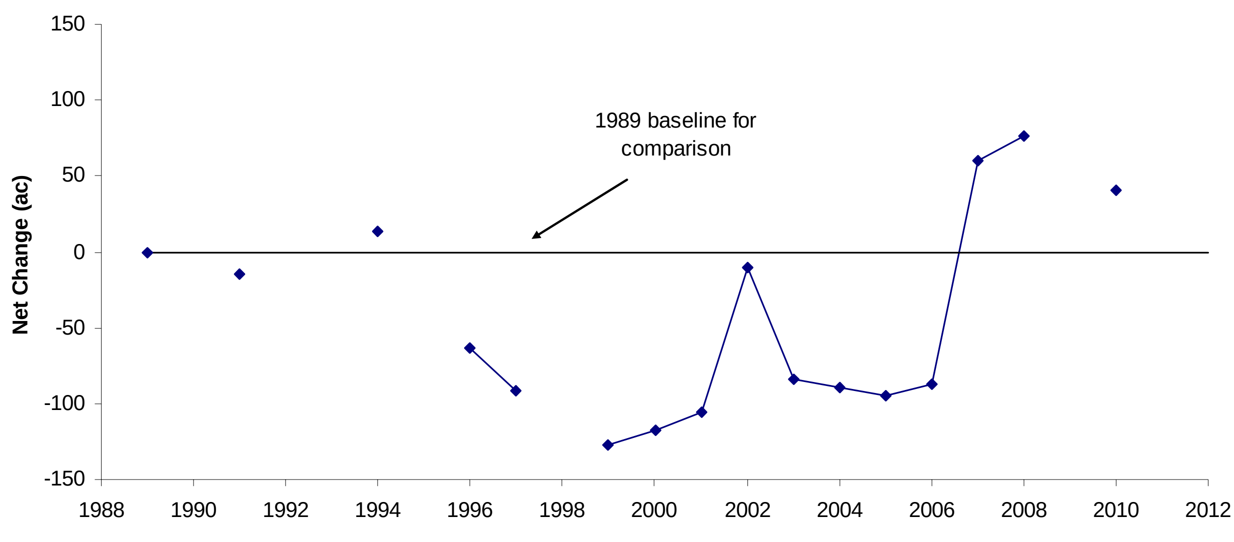


Figure 6. Net Acres of Brackish Marsh Converted to Salt Marsh Within the Main Study Area Since 1989.

Proportional Changes in Salt and Brackish Marsh

To control for the size difference between the Main Study and Reference Areas, the proportion of salt and brackish marsh areas relative to total marsh were compared over the period 1989 to 2010 (Figures 7 and 8). This analysis also allows us to compare temporal trends in salt marsh conversion between these two areas.

The salt marsh habitat in both the Main Study and Reference Areas decreased relative to 2008 levels, with a greater relative decrease observed in the Reference Area (Figure 7). The salt marsh habitat in the Main Study Area in 2010 is comparable to that documented in 2007, whereas salt marsh habitat in the Reference Area is less than the 2007 percentage. With respect to long-term trends, the percentage of salt marsh currently in the Main Study Area is greater than what was documented in 1989, whereas the salt marsh within the Reference Area is less.

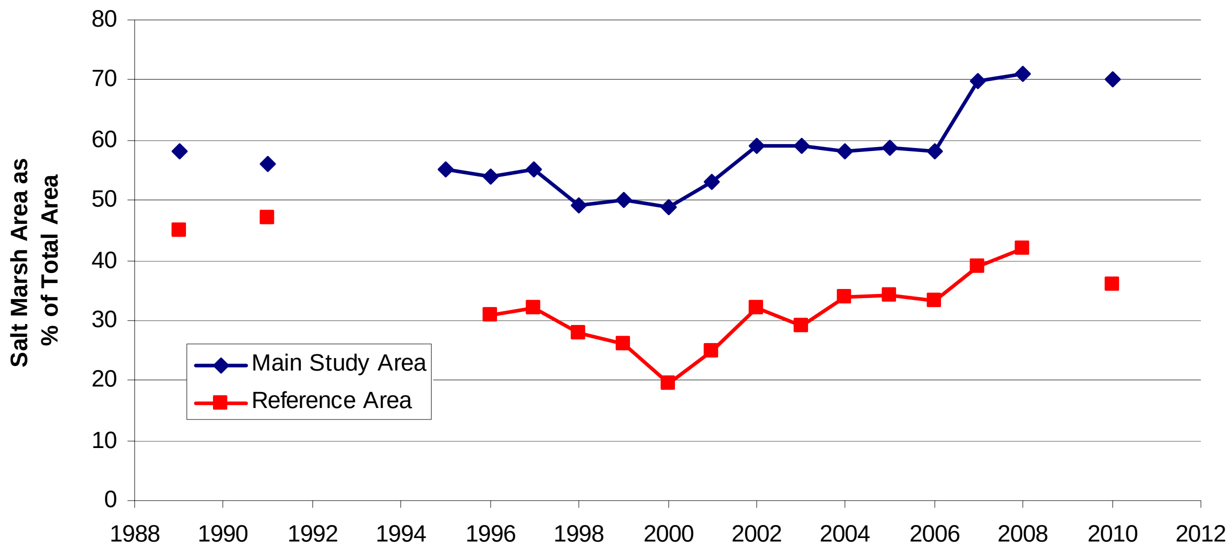


Figure 7. Temporal Comparison of the Percent of Salt Marsh Area.

The percentage of brackish marsh in the Reference Area has consistently declined since 2002, with substantial declines in 2007 and 2008 (Figure 8). This year, there was an increase in the amount of brackish marsh. The percentage of brackish marsh also increased in the Main Study Area, although it remains substantially less relative to the Reference Area.

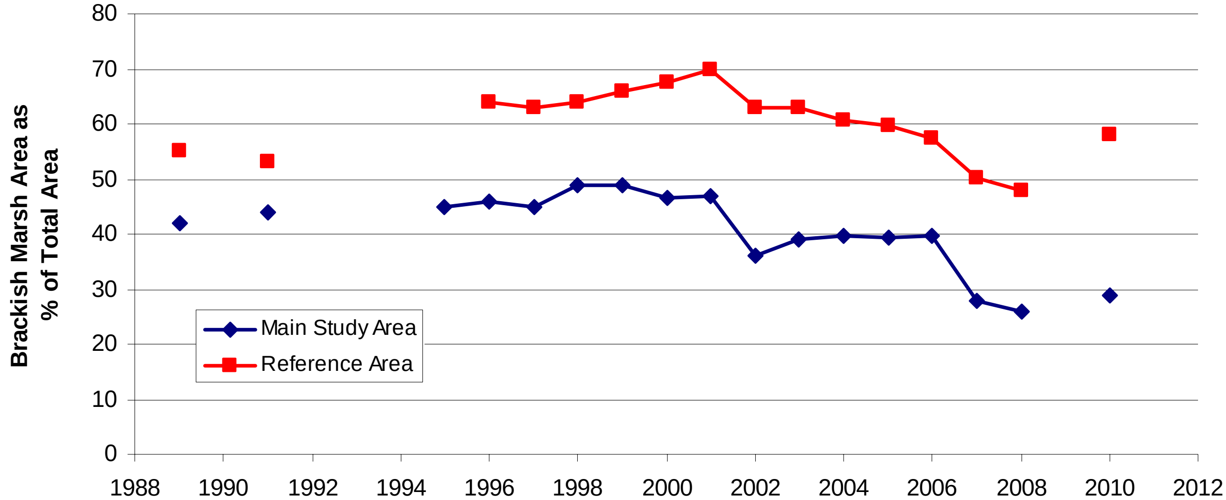


Figure 8. Temporal Comparison of the Percent of Brackish Marsh Area.

DISCUSSION

The most notable change in plant community composition between 2008 and 2010 was a decrease in salt marsh habitat and an increase in brackish marsh habitat in both the Main Study and Reference Areas. Despite the increase in brackish marsh habitat observed in 2010, we note that salt marsh not only continues to dominate in the Main Study, but that new salt marsh continues to form. Most of the 2010 conversion from salt to brackish marsh occurred in the Transition Reach of the Main Study Area, particularly Segments 9 and 11. The fact that similar changes in marsh composition (i.e., increased alkali bulrush presence) and species dominance were observed in both the Main Study and Reference Areas, partly suggests the same underlying processes and factors are responsible.

Since 1989, the overall marsh conversion trend in the Main Study Area is a net conversion of brackish marsh to salt marsh. The magnitude of this trend was reduced somewhat during the past two years because in some areas, alkali bulrush was dormant during the prior drought period, but re-sprouted and returned to dominance this year. In this Discussion section, this recent salt to brackish marsh conversion is assessed within the historical context of these wetlands, and possible explanations for large-scale changes are examined.

MARSH CONVERSION

The dynamic nature of the South Bay marshes is highly apparent, not only in the seasonal shifts in species composition, but also in the large-scale die-back and re-emergence and/or re-establishment events, such as those that occurred in 2006 (H. T. Harvey & Associates 2006b) and 2008 (H. T. Harvey & Associates 2008). The shifts observed in 2006 persisted into 2008, with pickleweed colonizing formerly dead patches in the Transition Reach (Figure 9), and spearscale colonization in the Upper Reach. Note that the observed shifts in the Transition Reach take into account total marsh area. However, in 2010, vegetation mapping identified widespread increases in brackish marsh area, and of alkali bulrush in particular. Not only has alkali bulrush re-emerged and/or re-established in areas where it died back previously, but it appears to be out-competing other brackish and salt marsh species. The mechanisms for this apparent die back and re-growth are described in more detail below, but the ability of alkali bulrush to enter dormancy, where underground parts are alive but do not sprout in unfavorable situations (i.e., drought and higher salinity water), may have contributed to the observed re-growth.

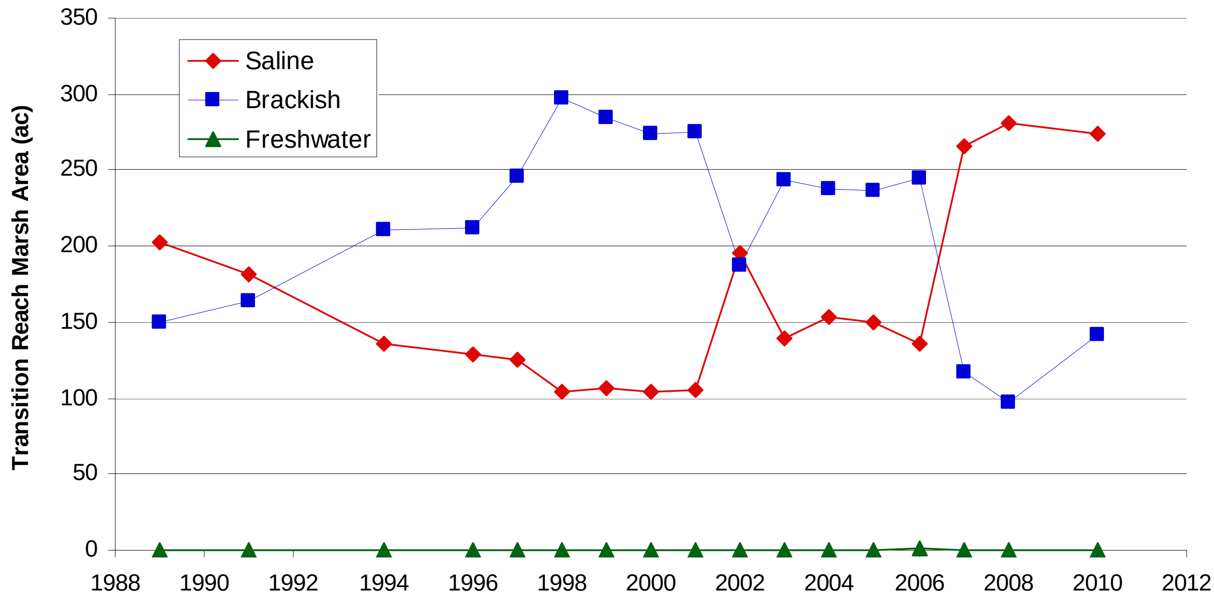


Figure 9. Transition Reach Dominant Species Acreages by Habitat Type 1989–2010.

As noted in previous reporting years (e.g., H. T. Harvey & Associates 2007, 2008), changes in the Main Study Area over the past 2 years have not been limited entirely to conversions of habitat type (i.e., salt or brackish); shifts in species composition within given habitat types have also occurred. With respect to salt marsh species, areas of both pickleweed and cordgrass increased this year (by 71.6 and 29.2 ac, respectively), because this year there were no areas where the two species were co-dominant. Similar species composition changes within a habitat type were also observed this year for brackish marsh. The extent of alkali bulrush increased by 139.9 ac, whereas spearscale and peppergrass both decreased (by 16.4 and 73.6 ac, respectively).

The Reference Reach had similar increases in brackish marsh and decreases in salt marsh. (Figure 10). This suggests that the changes were due to similar underlying factors, namely rainfall and salinity, both of which are discussed in more detail below.

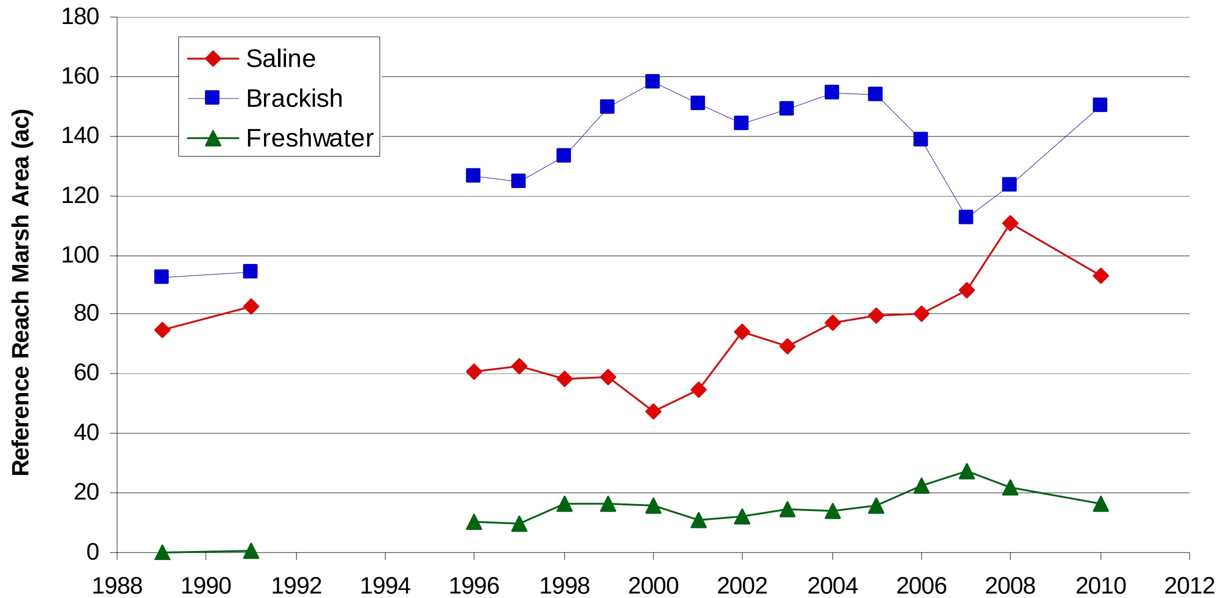


Figure 10. Reference Reach Dominant Species Acreages by Habitat Type: 1989–2010.

NEW MARSH FORMATION

There has been a net increase of 456.6 ac (33%) of overall marsh area (new marsh formed minus marsh lost) since 1989 in the Main Study Area. Much of the new marsh formed within the Main Study Area is occurring in three locations:

1) accreting mudflats along Coyote Creek near Calaveras Point (i.e., Lower Reach Segments 2, 3 and 4) immediately east of the mouth of Alviso Slough (Figure B-5);

2) Segments 22 and 23 near the mouth of Alviso Slough (Figure B-5); and

3) within the Islands Ponds restoration site that breached in 2006 (i.e., Segment 20 (Pond A21) (Figure B-6).

The mudflats along Coyote Creek reached an elevation supportive of wetland vegetation in 1996 and 1997, and as supported by 2010 data, continue to foster conditions suitable for plant establishment. The large mudflat in Coyote Creek immediately upstream of the confluence with Alviso Slough reached an elevation capable of supporting wetland vegetation in 2000 and 2001. This mudflat continues to be colonized by species such as cordgrass and pickleweed. With respect to the Island Ponds, some vegetation was previously mapped in 2008, but significant plant colonization occurred over the past two years, particularly in Pond A21. There was some concern that the increased tidal prism associated with the 2006 breaching of the Island Ponds would cause erosion of the newly accreted marshes at Calaveras Point and near the mouth of Alviso Slough, but instead new marsh continues to form.

The majority of new salt marsh formation in the Reference Area is occurring near the mouth of Alviso Slough in Segment 30. New brackish marsh, on the other hand, has formed in Segments 28 and 29, whereas new freshwater marsh has formed in Segment 27 (Figure B-8).

EVALUATION OF MARSH CONVERSION

Depth and duration of flooding over the marsh surface influences marsh species composition (Webb and Mendelssohn 1996, Webb et al. 1995, Pennings and Callaway 1992, Mendelssohn and McKee 1988, Mall 1969); surface water and interstitial salinities positively and significantly correlate with the distribution of wetland vegetation (Reardon 1996, Callaway and Sabraw 1994, Allison 1992, Callaway et al. 1989, Zedler 1983, Zedler and Beare 1986). Espinar et al. (2005) found that the salinity and flooding regime of a site can influence germination of alkali bulrush, documenting that an increase in salinity and prolonged inundation during germination can result in decreased germination success. Variability in abiotic factors such as precipitation, tidal fluctuation and evapotranspiration, as well as human-influenced factors such as freshwater discharges, non-point source pollution (nutrients and sediments) and climate change, also influence plant species distribution. In the sections that follow, we evaluate and discuss the potential contributions of each of these inputs and their influence on vegetation distribution in the wetlands of South San Francisco Bay.

Alkali Bulrush Ecology

In northern California, alkali bulrush is dormant in the winter months, with shoot growth from corms occurring in March and April and flowers appearing in May. The peak growth of alkali bulrush occurs in June or July with peak shoot mass in August or September (Kantrud 1996) Alkali bulrush typically reproduces asexually via the expansion of clones by a network of creeping rhizomes and corms concentrated at the outside edges of the clones. Corm sprouting and growth are inhibited by increased salinity, with the upper salinity limit for sprouting of corms of approximately 21-30 ppt (Kantrud 1996). Corms may remain dormant under conditions of low water levels and high salinity for at least two years (Kantrud 1996).

WPCP Discharges and Freshwater Flows

Freshwater flows into the South Bay are numerous and include the WPCP, Guadalupe River (Alviso Slough) and Coyote Creek, as well as the overall input from the Sacramento/San Joaquin Delta (Figure 11). The river flows change with rainfall, but the flows from the WPCP, have been relatively constant since 1989 (~169 ft^3s^{-1} ±30%) (Figure 11). During summer, the WPCP effluent dominates the local dry season flows; during winters with normal rainfall, freshwater flow from the local drainages (Coyote Creek and Guadalupe River) are larger than the WPCP effluent. Still larger, however, is the flow from the Sacramento/San Joaquin Delta, which can reduce the salinity of the South Bay considerably.

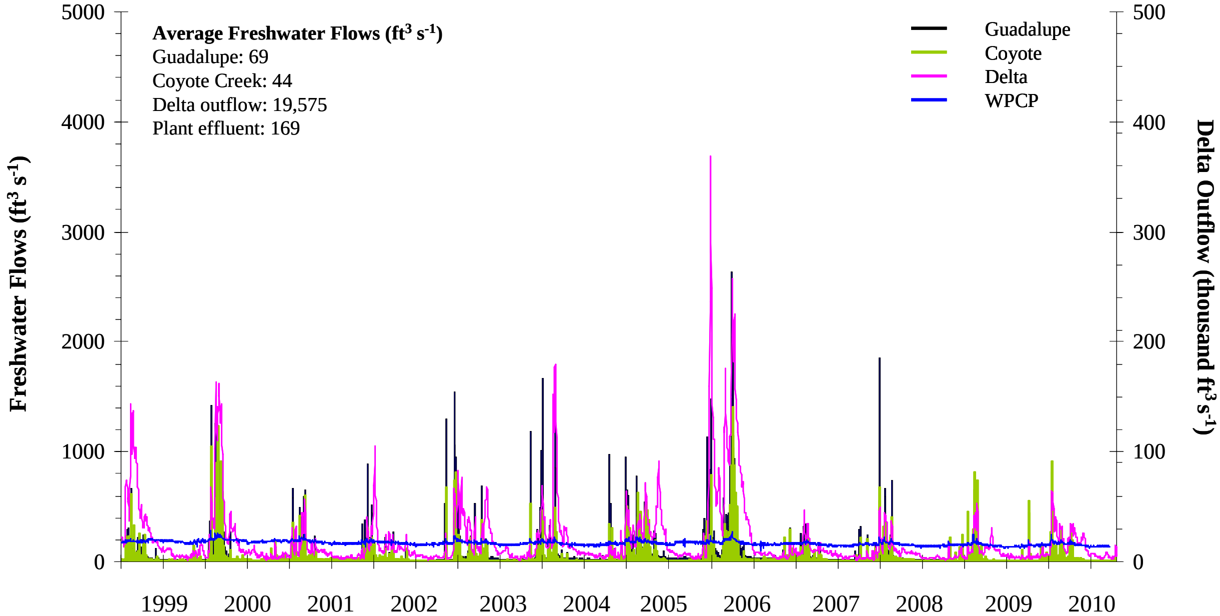


Figure 11. South San Francisco Bay Average Freshwater Flows 1999-2010 (City of San Jose 2010).

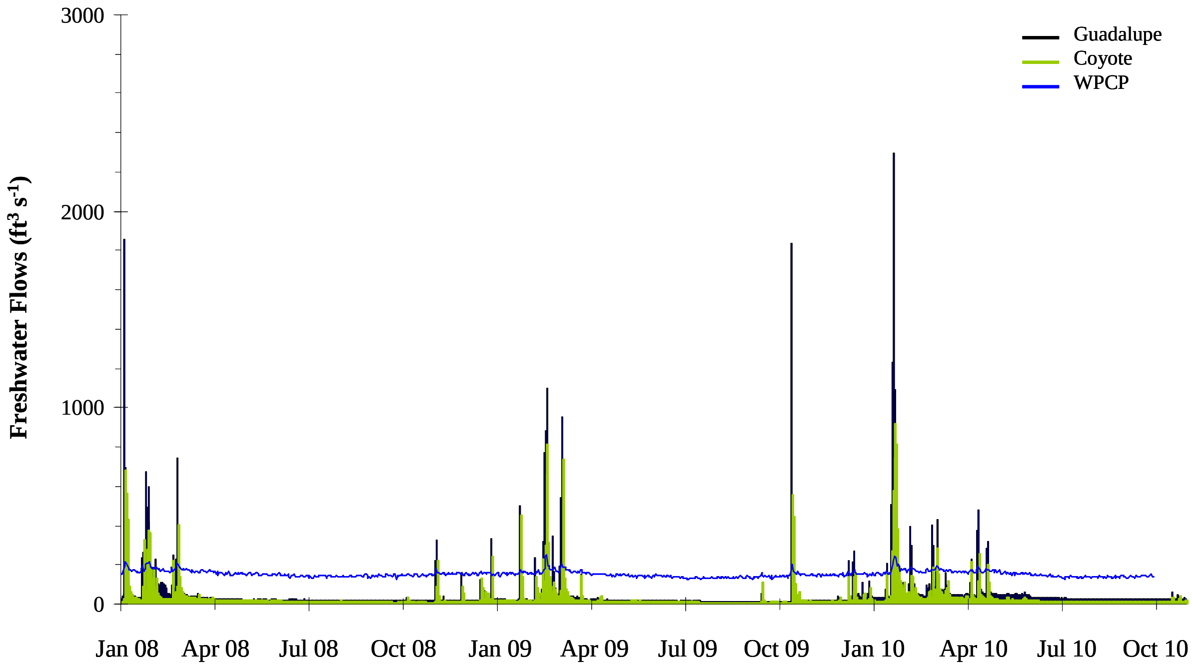


Figure 12. South San Francisco Bay Average Freshwater Flows 2008-2010 (City of San Jose 2010).

Rainfall

Rainfall quantities and timing affect surface and interstitial salinity, thereby influencing wetland species composition. For example, Espinar (2005) showed that prolonged inundation significantly affects the germination success of alkali bulrush. The variability of rainfall between years in California's Mediterranean climate contributes to variation in the germination conditions of upper intertidal marshes. Based on work by Noe and Zedler (2001), rainfall has a strong influence on soil salinity, which has the potential to be a greater influence than estuarine water salinity on the seed germination success of marsh species. As a result, the amount of brackish marsh vegetation mapped in one year may be directly influenced by the rainfall in the previous year. Therefore, changes in precipitation timing and quantity could cause dormant corms of species like alkali bulrush to re-sprout after years of unfavorable conditions.

With this in mind, the lag time between when certain abiotic events occur and when their actual ecological influence becomes apparent must be taken into account. For example, below-average late season rains in 2007 and early in 2008 (Figure 12) resulted in decreased freshwater input from local drainages and from the Delta, contributing to higher than normal ambient Bay salinities (Figure 13). The decreased freshwater input and higher salinities were likely key factors underlying the increase in salt marsh species observed in 2007 and 2008.

Since 2008, however, winter/spring precipitation has been increasing (Figure 13). The salinity patterns for Calaveras Point and the Delta outflow were similar over the past two years relative to 2007 and 2008. Salinity at the railroad bridge (i.e., R x R Bridge; Figure 1), which crosses the South Bay in between the Upper and Transition Reaches, was lower than in 2007 and 2008 and corresponds to the area where the primary shifts from salt marsh to brackish marsh dominance occurred this year (Figure 14). Although brackish marsh conversion in the Transition Reach mirrors regional precipitation patterns, the influence of South Bay ambient salinities must also be acknowledged.

Mean Sea Level Elevation and Sea Level Rise

The shift between alkali bulrush and pickleweed distribution does not appear to be solely related to interstitial salinities, surface water salinities or inundation stress. In combination with these factors, shifts in vegetation are also likely influenced by interspecific competition and changes in average mean sea level. Mean sea level steadily increased from 1999 to 2006, with higher than average mean sea level in both 2005 and 2006 (Figure 15). This increase in average mean sea level contributed to flooding over the marsh surface and inundation stress in brackish marsh communities in 2005 and 2006. However, mean sea level dramatically decreased between 2006 and 2008 (Figure 15). Mean sea level over the period 2008 to 2010 has increased relative to that recorded over the period 2006 to 2008, suggesting the potential for greater inundation of the marsh surface.

Decreased marsh inundation related to lower mean sea levels in 2007 and 2008 may have contributed to increased soil salinities and less available porewater, causing plant stress and suppression of alkali bulrush populations. The deeper typical rooting depth of pickleweed (~18 in) versus the more shallow typical rooting depth of alkali bulrush (~8 in) may have increased

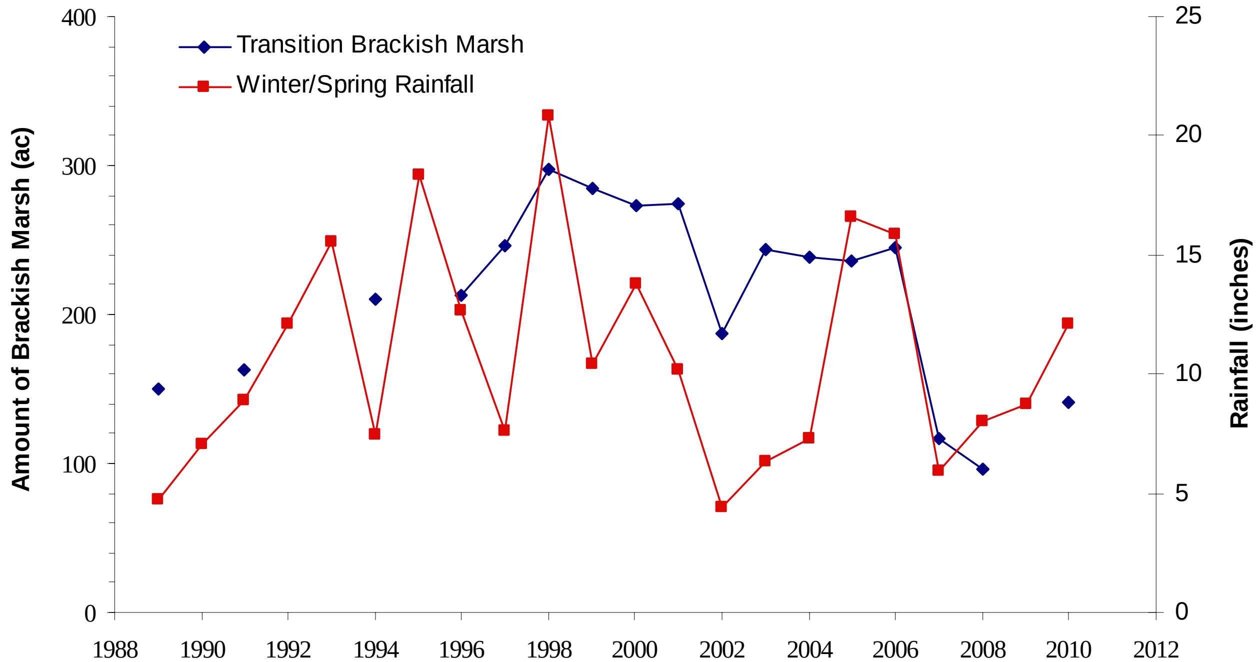


Figure 13. Total Winter/Spring (January – May) Precipitation (Rain) for San Jose, California from 1989-2010 (National Weather Service Station at San Jose).

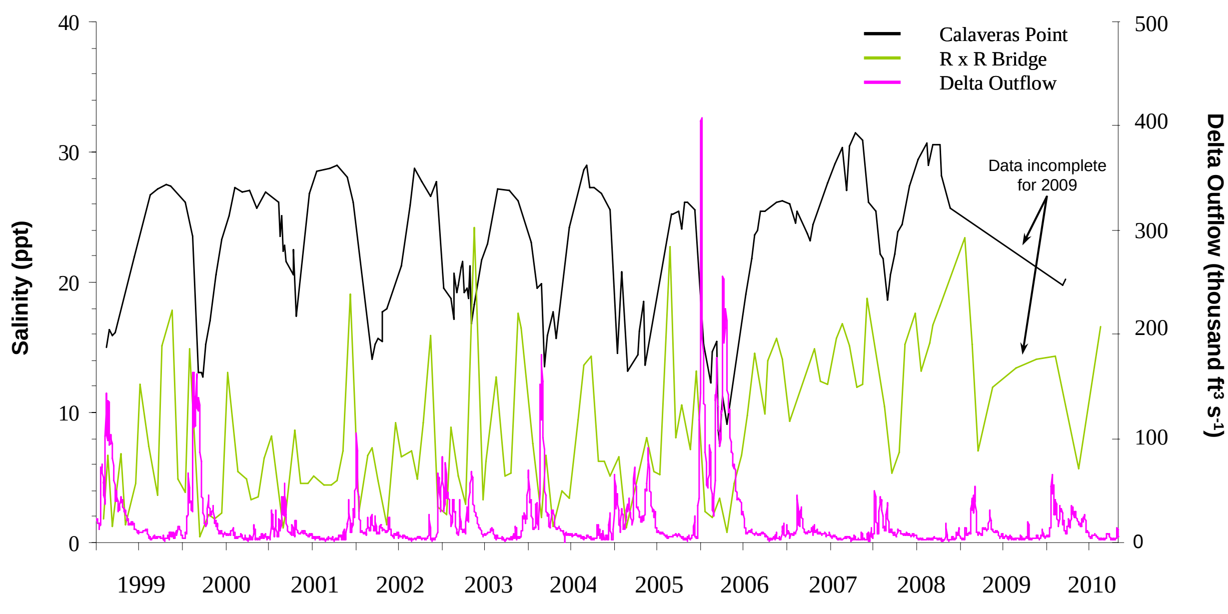


Figure 14. South San Francisco Bay Surface Water Salinities and Delta Outflows (City of San Jose, 2010).

pickleweed's competitive advantage during 2007 and facilitated its colonization of areas where alkali bulrush did not grow because pickleweed could better access porewater during periods of lower mean sea level (Kantrud 1996). Higher mean sea levels in 2009 and early in 2010 likely resulted in greater marsh inundation, ameliorating those plant stressors that contributed to the decline of alkali bulrush from 2006 to 2008. Such an effect may partially explain why alkali bulrush has re-colonized areas where it died back (or became dormant), as well as competitively displaced species like pickleweed and cordgrass in areas such as the Transition Reach and portions of the Reference Area. Greater inundation may also have contributed to the decreased prevalence of peppergrass and spearscale in 2010.

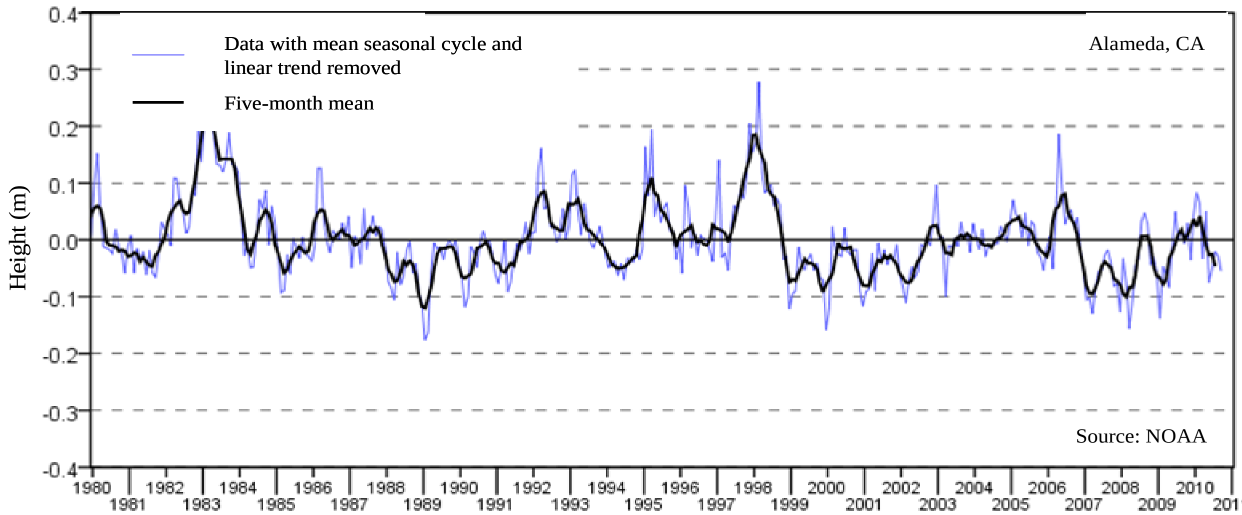
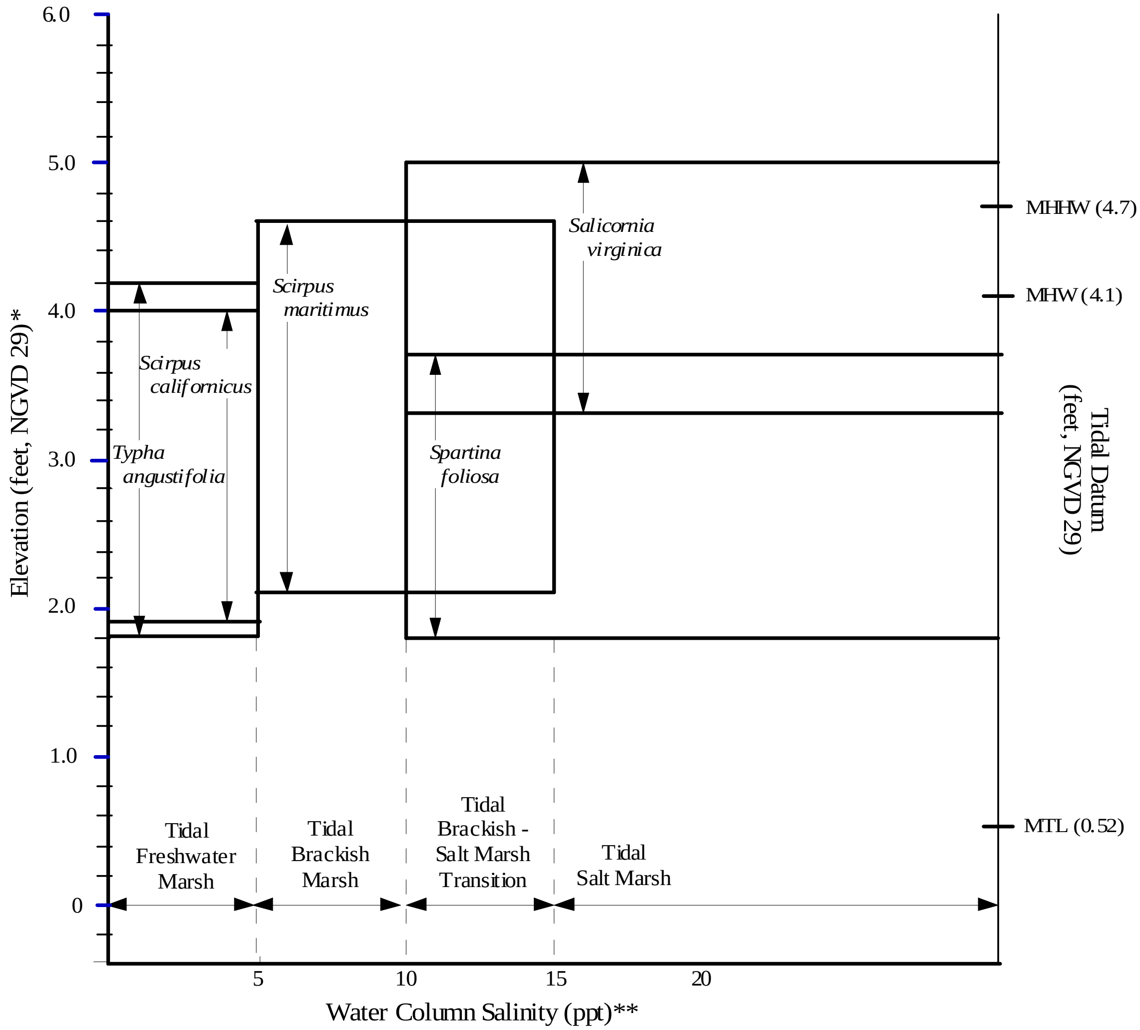


Figure 15. Interannual Variation of Mean Sea Level for Alameda, California: 1980–2010 (NOAA 2010).

Note: Figure 15 shows the monthly mean sea level with the average seasonal cycle and the linear trend removed (gray curve) and the 5-month average (black curve). Sea level was measured at Alameda and the graph is indicative of tidal trends in San Francisco Bay. However, it should be noted that the tidal amplitude in the South Bay is greater than the values reported above for Alameda. Source: NOAA 2010, (tidesandcurrents.noaa.gov/sltrends).

The range of elevations for marsh plant species with the corresponding predictions of water column salinity controls on tidal marsh species were projected for the Transition Reach as part of the Island Ponds restoration planning (H. T. Harvey & Associates 2005b). The mean elevation ranges of the dominant marsh plant species are sensitive to distinct variations in both salinity and position in the tidal profile. As shown in Figure 15, tidal salt marsh is projected to occur between 1.8 and 5.0 ft NGVD29 where water column salinity is greater than 15 ppt, while tidal brackish marsh is projected to occur from 2.1 and 4.6 ft NGVD29, where water column salinities are 5-10 ppt. (Figure 15). Based on these projections, tidal marsh habitats develop along salinity and elevation gradients with specific lower and upper mean elevations. With respect to overlapping salinity and elevation zones, changes in mean sea level such as those shown in Figure 15, have the potential to contribute to shifts in species composition.



* Shows means of elevation limits. Island Pond Report (2456-01) Appendix B contains complete data.
** Salinity data modeled (Gross, 2003). Elevation and habitat data is empirical.

Figure 16. Approximate Elevation and Water Column Salinity Range of Dominant Plant Species in Tidal Marsh Habitats Along Coyote Creek and Mud Slough (South Bay)

Tidal Prism

During the period of land subsidence in the South Bay (which ceased in the 1960s), the relative tidal height was increasing, which may have contributed to the more saline marshes observed prior to that time. The subsidence presumably helped to counterbalance the sedimentation in channels like Alviso Slough. When subsidence was controlled by increased water discharges, regulated pumping and artificial recharge, high sedimentation rates began to reduce the tidal signature, eventually leading to the expansion of South Bay wetlands and reduction of salinities in the upper reaches of the project area.

Recent sedimentation in the South Bay has resulted in expanding mudflats and narrower channels with steeper channel banks, providing area for wetland plant colonization. Habitat conversion within the Main Study Area (especially in the Upper and Transition Reaches) is related to this ongoing resizing of channels and resultant decrease in tidal signature observed in the South Bay.

Recent restoration in the South Bay at the Island Ponds, and other proposed South Bay Salt Pond Restoration Project Phase 1 actions, will increase the tidal signature in the Main Study and the Reference Areas.

South Bay Salt Pond (SBSP) Restoration Project

As part of the Initial Stewardship Plan for the SBSP Restoration Project, three former salt ponds (Island Ponds A19, A20, and A21) adjacent to Segments 14, 15 and 21 in the Main Study Area were breached in the Spring 2006 (Figure 1). Based on a study performed before the actual breaching of the Island Ponds (Gross 2003), restoration of these ponds would contribute approximately 1200 acre-ft of additional tidal prism at Mean Higher High Water. Given the central location of the Island Ponds within the Main Study Area, an increase in tidal prism of this magnitude would likely contribute to vegetation shifts unrelated to the WPCP discharges.

In 2008, increases in salt marsh species in the Transition Reach were postulated to be at least partially the result of the Island Pond restoration. This was based on Island Pond breach modeling that projected increased tidal flows in Coyote Creek and predicted that water column salinities would increase by 3-8 ppt (Gross 2003). However, the habitat shifts in 2010 suggest that changes in the tidal prism were not the primary drivers of the changes in 2007 and 2008.

Current research indicates that saline waters discharged from recently breached Pond A21 are retained along the northern portions of Coyote Creek near the Island Ponds, particularly on the ebb tide. The horizontal salinity stratification along this stretch of Coyote Creek confines the WPCP freshwater outfall flows along the southern bank (pers. comm. Stacey 2007). Although no difference was observed in 2007 or 2008, as brackish marsh converted to saline marsh in habitats bordering both the northern and southern shores of Coyote Creek, the conversion back to brackish marsh in 2010 does appear to be slightly skewed to the southern shore of Coyote Creek, which may be an effect of the horizontal zonation of salinity in this area. Restoration activities at Ponds A6 (breached in December 2010) and A8 (to be opened to muted tidal action in June 2011) are both expected to further increase the tidal prism and water column salinities.

CONCLUSIONS

The key findings for 2010 are listed as follows:

- The extent of salt marsh within the project area continues to increase, with the majority of these increases resulting from new marsh establishment in areas of sediment deposition;
- The primary trend in 2010 was a net increase in brackish marsh habitat and a net decrease in salt and freshwater marsh habitats compared to 2008;
- The long-term trend for the project area (1989-2010) is significant increases in salt marsh area, decreases in brackish marsh and approximately no change in freshwater marsh area;
- Changes in the plant composition of South Bay marshes are driven by numerous local and regional-scale factors, primarily precipitation, surface and interstitial salinities, relative sea level and species-level salinity tolerances.
- The dynamic shifts in vegetation both in the recent past (2006-2010) and over the long term (1989-2010) do not appear to be related to the WPCP discharge, which has been relatively constant over this time.

Despite increases in brackish marsh between 2008 and 2010, the overall trend in the Main Study Area is that new salt marsh is forming and other marsh types have converted to salt marsh. The most significant conversions occurred between 2006 and 2008 (Figures B-1, B-2, and B-3). This conversion represents the largest such shift observed since the study began in 1989, and emphasizes the dynamic nature of these marshes.

Salt marsh conversion has historically been driven by large-scale influences (both natural and anthropogenic). These include local and regional freshwater inputs, historic landscape-scale changes such as salt pond construction (SFEI 1999), and subsequent changes in channel morphology. Interannual differences in rainfall and mean sea level, as well as changes in relative tidal signature and fluctuating salinities in the Coyote Creek system since the late 1960s, have also contributed to marsh conversion in the South Bay. Although the average local freshwater inflows in the South Bay and from the Delta have fluctuated between years, the WPCP flows have remained relatively constant (~169 cfs ±30%) since this study started in 1989.

Vegetation shifted from alkali bulrush to pickleweed throughout the Main Study Area and in the Reference Area in 2007 and 2008; these shifts appear to be related to a combination of factors favoring more salt-tolerant species. The lack of late season rainfall in 2007, combined with increased surface water salinities, lower mean sea level and the localized effect of the Island Ponds restoration, all influenced marsh vegetation distribution between 2006 and 2008. The shifts from pickleweed to alkali bulrush in 2010 are likely the result of normal to slightly above normal winter/spring rainfall, decreased surface water salinities and higher mean sea level.

Saline marsh species were dominant over brackish marsh species in 2007, 2008 and 2010 in the Transition Reach of the Main Study Area; other years that this occurred were 1989, 1991 and 2002 (Figure 9). In 2002, similar to 2007 and 2008, there was a combination of low mean sea level (Figure 15) and elevated salinities at Calaveras Point, with monthly mean salinities in the 20-30 ppt range for the first four months of each year. Lower mean sea level and higher ambient salinities likely contributed to saline species dominance in 2007 and 2008; the freshening of the estuary from increased freshwater inputs and increased mean sea level within San Francisco Bay likely contributed to the increase in brackish marsh plant associations observed in 2010. In 2008, we suggested that a return to normal rainfall patterns and amounts, freshwater inputs and ambient San Francisco Bay salinities typical of pre-2006 levels could result in a shift back to alkali bulrush dominated habitat, particularly if rainfall were to exceed long-term averages (H. T. Harvey & Associates 2008). By all indications, and using the conversion of vegetation as the prime indicator of change, this appears to be what transpired in 2010.

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APPENDIX A.
2010 VEGETATION MAPS

2010 MARSH PLANT ASSOCIATIONS OF SOUTH SAN FRANCISCO BAY

LOWER REACH DOMINANT SPECIES

SEGMENTS 1, 2, 3, 4, 8, 22 and 23

- Alkali Bulrush
- Alkali Heath
- Cordgrass
- Gumplant
- Jaumea
- Peppergrass
- Peripheral Halophytes
- Pickleweed
- Saltgrass
- Spearscale
- Upland Species
- Dead Vegetation
- Water / Mud Flat
- Levee

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2010 South Bay Marsh Studies Dominant Plant Species by Reach

Proj No. 477-29	Date Jan. 2011	Figure A-1
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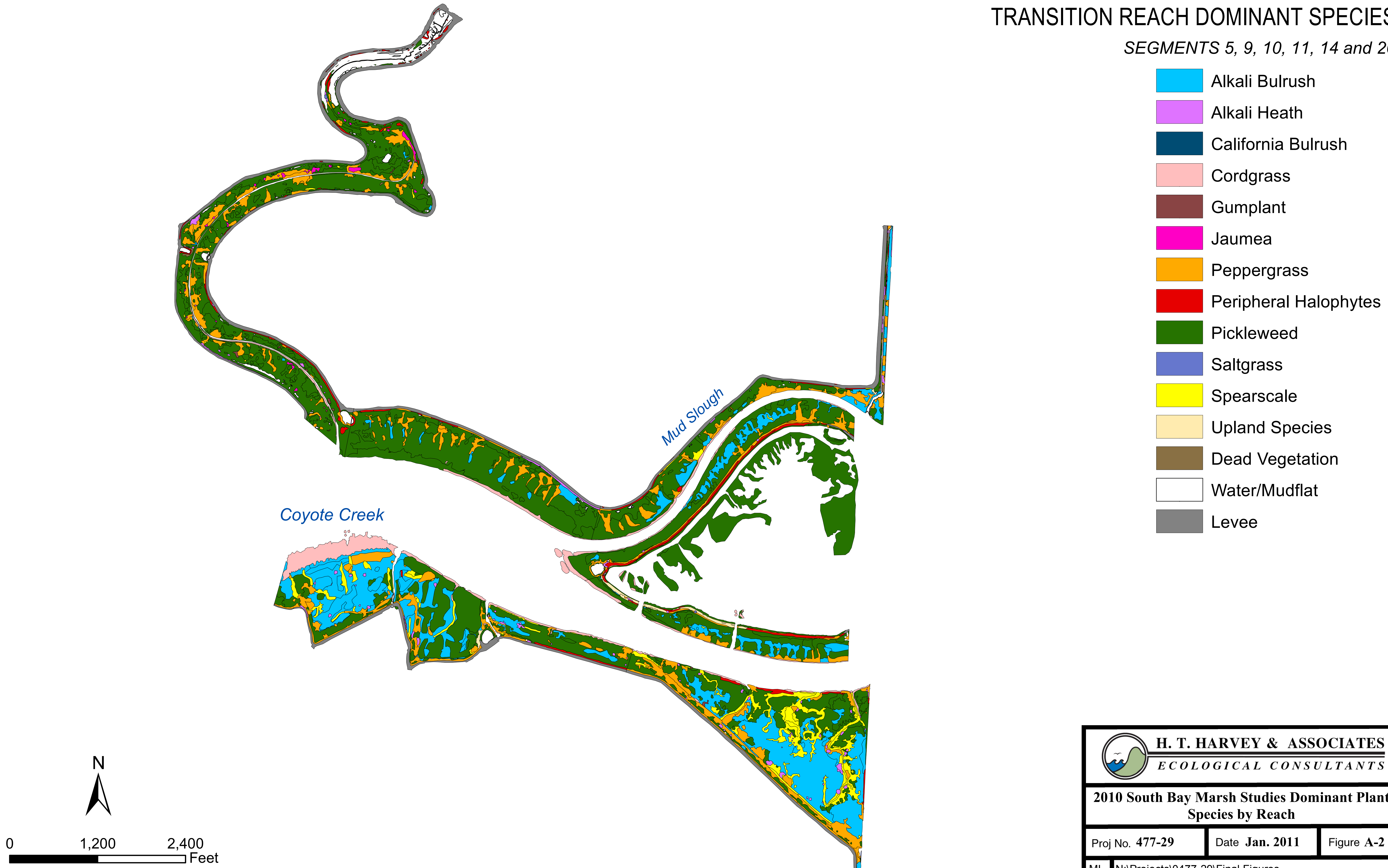
2010 MARSH PLANT ASSOCIATIONS OF SOUTH SAN FRANCISCO BAY

TRANSITION REACH DOMINANT SPECIES

SEGMENTS 5, 9, 10, 11, 14 and 20



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2010 South Bay Marsh Studies Dominant Plant Species by Reach

Proj No. 477-29	Date Jan. 2011	Figure A-2
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2010 MARSH PLANT ASSOCIATIONS OF SOUTH SAN FRANCISCO BAY

UPPER REACH DOMINANT SPECIES

SEGMENTS 12, 13, 15, 16, 17, 18, 19, 21, 24, 25 and 26

- Alkali Bulrush
- Alkali Heath
- Arundo
- California Bulrush
- Cattail
- Cordgrass
- Grass-leaved Goldenrod
- Gumplant
- Jaumea
- Peppergrass
- Peripheral Halophytes
- Pickleweed
- Saltgrass
- Spearscale
- Water Primrose
- Upland Species
- Dead Vegetation
- Water
- Levee

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2010 South Bay Marsh Studies Dominant Plant Species by Reach

Proj No. 477-29	Date Jan. 2011	Figure A-3
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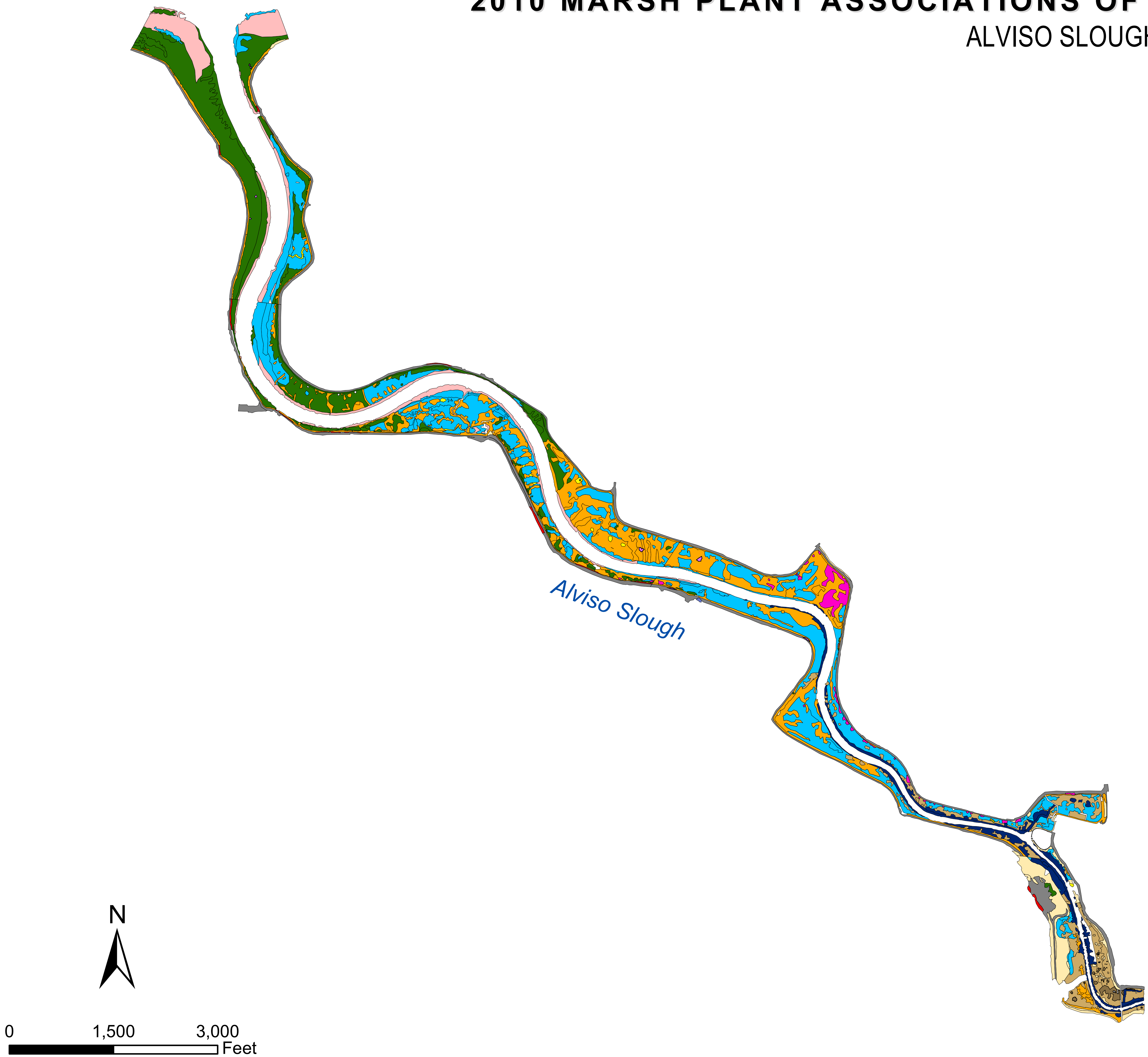
2010 MARSH PLANT ASSOCIATIONS OF SOUTH SAN FRANCISCO BAY

ALVISO SLOUGH (REFERENCE AREA) DOMINANT SPECIES

SEGMENTS 27, 28, 29 and 30



- Alkali Bulrush
- Alkali Heath
- Arundo
- California Bulrush
- Cattail
- Cordgrass
- Grass-leaved Goldenrod
- Gumplant
- Jaumea
- Peppergrass
- Peripheral Halophytes
- Pickleweed
- Saltgrass
- Spearscale
- Upland Species
- Dead Vegetation
- Water
- Levee

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2010 South Bay Marsh Studies Dominant Plant Species by Reach

Proj No. 477-29	Date Jan. 2011	Figure A-4
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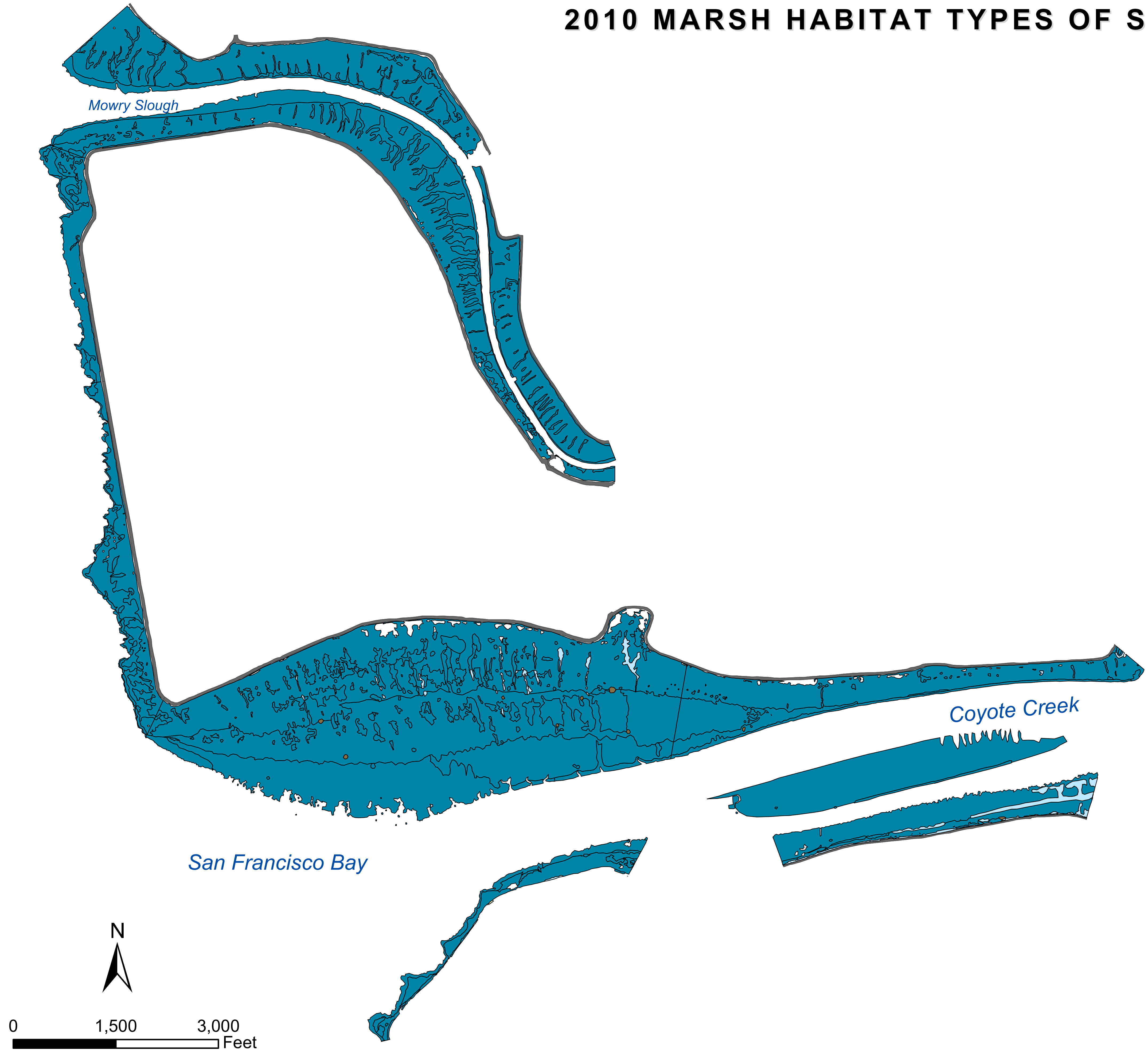
2010 MARSH HABITAT TYPES OF SOUTH SAN FRANCISCO BAY

LOWER REACH HABITATS

SEGMENTS 1, 2, 3, 4, 8, 22 and 23



Brackish
Saline

Levee
Upland Species
Dead Vegetation
Water

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2010 South Bay Marsh Studies Marsh Habitat Types by Reach

Proj No. 477-29	Date Jan. 2011	Figure A-5

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2010 MARSH HABITAT TYPES OF SOUTH SAN FRANCISCO BAY

TRANSITION REACH HABITATS

SEGMENTS 5, 9, 10, 11, 14 and 20

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2010 South Bay Marsh Studies Marsh Habitat Types by Reach

Proj No. 477-29	Date Jan. 2011	Figure A-6
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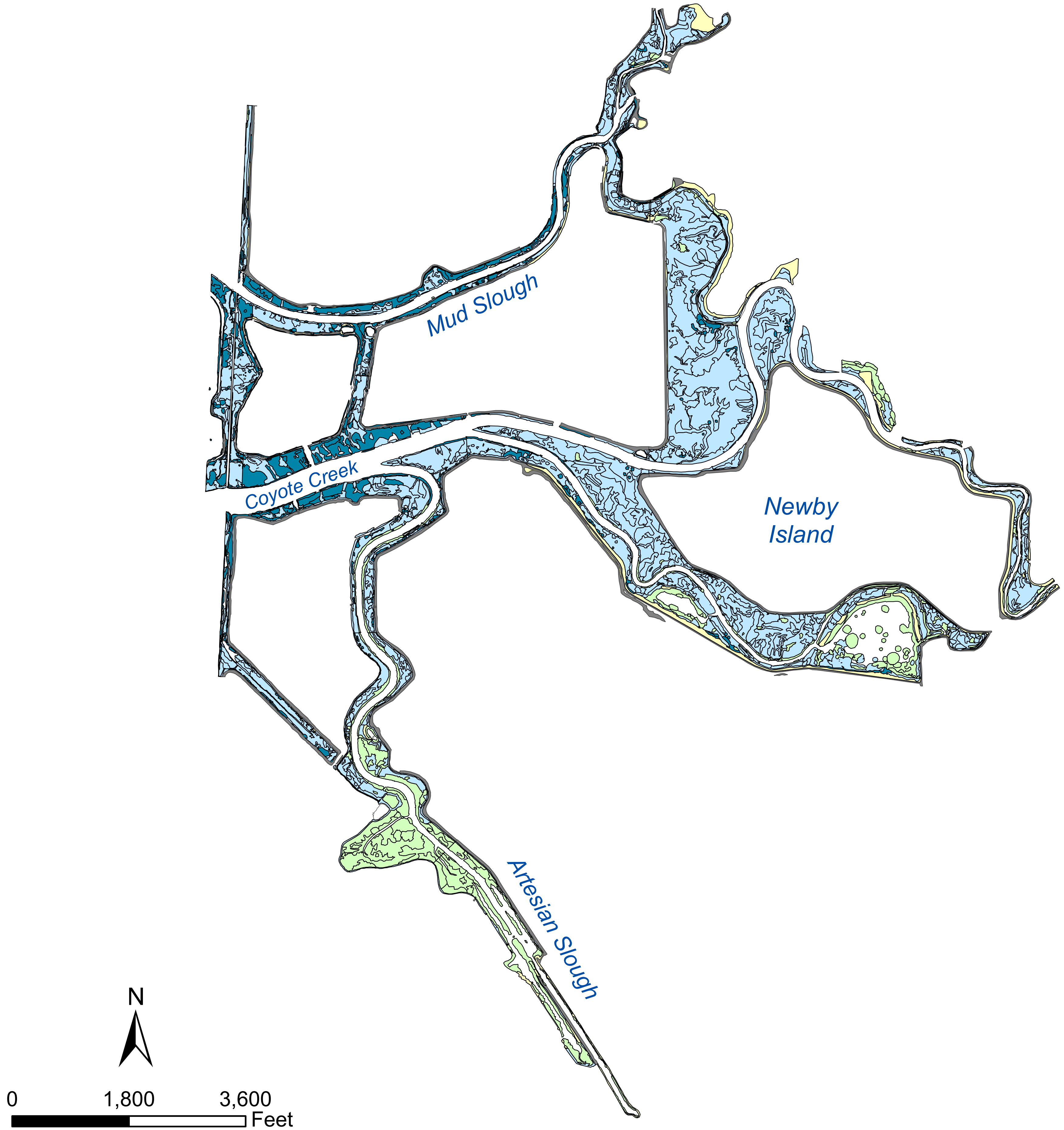
2010 MARSH HABITAT TYPES OF SOUTH SAN FRANCISCO BAY

UPPER REACH HABITATS

SEGMENTS 12, 13, 15, 16, 17, 18, 19, 21, 24, 25 and 26



Fresh
Brackish
Saline
Levee
Upland Species
Dead Vegetation
Water

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2010 South Bay Marsh Studies Marsh Habitat Types by Reach

Proj No. 477-29	Date Jan. 2011	Figure A-7
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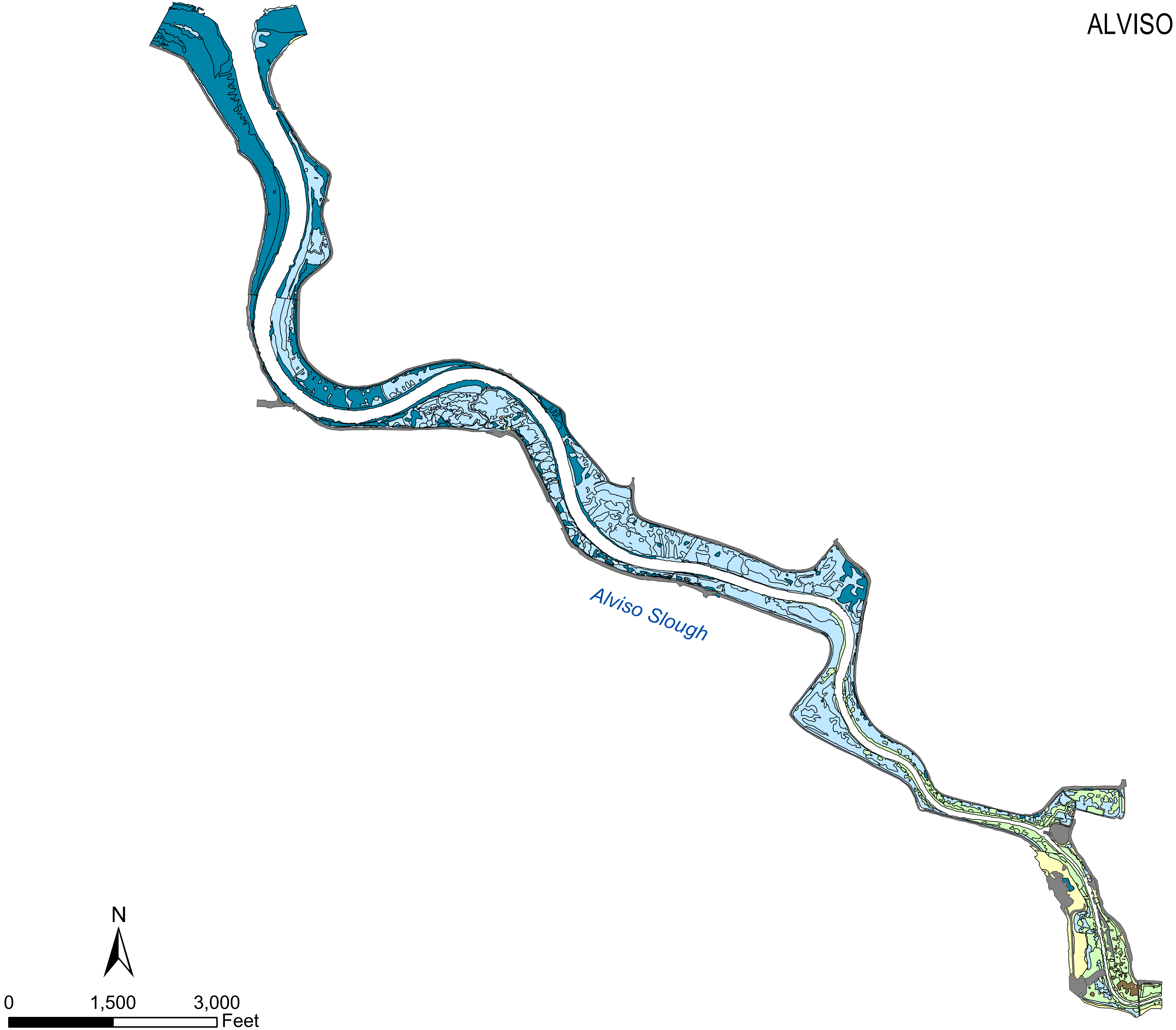
2010 MARSH HABITAT TYPES OF SOUTH SAN FRANCISCO BAY

ALVISO SLOUGH (REFERENCE AREA) HABITATS

SEGMENTS 27, 28, 29 and 30



Fresh
Brackish
Saline

Levee
Upland Species
Dead Vegetation
Water

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2010 South Bay Marsh Studies Marsh Habitat Types by Reach

Proj No. **477-29**	Date **Jan. 2011**	Figure **A-8**
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APPENDIX B.
1989/2010 SPATIAL ANALYSIS MAPS

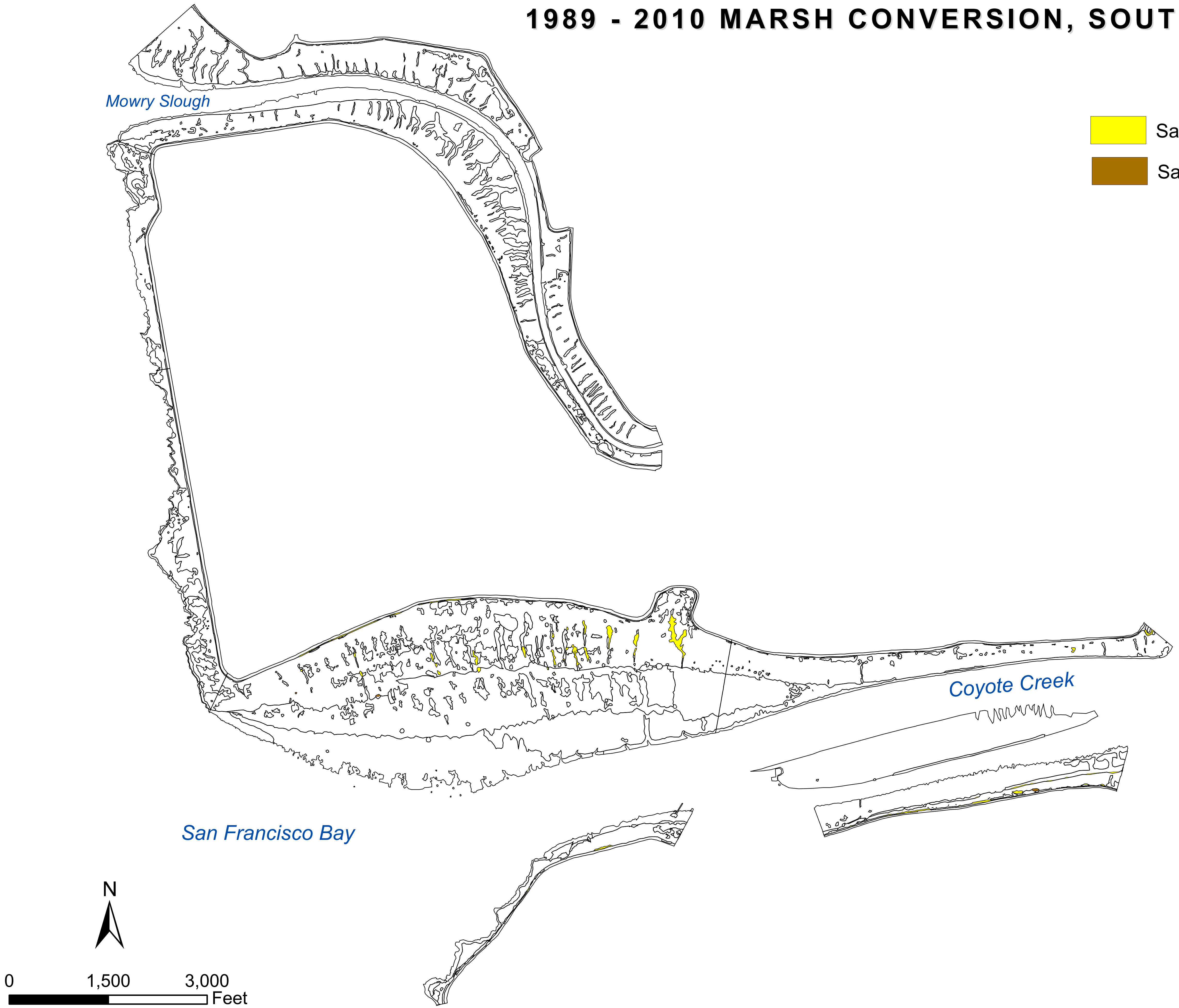
1989 - 2010 MARSH CONVERSION, SOUTH SAN FRANCISCO BAY

LOWER REACH HABITATS

SEGMENTS 1, 2, 3, 4, 8, 22 and 23

Saline Marsh Converted to Brackish Marsh

Saline Marsh Converted to Dead Vegetation



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1989 - 2010 Marsh Conversion by Reach

Proj No. 477-29	Date Jan. 2011	Figure B-1

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1989 - 2010 MARSH CONVERSION, SOUTH SAN FRANCISCO BAY

TRANSITION REACH HABITATS

SEGMENTS 5, 9, 10, 11, 14 and 20

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1989 - 2010 Marsh Conversion by Reach

Proj No. 477-29	Date Jan. 2011	Figure B-2
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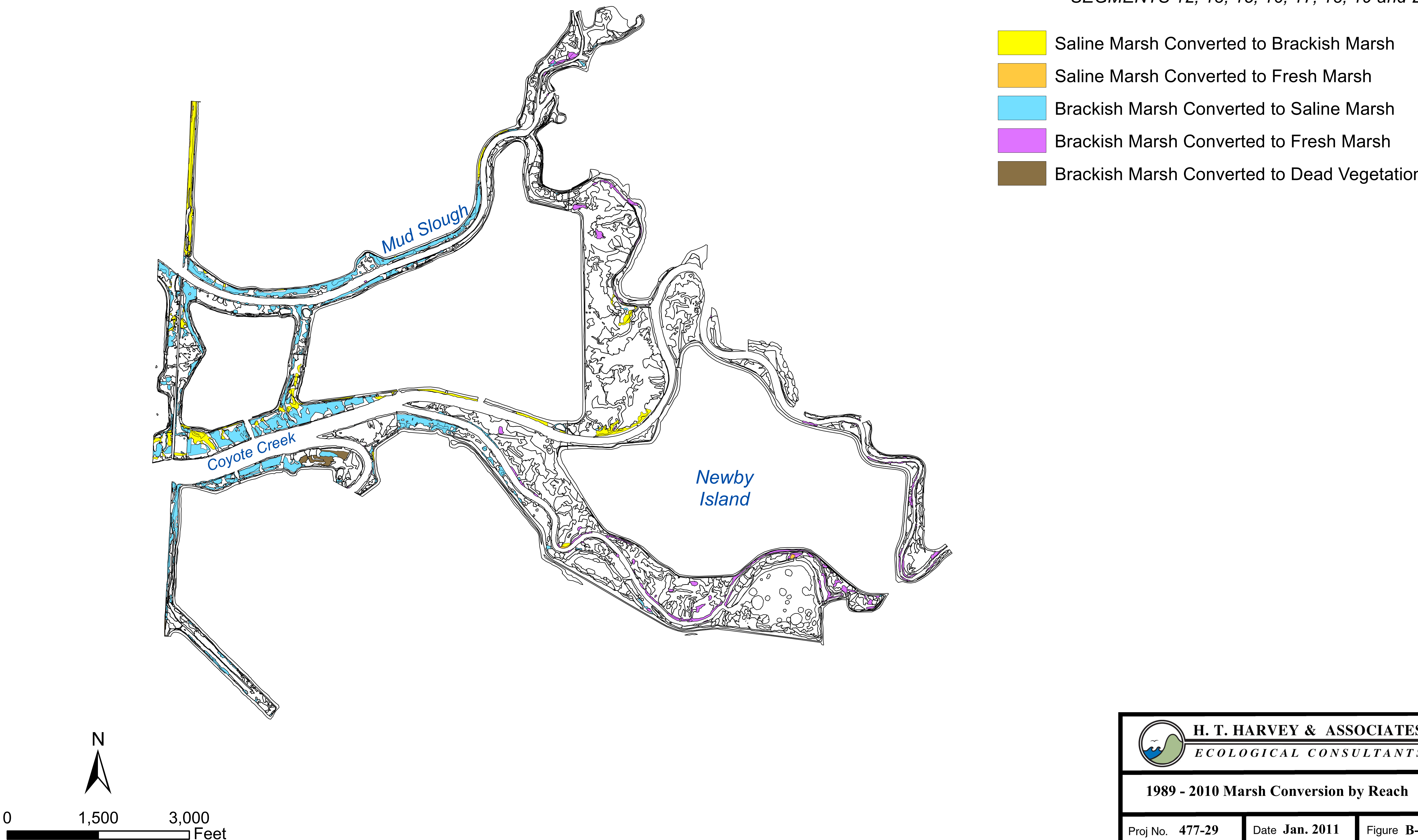
1989 - 2010 MARSH CONVERSION, SOUTH SAN FRANCISCO BAY

UPPER REACH HABITATS

SEGMENTS 12, 13, 15, 16, 17, 18, 19 and 21



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1989 - 2010 Marsh Conversion by Reach

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1989 - 2010 MARSH CONVERSION, SOUTH SAN FRANCISCO BAY

ALVISO SLOUGH (REFERENCE AREA) HABITATS

SEGMENTS 28, 29 and 30

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1989 - 2010 Marsh Conversion by Reach

Proj No. 477-29	Date Jan. 2011	Figure B-4

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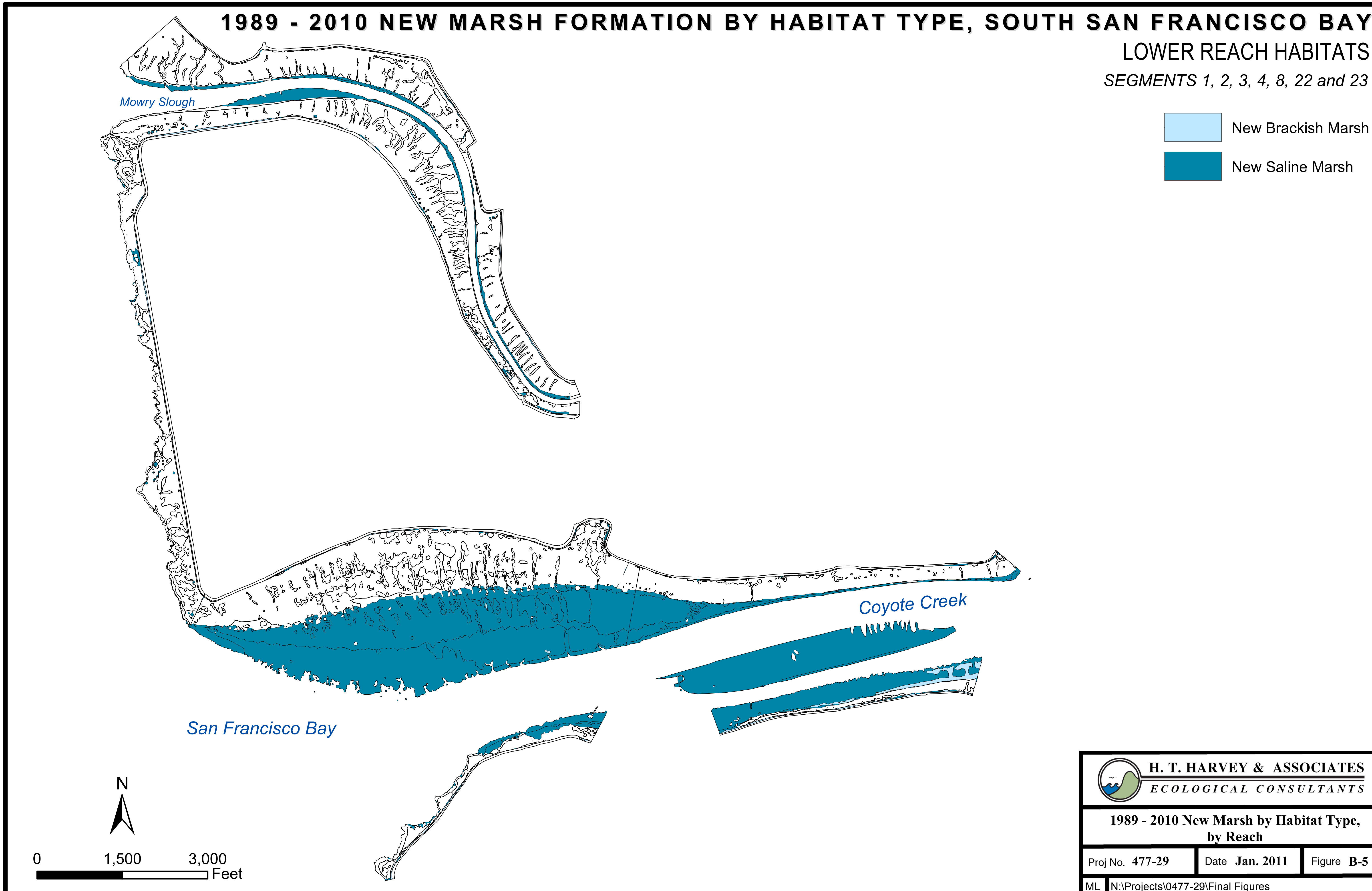
1989 - 2010 NEW MARSH FORMATION BY HABITAT TYPE, SOUTH SAN FRANCISCO BAY
LOWER REACH HABITATS
SEGMENTS 1, 2, 3, 4, 8, 22 and 23
New Brackish Marsh
New Saline Marsh
Mowry Slough
Coyote Creek
San Francisco Bay
N
0
1,500
3,000
Feet
H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS
1989 - 2010 New Marsh by Habitat Type, by Reach
Proj No. 477-29
Date Jan. 2011
Figure B-5
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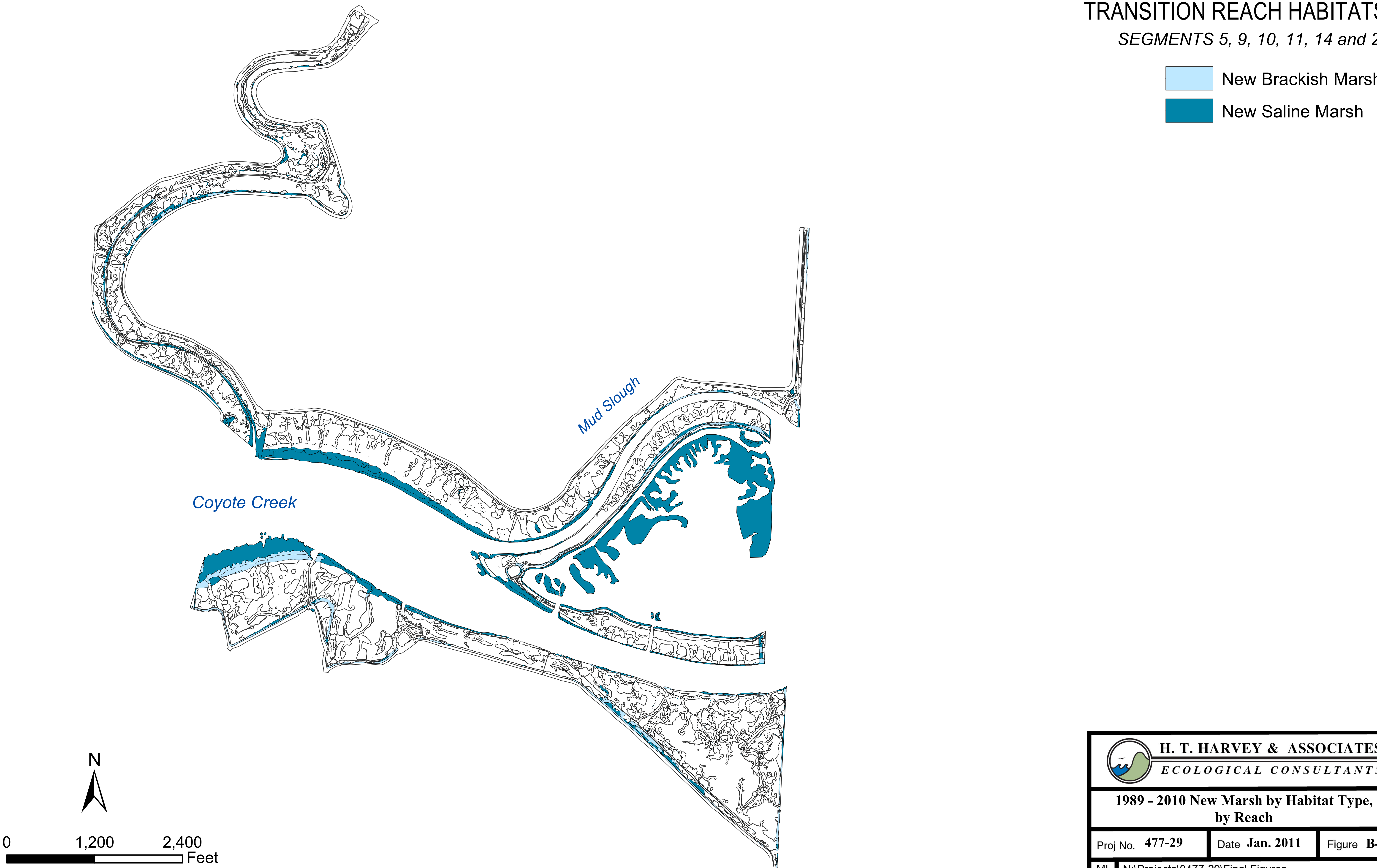
1989 - 2010 NEW MARSH FORMATION BY HABITAT TYPE, SOUTH SAN FRANCISCO BAY

TRANSITION REACH HABITATS

SEGMENTS 5, 9, 10, 11, 14 and 20



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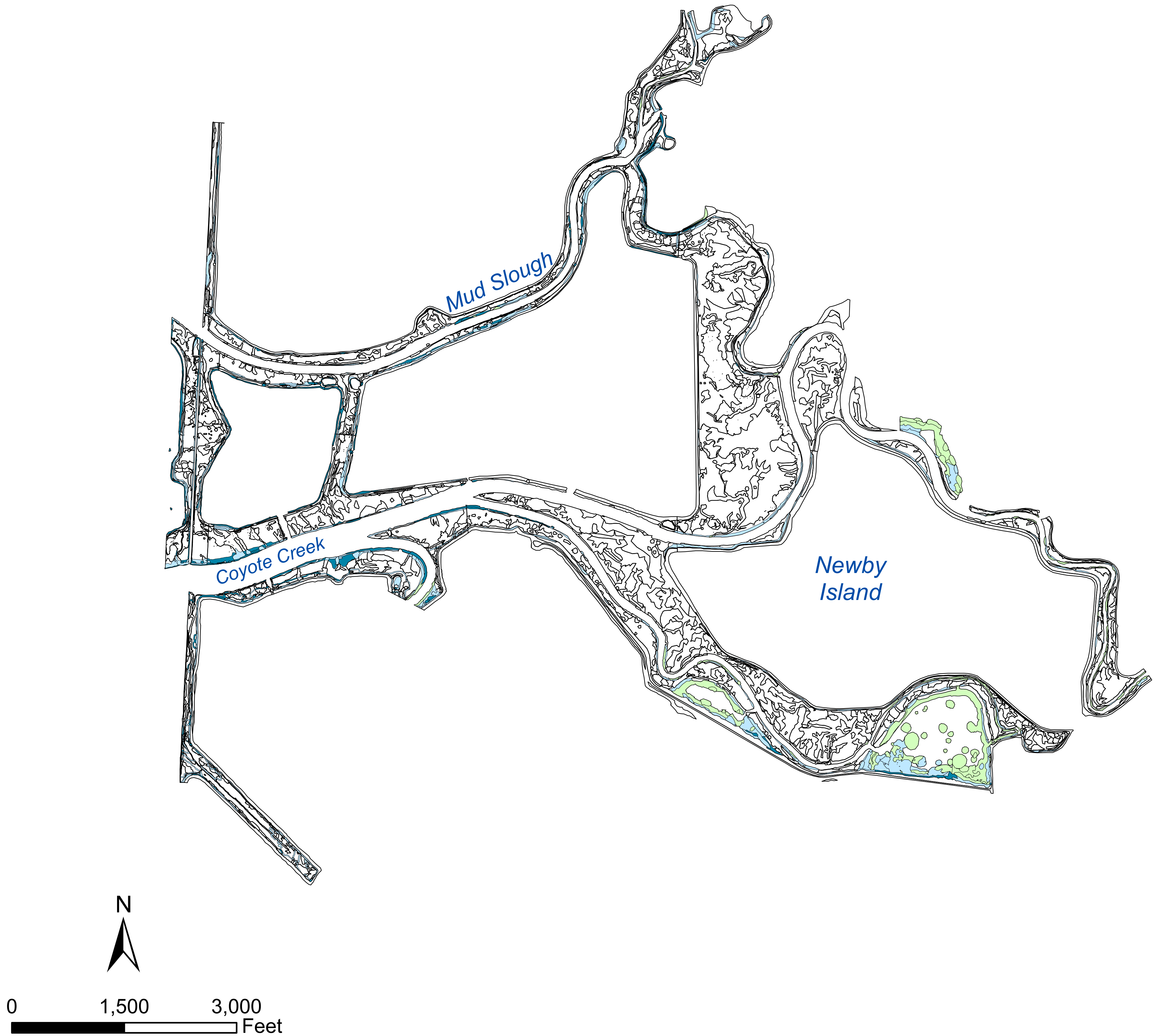
1989 - 2010 New Marsh by Habitat Type, by Reach

Proj No. 477-29	Date Jan. 2011	Figure B-6
ML	N:\Projects\0477-29\Final Figures	

1989 - 2010 NEW MARSH FORMATION BY HABITAT TYPE, SOUTH SAN FRANCISCO BAY

UPPER REACH HABITATS

SEGMENTS 12, 13, 15, 16, 17, 18, 19 and 21



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1989 - 2010 New Marsh by Habitat Type, by Reach

Proj No. 477-29	Date Jan. 2011	Figure B-7
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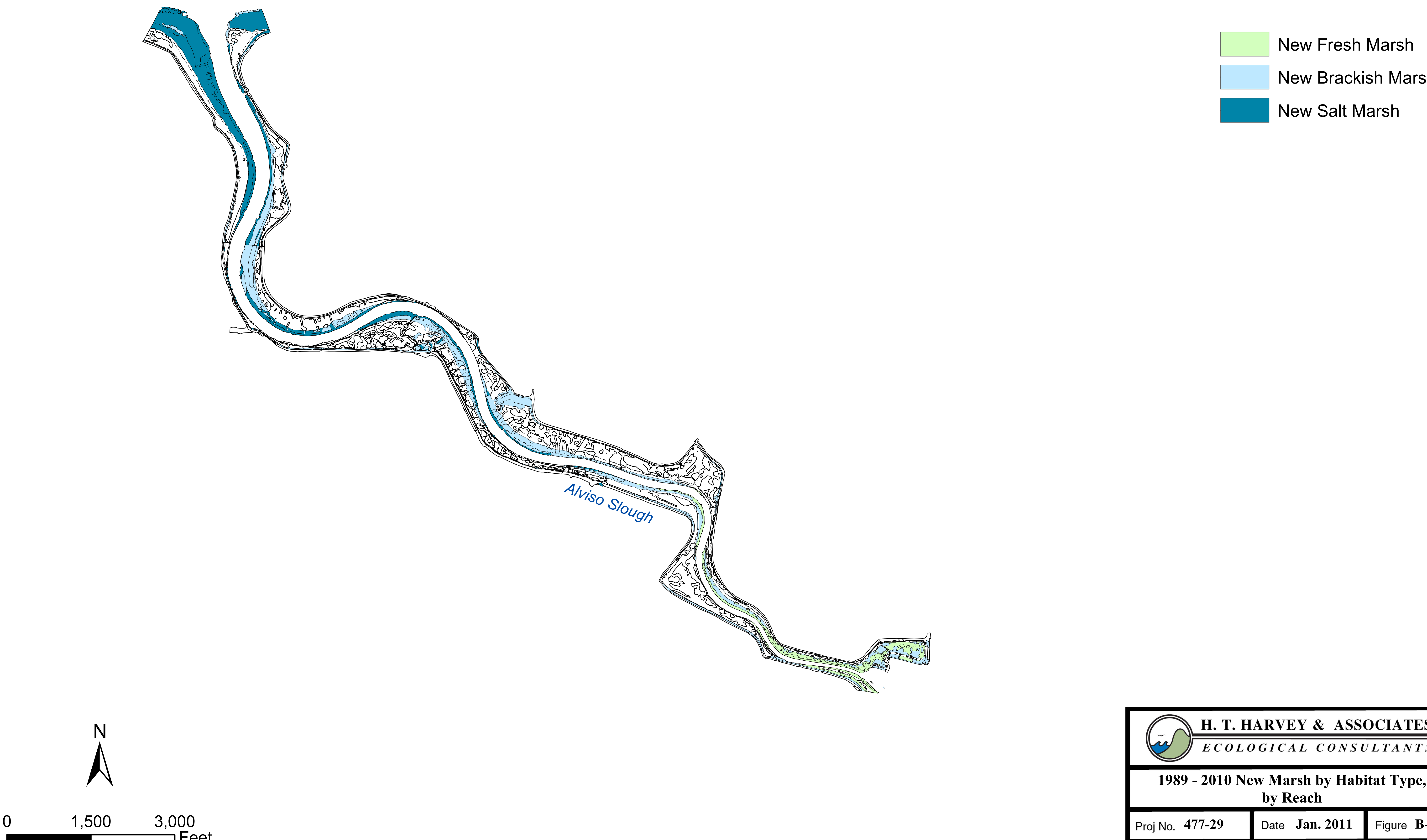
1989 - 2010 NEW MARSH FORMATION BY HABITAT TYPE, SOUTH SAN FRANCISCO BAY

ALVISO SLOUGH (REFERENCE AREA) HABITATS

SEGMENTS 28, 29 and 30



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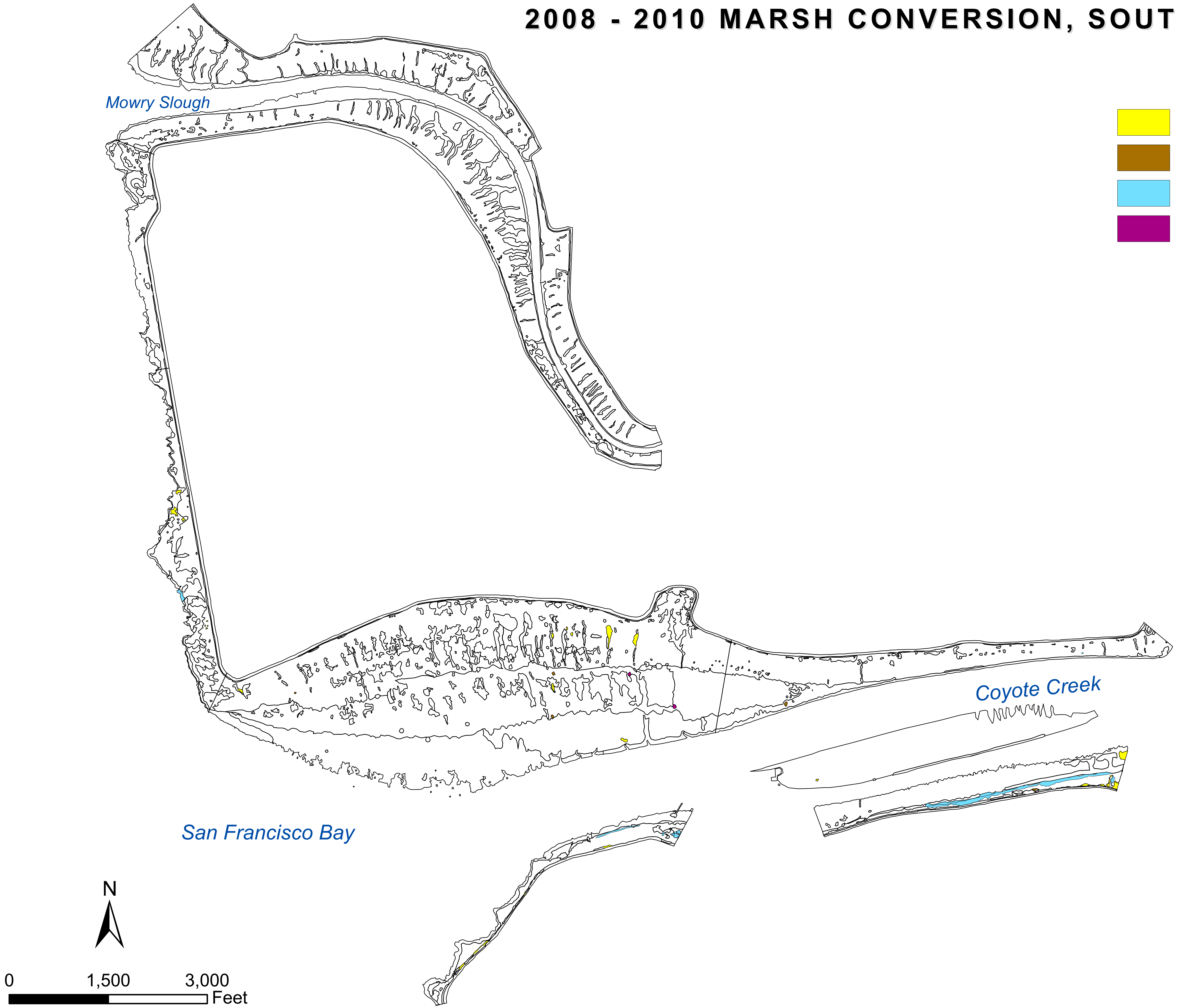
1989 - 2010 New Marsh by Habitat Type, by Reach

Proj No. 477-29	Date Jan. 2011	Figure B-8
ML	N:\Projects\0477-29\Final Figures	

2008 - 2010 MARSH CONVERSION, SOUTH SAN FRANCISCO BAY

LOWER REACH HABITATS

SEGMENTS 1, 2, 3, 4, 8, 22 and 23



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2008 - 2010 Marsh Conversion by Reach

Proj No. **477-29**	Date **Jan. 2011**	Figure **B-9**
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2008 - 2010 MARSH CONVERSION, SOUTH SAN FRANCISCO BAY

TRANSITION REACH HABITATS

SEGMENTS 5, 9, 10, 11, 14 and 20

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2008 - 2010 Marsh Conversion by Reach

Proj No. 477-29	Date Jan. 2011	Figure B-10

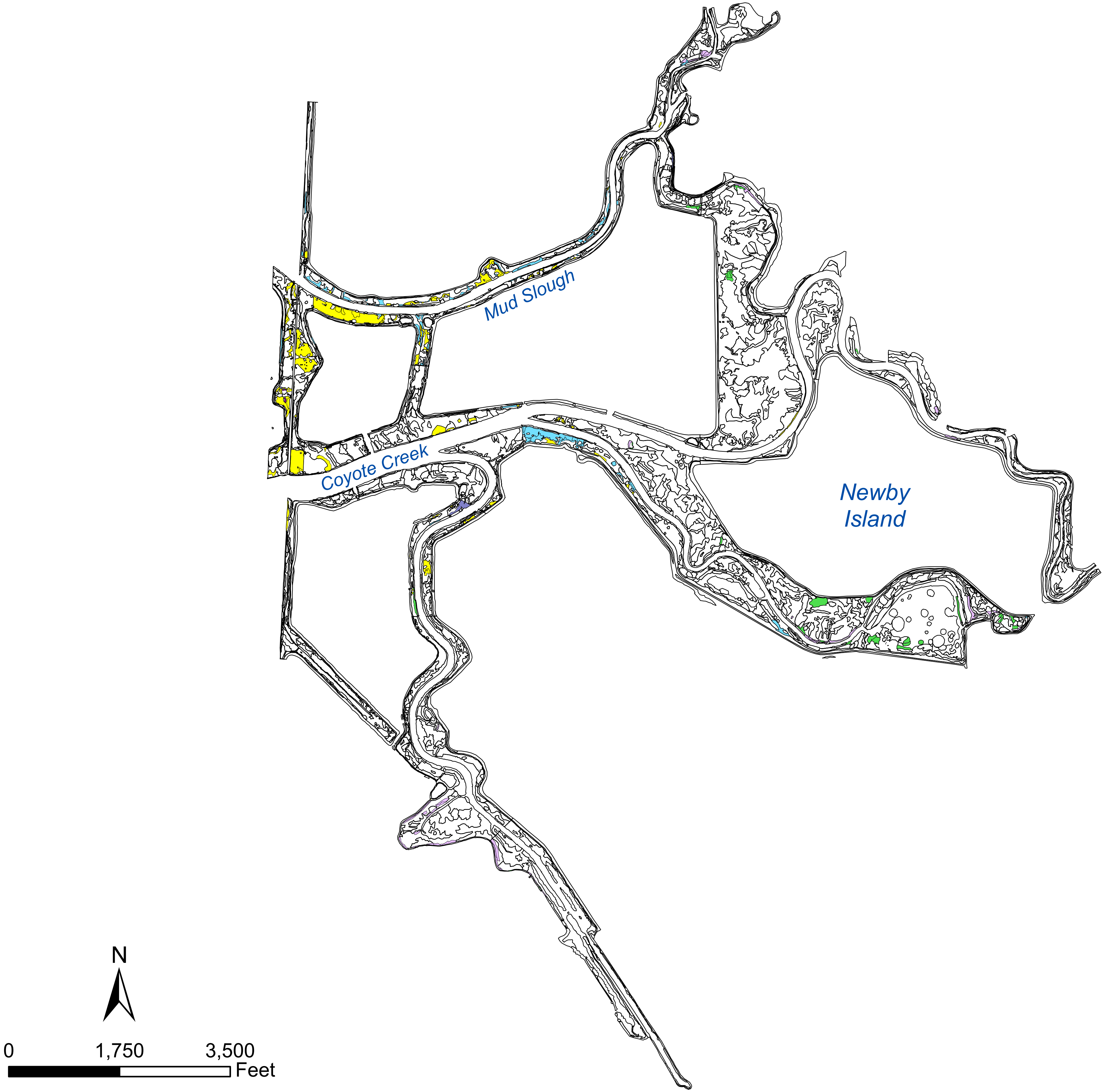
ML N:\Projects\0477-29\Final Figures

2008 - 2010 MARSH CONVERSION, SOUTH SAN FRANCISCO BAY

UPPER REACH HABITATS

SEGMENTS 12, 13, 15, 16, 17, 18, 19, 24, 25 and 26

- Saline Marsh Converted to Brackish Marsh
- Brackish Marsh Converted to Saline Marsh
- Brackish Marsh Converted to Fresh Marsh
- Fresh Marsh Converted to Brackish Marsh
- Dead Marsh Converted to Brackish Marsh
- Dead Marsh Converted to Saline Marsh



H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

2008 - 2010 Marsh Conversion by Reach

Proj No. **477-29**	Date **Jan. 2011**	Figure **B-11**
ML	N:\Projects\0477-29\Final Figures	

2008 - 2010 MARSH CONVERSION, SOUTH SAN FRANCISCO BAY

ALVISO SLOUGH (REFERENCE AREA) HABITATS

SEGMENTS 27, 28, 29 and 30

- Saline Marsh Converted to Brackish Marsh
- Brackish Marsh Converted to Saline Marsh
- Brackish Marsh Converted to Fresh Marsh
- Brackish Marsh Converted to Dead Marsh
- Fresh Marsh Converted to Brackish Marsh
- Fresh Marsh Converted to Saline Marsh
- Fresh Marsh Converted to Dead Marsh
- Dead Marsh Converted to Brackish Marsh
- Dead Marsh Converted to Fresh Marsh

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2008 - 2010 Marsh Conversion by Reach

Proj No. 477-29	Date Jan. 2011	Figure B-12

ML N:\Projects\0477-29\Final Figures

APPENDIX C.
VEGETATION MATRICES

Table C1. Acreage Summary of Segment 1 for 1989, 1994/1995, 1996-2008 and 2010.

DOMINANT SPECIES CATEGORY

	Year															
Saline Marsh Vegetation	1989	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	13.3	19.2	27.2	18.6	12.2	12.6	16.3	18.7	24.2	23.1	22.9	22.5	22.6	21.9	19.9	20.1
Cordgrass	9.0	1.4	3.4	2.8	9.7	1.94	0.9	1.5	0.5	0.6	0.6	0.6	0.8	0.8	0.8	2.1
Pickleweed-Cordgrass Mix	14.1	0.0	0.0	1.3	0.8	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pickleweed-Spearscale Mix	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkali Heath	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.3	0.3	0.3	0.7	0.7
Gumplant	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.4	0.5	0.2	0.2
Saltgrass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0
Peripheral Halophytes	1.0	1.5	1.7	0.0	1.4	1.43	1.2	4.4	0.3	0.5	0.5	0.5	0.5	0.6	0.7	0.7
Total Saline Dominant Species:	**37.4**	**22.1**	**32.3**	**22.7**	**24.3**	**16.8**	**18.5**	**24.8**	**25.2**	**24.4**	**24.5**	**24.2**	**24.6**	**24.1**	**23.7**	**23.8**
Brackish Marsh Vegetation																
Alkali Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Peppergrass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spearscale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.3	0.3	0.0	0.0
Total Brackish Dominant Species:	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.2**	**0.2**	**0.3**	**0.3**	**0.0**	**0.0**
Freshwater Marsh Vegetation																
California Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cattail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total Segment Acreage	**37.4**	**22.1**	**32.3**	**23.3**	**26.5**	**27.1**	**24.4**	**24.8**	**25.2**	**24.4**	**24.7**	**24.4**	**24.9**	**24.4**	**23.7**	**23.8**

Table C2. Acreage Summary of Segment 2 for 1989, 1994/1995, 1996-2008 and 2010.

DOMINANT SPECIES CATEGORY

	Year															
Saline Marsh Vegetation	1989	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	26.1	35.5	32.9	32.4	19.0	36.2	36.4	32.5	39.3	37.7	38.0	37.9	35.7	35.6	35.4	35.3
Cordgrass	13.7	2.3	2.6	3.8	10.5	3.1	1.5	3.1	0.4	0.6	0.5	0.5	2.8	1.7	1.8	1.8
Pickleweed-Cordgrass Mix	0.0	0.0	0.0	1.8	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkali Heath	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.4	0.3	0.4	0.4	0.4	1.0	1.1
Gumplant	0.0	0.0	0.0	0.2	0.2	1.4	1.0	1.6	1.3	1.2	1.4	1.4	1.4	1.1	0.4	0.5
Saltgrass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Peripheral Halophytes	3.9	2.3	1.6	0.7	3.0	2.2	2.0	5.0	0.6	0.8	1.0	1.0	1.0	1.0	1.0	1.0
Total Saline Dominant Species:	**43.7**	**40.1**	**37.1**	**38.9**	**32.7**	**42.9**	**41.6**	**42.1**	**41.8**	**41.7**	**41.2**	**41.2**	**41.3**	**39.8**	**39.7**	**39.8**
Brackish Marsh Vegetation																
Alkali Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Peppergrass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spearscale	0.0	0.0	0.0	0.4	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Brackish Dominant Species:	**0.0**	**0.0**	**0.0**	**0.4**	**7.5**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Freshwater Marsh Vegetation																
California Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cattail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total Segment Acreage	**43.7**	**40.1**	**37.1**	**39.8**	**41.2**	**42.9**	**41.7**	**42.1**	**41.8**	**41.7**	**41.2**	**41.2**	**41.3**	**39.8**	**39.7**	**39.8**

Table C3. Acreage Summary of Segment 3 for 1989, 1994/1995, 1996-2008 and 2010.

DOMINANT SPECIES CATEGORY

	Year															
Saline Marsh Vegetation	1989	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	160.1	114.7	79.3	95.1	98.7	118.3	187.4	163.7	149.7	179.3	210.6	212.8	188.5	217.2	210.4	294.5
Cordgrass	0.6	3.4	2.9	86.6	104.6	15.9	46.3	70.6	42.1	57.8	37.0	45.5	45.7	47.7	56.9	61.6
Pickleweed-Cordgrass Mix	0.0	69.9	98.8	36.0	0.0	83.3	0.0	0.0	102.1	66.8	67.4	67.4	87.7	84.0	84.1	0.0
Pickleweed-Spearscale Mix	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkali Heath	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.1	0.2
Jaumea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Gumplant	0.0	0.0	2.7	6.9	2.2	7.4	6.6	7.6	4.6	4.8	6.0	6.0	4.7	4.8	4.2	4.2
Peripheral Halophytes	0.4	2.6	1.1	1.0	2.2	1.0	1.3	0.7	0.7	1.2	0.8	0.8	0.8	0.8	0.8	0.8
Dead Vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
Total Saline Dominant Species:	**161.1**	**190.6**	**184.8**	**225.6**	**207.9**	**225.9**	**241.5**	**242.6**	**299.4**	**310.0**	**321.9**	**332.6**	**327.5**	**354.6**	**357.1**	**361.4**
Brackish Marsh Vegetation																
Alkali Bulrush	0.0	0.0	0.1	0.0	49.2	50.8	39.9	44.2	13.2	17.6	19.0	19.0	25.8	0.2	0.2	0.2
Peppergrass	0.0	1.1	1.2	1.6	1.8	1.8	1.5	2.6	1.8	2.4	3.7	3.7	3.0	3.0	3.0	3.1
Spearscale	0.0	0.0	0.0	0.2	2.4	0.0	0.0	0.0	0.0	0.0	0.9	0.9	0.9	0.9	0.6	0.6
Total Brackish Dominant Species:	**0.0**	**1.1**	**1.3**	**1.8**	**53.4**	**52.6**	**41.4**	**46.7**	**15.0**	**20.0**	**23.6**	**23.6**	**29.7**	**4.1**	**3.8**	**3.9**
Freshwater Marsh Vegetation																
California Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cattail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total Segment Acreage	**161.1**	**191.7**	**212.3**	**227.6**	**262.1**	**278.5**	**282.9**	**289.4**	**314.4**	**330.0**	**345.5**	**356.2**	**357.2**	**358.7**	**360.9**	**365.3**

Table C4. Acreage Summary of Segment 4 for 1989, 1994/1995, 1996-2008 and 2010.

DOMINANT SPECIES CATEGORY

	Year															
Saline Marsh Vegetation	1989	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	49.1	43.9	46.9	50.1	49.8	47.6	57.5	53.3	53.2	55.3	54.8	55.1	52.4	63.7	63.6	70.5
Cordgrass	6.2	6.2	4.1	5.6	12.9	17.1	9.9	6.5	12.6	8.8	11.0	11.1	12.7	5.9	5.8	5.8
Pickleweed-Cordgrass Mix	0.0	3.4	6.2	7.2	0.1	0.0	0.0	9.8	10.0	12.2	8.2	9.9	11.3	6.8	7.0	0.0
Alkali Heath	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.5	0.2	0.2	0.2	0.3	0.3	0.3	0.3
Gumplant	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1
Peripheral Halophytes	0.6	2.4	1.5	0.9	1.7	1.7	1.8	0.5	0.4	0.6	0.7	0.7	0.7	0.7	0.7	0.7
Total Saline Dominant Species:	**55.9**	**55.9**	**58.7**	**64.0**	**64.6**	**66.5**	**69.4**	**70.5**	**77.0**	**77.4**	**75.1**	**77.2**	**77.6**	**77.5**	**77.5**	**77.4**
Brackish Marsh Vegetation																
Alkali Bulrush	0.0	0.0	0.0	0.0	4.8	6.2	7.2	5.5	0.5	0.2	2.6	0.6	0.1	0.1	0.0	0.0
Peppergrass	0.4	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.0	0.2	0.2	0.2	0.2	0.2	0.2
Spearscale	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Brackish Dominant Species:	**0.4**	**0.1**	**0.1**	**0.1**	**5.0**	**6.4**	**7.3**	**5.6**	**0.6**	**0.2**	**2.8**	**0.8**	**0.3**	**0.3**	**0.2**	**0.2**
Freshwater Marsh Vegetation																
California Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cattail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total Segment Acreage	**56.3**	**56.0**	**58.8**	**64.0**	**70.0**	**72.9**	**76.7**	**76.1**	**77.6**	**77.6**	**77.9**	**78.0**	**77.9**	**77.8**	**77.7**	**77.6**

Table C5. Acreage Summary of Segment 5 for 1989, 1994/1995, 1996-2008 and 2010.

DOMINANT SPECIES CATEGORY

	Year															
Saline Marsh Vegetation	1989	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	60.4	62.3	30.5	36.6	34.4	41.6	44.5	43.4	47.4	45.4	49.9	49.1	42.2	66.2	61.5	63.0
Cordgrass	0.3	2.1	2.7	2.6	3.6	2.3	2.0	0.9	1.6	1.7	1.7	1.7	1.7	1.5	1.0	1.0
Pickleweed-Cordgrass Mix	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pickleweed-Spearscale Mix	0.0	0.0	18.9	7.9	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkali Heath	0.0	0.0	0.0	0.2	0.1	0.4	0.2	0.3	1.2	1.3	0.8	0.8	0.8	0.8	0.5	0.6
Jaumea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.2	1.2	1.1	1.1
Gumplant	0.0	0.0	0.0	0.1	0.0	0.3	0.2	0.9	0.8	0.9	0.7	0.7	0.7	0.3	0.2	0.2
Peripheral Halophytes	1.2	0.5	1.0	2.8	3.2	6.6	4.2	2.6	1.8	1.9	3.2	1.8	1.8	1.8	2.0	2.4
Dead Vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8	6.9	8.0	0.0
Total Saline Dominant Species:	**61.9**	**64.9**	**53.1**	**50.2**	**43.5**	**52.3**	**51.2**	**48.1**	**52.8**	**51.2**	**57.5**	**55.3**	**55.2**	**78.7**	**74.3**	**68.3**
Brackish Marsh Vegetation																
Alkali Bulrush	24.4	19.2	27.3	32.1	34.7	32.0	31.4	32.6	26.3	26.8	23.5	23.7	24.5	0.2	0.2	0.2
Peppergrass	0.8	1.4	2.4	4.0	3.4	7.5	7.5	8.1	9.4	10.6	10.3	10.9	11.1	12.5	13.4	12.6
Spearscale	0.0	0.0	0.0	3.7	13.6	0.1	0.6	0.2	0.1	0.5	0.2	0.4	0.4	0.1	0.2	0.2
Total Brackish Dominant Species:	**25.2**	**20.6**	**29.7**	**39.8**	**51.7**	**39.6**	**39.5**	**40.8**	**35.8**	**37.9**	**34.0**	**35.0**	**36.0**	**12.8**	**13.8**	**13.0**
Freshwater Marsh Vegetation																
California Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Cattail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**
Total Segment Acreage	**87.1**	**85.5**	**82.8**	**90.0**	**95.2**	**91.9**	**90.7**	**89.0**	**88.6**	**89.1**	**91.5**	**90.3**	**91.2**	**91.5**	**88.1**	**81.4**

Table C6. Acreage Summary of Segment 8 for 1989, 1994/1995, 1996-2008 and 2010.

DOMINANT SPECIES CATEGORY

	Year															
Saline Marsh Vegetation	1989	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	199.7	204.9	151.8	149.4	101.0	171.1	182.4	181.5	199.2	199.1	203.0	202.3	199.1	195.9	202.0	202.0
Cordgrass	23.1	11.7	10.2	22.5	98.0	32.5	17.8	16.7	14.9	15.8	20.2	24.6	27.8	29.6	25.4	27.7
Pickleweed-Cordgrass Mix	0.0	0.0	49.0	25.7	0.0	0.0	0.0	4.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pickleweed-Spearscale Mix	0.0	0.0	0.0	0.0	0.0	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkali Heath	0.0	0.0	0.0	0.1	0.0	0.3	0.0	0.0	1.2	1.5	2.3	2.3	2.3	3.4	3.6	3.6
Gumplant	0.0	0.0	0.0	23.8	25.7	27.5	29.7	32.1	29.2	26.9	19.4	19.8	20.0	20.2	14.9	15.0
Saltgrass	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0	0.7	0.0	0.0	0.0	0.0	2.3	0.0
Peripheral Halophytes	11.1	10.0	7.8	6.0	10.1	7.7	5.8	6.5	3.3	3.7	4.4	4.4	4.5	5.2	4.6	4.6
Total Saline Dominant Species:	**233.9**	**226.6**	**218.8**	**227.5**	**234.8**	**245.7**	**239.0**	**241.5**	**248.6**	**247.7**	**249.3**	**253.4**	**253.7**	**254.3**	**252.8**	**252.9**
Brackish Marsh Vegetation																
Alkali Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Peppergrass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spearscale	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Brackish Dominant Species:	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Freshwater Marsh Vegetation																
California Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cattail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total Segment Acreage	**233.9**	**226.6**	**215.3**	**228.5**	**239.1**	**248.7**	**239.0**	**241.5**	**248.6**	**247.7**	**249.3**	**253.4**	**253.7**	**254.3**	**252.8**	**252.9**

Table C7. Acreage Summary of Segment 9 for 1989, 1994/1995, 1996-2008 and 2010.
DOMINANT SPECIES CATEGORY

	Year															
Saline Marsh Vegetation	1989	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	46.0	32.4	15.4	10.0	3.5	6.0	5.4	7.7	31.8	12.8	11.5	14.7	7.5	42.1	47.5	30.3
Cordgrass	4.4	8.9	3.9	6.6	7.3	4.7	2.6	3.4	5.1	6.5	6.2	6.8	8.5	8.7	9.7	9.1
Pickleweed-Cordgrass Mix	0.0	0.0	0.0	0.1	0.0	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pickleweed-Spearscale Mix	0.0	0.0	0.3	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkali Heath	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.4	0.2	1.8	2.0	1.2	1.6	0.9	0.7
Gumplant	0.0	0.0	0.0	0.0	0.0	0.3	0.6	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Peripheral Halophytes	0.0	0.0	1.3	2.0	3.3	1.2	1.3	0.4	0.1	0.8	0.4	0.5	0.0	0.5	0.1	0.6
Total Saline Dominant Species:	**50.4**	**41.3**	**20.9**	**19.2**	**14.1**	**12.6**	**10.3**	**12.1**	**37.6**	**20.3**	**19.9**	**24.0**	**17.2**	**52.9**	**58.2**	**40.7**
Brackish Marsh Vegetation																
Alkali Bulrush	15.4	22.2	44.1	50.4	67.0	60.2	56.9	56.7	33.0	50.4	51.8	47.4	51.4	6.4	6.2	28.0
Peppergrass	0.6	1.3	1.2	1.7	1.4	4.3	4.8	5.7	6.2	5.4	7.7	7.9	9.0	13.1	11.3	9.1
Spearscale	0.0	0.0	0.0	1.5	1.9	3.0	2.1	0.5	0.1	0.0	0.0	0.6	2.5	9.1	6.8	4.2
Total Brackish Dominant Species:	**16.0**	**23.5**	**45.3**	**53.6**	**70.2**	**67.5**	**63.8**	**62.8**	**39.3**	**55.8**	**59.5**	**55.9**	**62.9**	**28.6**	**24.3**	**41.3**
Freshwater Marsh Vegetation																
California Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0
Cattail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.8**	**0.0**	**0.0**	**0.0**
Total Segment Acreage	**66.4**	**64.8**	**66.2**	**72.8**	**84.3**	**80.1**	**74.1**	**74.9**	**76.9**	**76.1**	**79.4**	**79.8**	**80.9**	**81.5**	**82.5**	**82.0**

Table C8. Acreage Summary of Segment 10 for 1989, 1994/1995, 1996-2008 and 2010.

DOMINANT SPECIES CATEGORY

	Year															
Saline Marsh Vegetation	1989	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	24.2	21.2	10.7	10.4	8.3	8.0	9.2	9.0	35.6	28.1	24.0	23.8	22.0	42.5	43.5	42.6
Cordgrass	6.4	11.0	8.4	8.3	5.0	3.6	1.5	2.0	1.4	1.5	8.1	4.3	4.3	1.5	1.5	1.5
Pickleweed-Cordgrass Mix	0.0	0.0	0.0	0.0	0.0	0.1	0.7	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Jaumea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.7	0.0	0
Alkali Heath	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.5	0.5
Peripheral Halophytes	0.7	0.1	0.6	0.6	1.6	0.2	0.4	0.1	0.2	0.0	0.4	0.4	0.4	0.4	0.4	0.5
Total Saline Dominant Species:	**31.3**	**32.3**	**19.7**	**19.3**	**14.9**	**12.0**	**11.8**	**12.4**	**37.2**	**29.6**	**32.6**	**28.6**	**27.5**	**45.2**	**45.9**	**45.1**
Brackish Marsh Vegetation																
Alkali Bulrush	10.2	5.8	19.7	24.3	37.1	30.7	30.4	32.0	9.2	17.0	17.2	17.3	18.0	0.0	0.0	1.7
Peppergrass	2.5	1.7	1.6	2.7	1.7	6.3	5.4	5.8	4.7	5.2	5.9	5.9	6.4	6.4	5.8	4.9
Spearscale	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Total Brackish Dominant Species:	**12.7**	**7.5**	**21.3**	**27.0**	**38.9**	**37.0**	**35.9**	**37.8**	**13.9**	**22.2**	**23.1**	**23.2**	**24.4**	**6.4**	**5.8**	**6.6**
Freshwater Marsh Vegetation																
California Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Cattail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total Segment Acreage	**44.0**	**39.8**	**41.0**	**46.3**	**53.8**	**49.0**	**47.7**	**50.2**	**51.1**	**51.8**	**55.7**	**51.8**	**51.9**	**51.6**	**51.7**	**51.7**

Table C9. Acreage Summary of Segment 11 for 1989, 1994/1995, 1996-2008 and 2010.
DOMINANT SPECIES CATEGORY

	Year															
Saline Marsh Vegetation	1989	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	17.4	22.4	3.8	3.9	1.7	1.8	3.0	2.9	20.6	2.3	9.3	9.1	8.8	32.2	39.5	24.5
Cordgrass	0.0	1.6	1.1	1.1	1.6	2.3	0.6	1.1	1.6	1.0	0.1	0.9	0.8	2.2	1.7	1.0
Pickleweed-Cordgrass Mix	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pickleweed-Spearscale Mix	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Jaumea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.0	0.0	0.0	0.0	0.0
Alkali Heath	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	1.9	1.1	1.4	0.9	0.8	1.1
Gumplant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1
Peripheral Halophytes	1.0	0.0	0.4	1.1	1.5	1.2	0.2	0.3	0.0	0.3	0.0	0.6	0.5	1.2	1.4	1.0
Total Saline Dominant Species:	**18.4**	**24.0**	**5.4**	**6.4**	**5.0**	**5.3**	**3.9**	**4.4**	**22.4**	**3.9**	**11.5**	**11.7**	**11.5**	**36.6**	**43.5**	**27.7**
Brackish Marsh Vegetation																
Alkali Bulrush	51.0	48.8	63.4	64.4	68.5	68.6	65.9	64.8	47.9	63.4	57.4	54.3	53.1	14.4	5.2	28.4
Peppergrass	6.2	5.6	6.2	6.4	5.5	8.2	10.4	10.7	9.9	10.3	11.2	12.9	12.9	11.3	12.4	11.4
Spearscale	0.0	0.0	0.0	1.2	1.1	0.4	0.2	0.0	0.0	2.0	0.4	1.6	3.7	18.0	19.6	13.0
Total Brackish Dominant Species:	**57.2**	**54.4**	**69.6**	**72.0**	**75.1**	**77.2**	**76.5**	**75.6**	**57.8**	**75.7**	**69.0**	**68.8**	**69.7**	**43.7**	**37.2**	**52.8**
Freshwater Marsh Vegetation																
California Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.0	0.0
Cattail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.2**	**0.1**	**0.0**	**0.0**
Total Segment Acreage	**75.6**	**78.4**	**75.1**	**78.3**	**80.1**	**82.5**	**80.4**	**80.0**	**80.2**	**79.6**	**80.5**	**80.6**	**81.4**	**80.4**	**80.7**	**80.5**

Table C10. Acreage Summary of Segment 12 for 1989, 1994/1995, 1996-2008 and 2010.

DOMINANT SPECIES CATEGORY

	Year															
Saline Marsh Vegetation	1989	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	0.2	2.8	0.6	2.0	0.7	0.5	2.1	0.8	2.7	0.4	1.5	2.6	2.9	10.0	9.5	9.1
Cordgrass	0.0	2.2	1.1	1.1	0.7	1.4	0.2	0.0	0.8	1.3	1.0	1.4	1.9	2.4	2.1	2.1
Pickleweed-Cordgrass Mix	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pickleweed-Spearscale Mix	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkali Heath	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.5	0.3	0.6
Gumplant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Saltgrass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3
Saltgrass-Gumplant Mix	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Peripheral Halophytes	0.0	0.0	1.7	1.1	10.2	2.2	2.4	0.0	1.7	0.8	1.0	1.1	1.0	0.8	0.8	1.3
Total Saline Dominant Species:	**0.2**	**5.0**	**3.8**	**4.3**	**11.7**	**4.1**	**4.8**	**0.8**	**5.4**	**2.6**	**3.5**	**5.2**	**6.0**	**13.7**	**13.0**	**13.4**
Brackish Marsh Vegetation																
Alkali Bulrush	25.7	21.2	25.4	24.1	19.0	24.2	26.4	22.0	21.0	20.3	21.8	22.9	23.2	7.4	4.1	11.2
Peppergrass	12.2	17.5	13.4	14.5	9.9	18.4	14.3	22.1	18.4	22.1	21.9	16.8	16.2	18.1	18.1	17.9
Spearscale	0.0	0.0	0.0	0.5	1.7	0.0	0.1	0.0	0.2	0.3	0.1	1.6	1.2	3.1	9.4	4.3
Dead Vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	2.3	0.0
Total Brackish Dominant Species:	**37.9**	**38.7**	**38.8**	**39.0**	**30.6**	**42.6**	**40.8**	**44.1**	**39.6**	**42.7**	**43.8**	**41.3**	**40.6**	**33.3**	**33.9**	**33.4**
Freshwater Marsh Vegetation																
California Bulrush	0.0	0.0	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.7	0.5	0.3	0.4	0.4
Cattail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.1**	**0.2**	**0.2**	**0.2**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.7**	**0.7**	**0.4**	**0.4**	**0.4**
Total Segment Acreage	**38.1**	**43.7**	**43.1**	**43.5**	**44.5**	**47.4**	**46.0**	**45.2**	**45.3**	**45.6**	**47.6**	**47.2**	**47.3**	**47.4**	**47.3**	**47.2**

Table C11. Acreage Summary of Segment 13 for 1989, 1994/1995, 1996-2008 and 2010.

DOMINANT SPECIES CATEGORY

	Year															
Saline Marsh Vegetation	1989	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	0.0	0.4	0.8	1.5	0.5	0.4	0.5	0.0	0.4	0.2	0.0	0.2	0.7	1.8	2.0	2.6
Cordgrass	0.0	0.4	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.8
Pickleweed-Cordgrass Mix	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.0	0.0	0.0
Alkali Heath	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.3	0.1	0.1	0.1	1.1	1.1	0.8
Gumplant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
Peripheral Halophytes	0.4	0.0	11.9	7.0	4.0	3.1	1.8	0.0	0.4	1.5	0.1	0.1	0.5	0.1	0.1	0.1
Total Saline Dominant Species:	**0.4**	**0.8**	**12.7**	**8.7**	**4.5**	**3.5**	**2.4**	**0.1**	**1.0**	**2.0**	**0.3**	**0.5**	**1.5**	**3.1**	**4.0**	**4.3**
Brackish Marsh Vegetation																
Alkali Bulrush	95.3	79.9	84.8	73.3	63.0	76.1	83.8	78.7	80.5	76.9	68.2	77.1	48.7	42.9	31.9	51.7
Peppergrass	15.8	26.8	13.6	15.6	7.0	23.6	14.4	15.9	20.2	19.8	20.4	15.4	10.0	21.6	27.9	18.5
Spearscale	0.0	0.0	0.0	9.0	6.3	0.0	0.3	3.4	2.7	1.1	4.0	6.2	25.4	33.5	43.3	34.1
Dead Vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.3	2.1	0.0	0.0
Total Brackish Dominant Species:	**111.1**	**106.7**	**98.4**	**97.9**	**76.2**	**99.7**	**98.5**	**98.0**	**103.4**	**97.8**	**92.6**	**98.7**	**95.4**	**100.1**	**103.1**	**104.3**
Freshwater Marsh Vegetation																
California Bulrush	0.0	0.0	1.3	4.3	26.7	7.0	5.7	4.4	13.7	16.6	23.5	18.0	18.8	16.5	15.1	14.4
Cattail	0.0	0.0	0.1	0.2	1.8	1.1	2.2	0.8	2.2	2.4	3.9	6.3	8.7	8.3	6.8	5.8
Total Freshwater Dominant Species:	**0.0**	**0.0**	**1.4**	**4.5**	**28.5**	**8.1**	**7.9**	**5.2**	**15.9**	**19.0**	**27.4**	**24.3**	**27.5**	**24.8**	**21.9**	**20.2**
Total Segment Acreage	**111.5**	**107.5**	**112.5**	**111.1**	**109.2**	**111.3**	**108.8**	**103.2**	**120.3**	**118.8**	**120.3**	**123.5**	**124.4**	**128.0**	**129.0**	**128.8**

Table C12. Acreage Summary of Segment 14 for 1989, 1994/1995, 1996-2008 and 2010.

DOMINANT SPECIES CATEGORY

	Year															
Saline Marsh Vegetation	1989	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	5.9	8.9	3.4	2.5	0.5	0.8	6.7	0.5	8.4	5.6	6.8	6.3	6.1	15.0	16.2	15.2
Cordgrass	3.2	2.0	1.5	2.1	2.0	2.4	1.4	2.1	1.6	1.9	1.6	1.4	1.3	1.4	1.4	1.6
Pickleweed-Cordgrass Mix	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkali Heath	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0
Salt grass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0
Peripheral Halophytes	0.7	0.0	0.0	0.6	0.9	1.4	1.0	0.7	1.3	0.5	0.5	0.6	0.6	0.6	0.8	1.0
Dead Vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	1.6	0.0
Total Saline Dominant Species:	**9.8**	**10.9**	**4.9**	**5.2**	**3.4**	**4.6**	**9.1**	**3.4**	**11.3**	**8.0**	**8.9**	**8.4**	**8.2**	**17.1**	**20.2**	**17.8**
Brackish Marsh Vegetation																
Alkali Bulrush	10.6	9.1	14.6	16.7	19.3	18.5	13.8	18.4	11.0	14.2	12.5	13.2	13.0	3.1	1.2	4.0
Peppergrass	0.0	0.1	0.5	0.3	0.1	0.4	0.3	1.1	1.3	1.3	1.8	1.9	1.9	2.1	2.1	3.0
Spearscale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.5	0.1
Total Brackish Dominant Species:	**10.6**	**9.2**	**15.1**	**17.0**	**19.4**	**18.9**	**14.0**	**19.5**	**12.3**	**15.5**	**14.3**	**15.1**	**14.9**	**5.8**	**3.8**	**7.1**
Freshwater Marsh Vegetation																
California Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cattail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	0.0	0.0	0.0
Total Segment Acreage	**20.4**	**20.1**	**20.0**	**22.2**	**22.9**	**23.5**	**23.2**	**22.9**	**23.6**	**23.5**	**23.2**	**23.5**	**23.1**	**22.9**	**24.0**	**24.9**

Table C13. Acreage Summary of Segment 15 for 1989, 1994/1995, 1996-2008 and 2010.

DOMINANT SPECIES CATEGORY

	Year															
Saline Marsh Vegetation	1989	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	9.1	4.2	2.0	1.2	0.4	0.2	5.2	8.2	9.0	6.2	6.3	3.9	3.7	15.3	17.9	16.5
Cordgrass	0.0	0.7	0.4	0.7	0.2	0.8	0.1	0.3	0.0	0.0	0.0	0.2	0.2	0.2	0.3	0.3
Pickleweed-Cordgrass Mix	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkali Heath	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.2
Peripheral Halophytes	0.0	0.0	0.2	0.5	0.8	1.4	0.1	0.2	0.9	0.6	1.3	1.3	0.5	1.7	1.6	1.8
Total Saline Dominant Species:	**9.1**	**4.9**	**2.6**	**2.3**	**1.3**	**2.4**	**5.3**	**8.8**	**9.9**	**6.8**	**7.7**	**5.4**	**4.5**	**17.36**	**19.9**	**18.8**
Brackish Marsh Vegetation																
Alkali Bulrush	20.2	16.7	18.7	17.9	22.5	21.0	15.6	11.5	10.8	13.3	13.1	15.2	16.0	3.3	1.6	2.6
Peppergrass	0.0	7.8	7.4	8.9	6.1	9.8	9.6	10.2	10.2	10.7	10.7	10.9	9.5	8.5	9.0	9.2
Spearscale	0.0	0.0	0.0	0.3	0.7	0.2	0.1	0.0	0.0	0.0	0.0	0.1	0.9	1.2	1.1	1.0
Total Brackish Dominant Species:	**20.2**	**24.5**	**26.1**	**27.2**	**29.2**	**31.0**	**25.2**	**21.7**	**21.0**	**24.0**	**23.8**	**26.2**	**26.4**	**13.05**	**11.7**	**12.8**
Freshwater Marsh Vegetation																
California Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cattail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total Segment Acreage	**29.3**	**29.4**	**28.7**	**29.5**	**30.5**	**33.4**	**30.6**	**30.5**	**30.9**	**30.8**	**31.5**	**31.6**	**30.9**	**30.41**	**31.6**	**31.6**

Table C14. Acreage Summary of Segment 16 for 1989, 1994/1995, 1996-2008 and 2010.
DOMINANT SPECIES CATEGORY

	Year															
Saline Marsh Vegetation	1989	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0
Cordgrass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pickleweed-Cordgrass Mix	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkali Heath	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4
Peripheral Halophytes	0.0	0.0	2.1	1.1	0.0	0.0	0.0	0.4	0.1	0.4	0.0	0.0	0.1	0.0	0.0	0.0
Total Saline Dominant Species:	**0.0**	**0.1**	**2.1**	**1.3**	**0.0**	**0.0**	**0.0**	**0.5**	**0.3**	**0.6**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**
Brackish Marsh Vegetation																
Alkali Bulrush	37.2	29.4	35.3	18.2	33.6	28.2	26.9	23.4	26.7	25.7	23.0	22.4	21.2	19.4	10.7	22.3
Peppergrass	11.0	14.8	5.7	4.0	0.9	12.3	11.5	16.2	10.9	13.4	13.5	9.3	7.4	14.0	16.7	10.1
Spearscale	0.0	0.0	0.0	18.4	5.7	0.9	2.1	1.1	3.2	0.2	3.2	6.9	9.6	7.6	14.1	8.4
Total Brackish Dominant Species:	**48.2**	**44.2**	**41.0**	**40.6**	**40.2**	**41.4**	**40.4**	**40.7**	**40.8**	**39.3**	**39.7**	**38.6**	**38.2**	**40.9**	**41.5**	**40.8**
Freshwater Marsh Vegetation																
California Bulrush	0.0	0.0	0.3	0.7	0.7	3.4	3.7	3.4	4.4	4.8	4.7	4.5	4.9	4.1	4.0	3.9
Cattail	0.0	0.0	0.1	0.1	0.0	0.1	0.6	0.4	0.5	0.6	1.3	2.0	2.8	1.8	1.7	2.2
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.4**	**0.9**	**0.7**	**3.5**	**4.3**	**3.8**	**4.9**	**5.4**	**6.0**	**6.5**	**7.7**	**5.9**	**5.7**	**6.1**
Total Segment Acreage	**48.2**	**44.2**	**45.1**	**43.3**	**42.8**	**54.8**	**44.7**	**45.1**	**46.0**	**45.3**	**46.1**	**45.5**	**46.3**	**47.1**	**47.6**	**47.3**

Table C15. Acreage Summary of Segment 17 for 1989, 1994/1995, 1996-2008 and 2010.
DOMINANT SPECIES CATEGORY

	Year															
Saline Marsh Vegetation	1989	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	0.0	1.8	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.9	0.9
Cordgrass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Pickleweed-Cordgrass Mix	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkali Heath	0.0	0.0	1.8	2.3	0.0	0.1	0.0	0.0	1.8	2.2	2.0	2.7	2.1	2.4	1.1	0.8
Gumplant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Peripheral Halophytes	3.3	0.0	0.0	1.1	2.1	1.8	0.0	0.0	0.0	5.2	0.9	0.9	0.8	0.8	0.8	0.8
Total Saline Dominant Species:	**3.3**	**1.8**	**1.8**	**3.5**	**2.1**	**1.9**	**0.0**	**0.0**	**1.9**	**7.4**	**2.9**	**3.6**	**3.0**	**3.3**	**2.9**	**2.5**
Brackish Marsh Vegetation																
Alkali Bulrush	90.1	75.9	75.9	44.5	76.3	68.3	66.5	63.9	63.6	61.2	59.8	62.6	60.3	44.0	20.0	53.9
Peppergrass	8.8	18.9	18.9	21.1	11.7	28.4	29.4	29.0	22.9	29.7	30.8	28.2	26.3	29.1	33.3	34.5
Spearscale	0.0	0.0	0.0	26.6	11.3	0.0	1.8	0.3	7.6	0.5	3.5	5.3	10.2	11.8	43.8	9.4
Dead Vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.1	0.0	0.0
Total Brackish Dominant Species:	**98.9**	**94.8**	**94.8**	**92.2**	**99.3**	**96.7**	**97.8**	**93.2**	**94.1**	**91.4**	**94.1**	**96.1**	**96.8**	**96.0**	**97.1**	**97.8**
Freshwater Marsh Vegetation																
California Bulrush	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.1	0.2	0.1	0.1	0.2	0.2	0.3	0.3
Cattail	0.0	0.0	0.0	0.5	0.7	0.2	1.2	0.9	1.0	2.2	1.6	1.6	1.8	2.0	1.4	1.2
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.0**	**0.5**	**0.8**	**0.2**	**1.3**	**0.9**	**1.1**	**2.4**	**1.7**	**1.7**	**2.0**	**2.2**	**1.7**	**1.5**
Total Segment Acreage	**102.2**	**96.6**	**96.6**	**96.2**	**102.2**	**98.8**	**99.2**	**94.1**	**97.1**	**101.2**	**98.7**	**101.4**	**101.8**	**101.6**	**101.7**	**101.8**

Table C16. Acreage Summary of Segment 18 for 1989, 1994/1995, 1996-2008 and 2010.

DOMINANT SPECIES CATEGORY

	Year															
Saline Marsh Vegetation	1989	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	1.0	2.1	0.8	1.6	0.6	0.7	1.3	0.7	0.6	0.2	0.5	0.6	0.7	2.8	3.7	4.5
Cordgrass	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pickleweed-Cordgrass Mix	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pickleweed-Spearscale Mix	0.0	0.0	0.9	0.1	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkali Heath	0.0	0.3	0.2	0.3	0.1	0.1	0.2	0.0	0.4	0.3	0.4	0.4	0.4	0.4	0.5	0.4
Peripheral Halophytes	0.0	0.0	0.6	1.7	1.3	2.1	1.0	1.1	1.1	3.7	3.0	3.0	3.7	4.4	4.1	4.1
Dead Vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
Total Saline Dominant Species:	**1.0**	**2.4**	**2.5**	**3.8**	**3.5**	**2.9**	**2.5**	**1.8**	**2.1**	**4.2**	**3.9**	**4.0**	**4.8**	**7.8**	**8.3**	**9.0**
Brackish Marsh Vegetation																
Alkali Bulrush	33.5	24.2	24.7	13.4	24.2	22.9	23.9	21.1	20.9	20.3	20.7	20.7	20.3	9.2	7.6	11.7
Peppergrass	3.3	8.2	7.2	4.4	2.3	8.3	6.2	10.4	8.2	9.2	10.7	10.5	7.4	10.4	13.1	13.1
Spearscale	0.0	0.0	0.0	12.1	3.7	1.3	1.5	0.2	3.2	1.3	0.3	1.7	4.8	9.8	10.9	6.1
Dead Vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.1	0.0
Total Brackish Dominant Species:	**36.8**	**32.4**	**31.9**	**29.8**	**30.3**	**32.5**	**31.7**	**31.6**	**32.3**	**30.8**	**31.7**	**32.9**	**32.5**	**30.5**	**31.7**	**30.9**
Freshwater Marsh Vegetation																
California Bulrush	0.0	0.0	0.0	0.1	0.1	0.0	0.3	0.2	0.3	0.4	0.3	0.3	0.4	0.3	0.3	0.3
Cattail	0.0	0.0	0.0	0.1	0.2	0.1	0.1	0.3	0.0	0.4	0.1	0.1	0.5	0.4	0.4	0.1
Grass-leaved Goldenrod	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0	0.4
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.0**	**0.2**	**0.3**	**0.1**	**0.3**	**0.5**	**0.3**	**0.8**	**0.4**	**1.4**	**1.4**	**0.8**	**0.7**	**0.8**
Total Segment Acreage	**37.8**	**34.8**	**34.5**	**33.8**	**34.1**	**35.5**	**34.5**	**33.9**	**34.7**	**35.8**	**36.0**	**38.3**	**38.7**	**39.0**	**40.7**	**40.7**

Table C17. Acreage Summary of Segment 19 for 1989, 1994/1995, 1996-2008 and 2010.

DOMINANT SPECIES CATEGORY

	Year															
Saline Marsh Vegetation	1989	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	7.0	11.3	2.6	2.1	30.9	1.0	2.7	10.4	7.2	1.6	1.6	1.6	5.4	16.0	18.0	17.4
Cordgrass	0.0	2.0	1.8	0.7	0.1	0.5	0.0	0.0	0.1	0.2	0.0	0.0	0.3	0.3	0.3	0.4
Pickleweed-Cordgrass Mix	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
Pickleweed-Spearscale Mix	0.0	0.0	0.6	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkali Heath	0.0	0.4	0.2	0.3	0.0	0.1	0.2	0.0	0.4	0.3	0.4	0.4	0.5	0.5	0.9	1.0
Saltgrass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1
Peripheral Halophytes	0.0	0.5	1.5	2.8	3.6	3.8	3.1	2.7	2.3	1.5	1.5	1.5	1.9	1.7	1.1	1.2
Dead Vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Total Saline Dominant Species:	**7.0**	**14.2**	**6.7**	**6.0**	**34.8**	**5.6**	**6.0**	**13.1**	**10.0**	**3.6**	**3.5**	**3.5**	**8.2**	**18.7**	**20.6**	**20.1**
Brackish Marsh Vegetation																
Alkali Bulrush	29.9	22.1	31.4	24.7	0.8	29.8	27.4	17.7	23.4	29.0	29.1	29.1	20.2	7.0	4.4	8.0
Peppergrass	0.5	1.1	1.7	1.2	0.3	2.0	2.3	2.2	2.0	2.2	3.4	3.4	3.1	4.0	4.8	5.1
Spearscale	0.0	0.0	0.0	4.2	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	4.1	5.3	7.0	2.8
Spearscale-Pickleweed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
Dead Vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0
Total Brackish Dominant Species:	**30.4**	**23.2**	**33.1**	**30.1**	**1.7**	**31.9**	**29.7**	**19.9**	**25.4**	**31.2**	**32.5**	**32.5**	**27.4**	**17.3**	**16.2**	**15.9**
Freshwater Marsh Vegetation																
California Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Cattail	0.0	0.0	0.0	0.2	0.0	0.6	0.6	0.0	0.0	0.0	0.1	0.1	0.6	0.2	0.2	0.2
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.0**	**0.2**	**0.0**	**0.6**	**0.6**	**0.0**	**0.0**	**0.0**	**0.1**	**0.1**	**0.7**	**0.3**	**0.3**	**0.3**
Total Segment Acreage	**37.4**	**37.4**	**39.8**	**36.2**	**36.5**	**38.1**	**36.3**	**33.0**	**35.4**	**34.8**	**36.1**	**36.1**	**36.3**	**36.3**	**37.1**	**36.3**

Table C18. Acreage Summary of Segment 20 for 1989, 1994/1995, 1996-2008 and 2010.
DOMINANT SPECIES CATEGORY

	Year															
Saline Marsh Vegetation	1989	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	30.8	31.2	18.6	18.2	14.6	14.4	13.6	18.0	29.8	20.5	18.8	18.6	17.6	36.4	42.4	67.7
Cordgrass	2.4	6.0	5.0	4.7	2.7	2.6	1.7	1.6	2.5	3.0	3.0	3.2	3.2	3.1	3.1	3.4
Pickleweed-Cordgrass Mix	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pickleweed-Spearscale Mix	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkali Heath	0.0	0.0	0.0	0.1	0.2	0.0	0.3	0.1	0.0	0.0	0.4	0.4	0.4	0.8	0.5	0.5
Peripheral Halophytes	0.0	0.0	1.6	1.4	3.3	1.9	1.3	1.3	1.6	1.5	1.3	0.0	1.2	1.2	1.7	3.2
Saltgrass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Dead Vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.5	0.0
Total Saline Dominant Species:	**33.2**	**37.2**	**25.2**	**24.5**	**20.9**	**18.9**	**16.9**	**21.6**	**33.9**	**25.0**	**23.5**	**22.2**	**22.4**	**41.8**	**49.3**	**74.8**
Brackish Marsh Vegetation																
Alkali Bulrush	26.5	17.0	28.9	33.1	36.4	37.9	36.8	31.4	22.0	30.4	30.0	29.7	29.9	9.8	2.1	9.8
Peppergrass	1.9	3.3	2.5	3.3	3.3	6.7	7.2	6.6	5.6	6.0	7.6	8.0	8.6	9.4	9.4	10.2
Spearscale	0.0	0.0	0.0	0.1	2.1	0.1	0.1	0.1	0.0	0.0	0.2	0.4	0.5	0.2	0.2	0.5
Dead Vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	5.7	0.0
Total Brackish Dominant Species:	**28.4**	**20.3**	**31.4**	**36.5**	**41.8**	**44.7**	**44.0**	**38.2**	**27.6**	**36.4**	**37.8**	**38.1**	**39.0**	**19.7**	**17.4**	**20.5**
Freshwater Marsh Vegetation																
California Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cattail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total Segment Acreage	**61.6**	**57.5**	**56.6**	**61.0**	**62.7**	**63.6**	**61.0**	**59.7**	**61.5**	**61.4**	**61.3**	**60.3**	**61.4**	**61.5**	**66.7**	**95.3**

Table C19. Acreage Summary of Segment 21 for 1989, 1994/1995, 1996-2008 and 2010.
DOMINANT SPECIES CATEGORY

	Year															
Saline Marsh Vegetation	1989	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	2.7	7.0	2.9	2.2	1.1	1.0	3.6	4.6	5.4	5.1	4.1	3.6	4.5	12.2	17.9	9.7
Cordgrass	0.5	0.4	0.3	0.4	0.3	0.2	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2
Pickleweed-Cordgrass Mix	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkali Heath	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.2	0.2	0.3	0.4	0.4
Peripheral Halophytes	0.0	3.6	0.4	0.3	1.2	0.9	1.9	1.4	1.1	1.6	1.0	0.8	1.7	0.6	0.8	2.4
Total Saline Dominant Species:	**3.2**	**11.0**	**3.6**	**2.9**	**2.7**	**2.1**	**5.6**	**6.1**	**6.6**	**6.9**	**5.2**	**4.7**	**6.5**	**13.4**	**19.3**	**12.7**
Brackish Marsh Vegetation																
Alkali Bulrush	19.8	15.1	18.6	17.6	20.6	20.5	18.4	14.9	15.4	15.8	16.2	16.6	16.9	5.5	3.2	8.4
Peppergrass	2.9	3.7	4.1	5.3	3.4	6.2	5.1	0.1	5.9	5.5	6.5	6.5	5.3	6.0	6.7	8.0
Spearscale	0.0	0.0	0.0	0.8	1.0	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.3	2.4	2.9	2.3
Dead Vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Total Brackish Dominant Species:	**22.7**	**18.8**	**22.7**	**23.7**	**24.9**	**26.9**	**23.5**	**15.0**	**21.3**	**21.3**	**22.7**	**23.2**	**22.5**	**13.8**	**12.9**	**18.7**
Freshwater Marsh Vegetation																
California Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cattail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total Segment Acreage	**25.9**	**29.8**	**26.7**	**26.7**	**27.6**	**29.0**	**29.1**	**21.1**	**27.9**	**28.2**	**27.9**	**27.9**	**29.0**	**27.2**	**32.2**	**31.4**

Table C20. Acreage Summary of Segment 22 for 1989, 1994/1995, 1996-2008 and 2010.

DOMINANT SPECIES CATEGORY

	Year															
Saline Marsh Vegetation	1989	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	7.5	6.1	7.3	6.1	5.2	5.0	5.5	4.9	4.9	5.1	5.1	4.2	4.8	16.7	17.8	11.9
Cordgrass	2.7	3.9	2.8	3.8	3.5	4.7	2.3	4.1	4.1	8.3	32.8	42.6	49.0	50.0	62.6	84.9
Pickleweed-Cordgrass Mix	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkali Heath	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Gumplant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0
Peripheral Halophytes	0.4	0.0	0.5	1.0	1.2	0.9	0.9	0.0	0.0	1.2	1.0	0.0	0.0	0.0	0.0	0.0
Dead Vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
Total Saline Dominant Species:	**10.6**	**10.0**	**10.6**	**10.9**	**9.9**	**10.7**	**8.7**	**9.0**	**9.0**	**14.6**	**39.0**	**46.8**	**53.9**	**67.0**	**80.5**	**96.8**
Brackish Marsh Vegetation																
Alkali Bulrush	0.0	0.0	0.2	1.0	2.9	2.7	4.6	2.3	2.3	3.8	6.3	8.9	8.2	4.7	4.0	5.0
Peppergrass	0.0	0.2	0.4	0.0	0.0	0.6	0.7	3.6	3.6	0.2	1.2	1.6	2.0	1.8	1.8	1.9
Total Brackish Dominant Species:	**0.0**	**0.2**	**0.6**	**1.0**	**2.9**	**3.3**	**5.4**	**6.0**	**5.9**	**4.0**	**7.5**	**10.5**	**10.2**	**6.5**	**5.8**	**6.9**
Freshwater Marsh Vegetation																
California Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cattail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total Segment Acreage	**10.6**	**10.2**	**11.2**	**11.9**	**12.8**	**14.0**	**14.1**	**14.9**	**14.9**	**18.6**	**46.5**	**57.3**	**64.1**	**73.5**	**86.3**	**103.7**

Table C21. Acreage Summary of Segment 23 for 1989, 1994/1995, 1996-2008 and 2010.

DOMINANT SPECIES CATEGORY

	Year															
Saline Marsh Vegetation	1989	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	8.8	14.1	14.1	11.1	10.2	10.2	10.9	10.5	8.8	13.1	10.3	13.2	12.4	11.9	13.8	14.9
Cordgrass	7.9	3.7	3.6	4.8	6.2	5.9	6.2	7.4	7.9	8.4	10.5	9.9	10.8	11.8	10.0	9.5
Pickleweed-Cordgrass Mix	0.0	0.0	0.0	0.1	0.0	1.3	0.2	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0
Alkali Heath	0.0	0.0	0.2	0.0	0.0	0.2	0.3	0.0	0.0	0.3	0.2	0.0	0.0	0.0	0.8	0.8
Gumplant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0
Saltgrass	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Peripheral Halophytes	1.9	0.0	0.8	1.4	1.7	1.5	1.7	2.6	1.9	1.2	1.7	1.7	1.7	0.5	3.1	3.2
Total Saline Dominant Species:	**18.6**	**17.8**	**18.7**	**17.4**	**18.1**	**19.1**	**20.0**	**20.5**	**18.6**	**23.2**	**23.6**	**24.9**	**25.0**	**24.3**	**27.8**	**28.4**
Brackish Marsh Vegetation																
Alkali Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.4	0.4	0.0	0.3	0.0
Peppergrass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	3.3	0.2	0.2
Spearscale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0
Total Brackish Dominant Species:	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**4.0**	**0.0**	**0.4**	**0.5**	**3.4**	**0.6**	**0.2**
Freshwater Marsh Vegetation																
California Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cattail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total Segment Acreage	**18.6**	**17.8**	**18.8**	**17.4**	**18.1**	**19.1**	**20.1**	**20.5**	**18.6**	**27.2**	**23.6**	**25.3**	**25.5**	**27.7**	**28.4**	**28.6**

Table C22. Acreage Summary of Segment 24* for 1994/1995, 1996-2008 and 2010.

DOMINANT SPECIES CATEGORY

	Year														
Saline Marsh Vegetation	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	0.8	0.2	0.6	0.6	0.2	1.3	0.6	0.8	0.0	0.7	1.1	0.9	1.5	1.6	1.0
Cordgrass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Pickleweed-Cordgrass Mix	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkali Heath	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.1	0.1
Peripheral Halophytes	1.5	2.2	0.7	0.8	0.5	1.0	0.0	0.0	0.0	0.1	0.0	0.4	0.2	0.1	0.0
Dead Vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Total Saline Dominant Species:	**2.3**	**2.4**	**1.3**	**1.4**	**0.7**	**2.3**	**0.6**	**0.8**	**0.1**	**0.8**	**1.1**	**1.3**	**1.9**	**1.8**	**1.2**
Brackish Marsh Vegetation															
Alkali Bulrush	1.5	2.0	1.8	2.2	2.4	2.7	2.0	2.1	2.7	1.9	3.4	3.7	1.8	1.9	2.9
Peppergrass	7.0	6.0	5.7	7.1	7.1	4.6	7.5	6.6	6.6	7.7	5.5	4.9	5.5	6.3	7.0
Spearscale	0.0	0.0	0.0	0.5	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.3	0.2	0.0
Dead Vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.0
Total Brackish Dominant Species:	**8.5**	**8.0**	**7.5**	**9.7**	**9.6**	**7.4**	**9.5**	**8.8**	**9.3**	**9.6**	**8.9**	**8.7**	**8.2**	**8.9**	**9.9**
Freshwater Marsh Vegetation															
California Bulrush	1.4	1.6	1.9	2.0	2.6	2.8	2.2	2.9	3.1	2.7	2.8	3.0	2.8	2.5	2.4
Cattail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Freshwater Dominant Species:	**1.4**	**1.6**	**1.9**	**2.0**	**2.6**	**2.8**	**2.2**	**2.9**	**3.1**	**2.7**	**2.8**	**3.0**	**2.8**	**2.5**	**2.4**
Total Segment Acreage	**12.2**	**12.0**	**10.7**	**13.1**	**12.9**	**12.4**	**12.3**	**12.5**	**12.5**	**13.1**	**12.8**	**13.0**	**12.8**	**13.2**	**13.5**

*** Segment 24 not mapped in 1989**

Table C23. Acreage Summary of Segment 25* for 1994/1995, 1996-2008 and 2010.

DOMINANT SPECIES CATEGORY

	Year														
Saline Marsh Vegetation	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.1
Cordgrass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pickleweed-Cordgrass Mix	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Peripheral Halophytes	5.3	4.0	2.6	0.0	1.0	0.0	0.0	0.1	0.1	1.3	1.5	1.9	1.0	0.5	0.5
Dead Vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Total Saline Dominant Species:	**5.3**	**4.0**	**2.6**	**0.0**	**1.0**	**0.1**	**0.0**	**0.1**	**0.2**	**1.5**	**1.6**	**1.9**	**1.1**	**0.6**	**0.6**
Brackish Marsh Vegetation															
Alkali Bulrush	2.9	4.3	3.4	3.3	5.8	6.5	4.9	5.7	3.6	4.7	7.1	6.8	8.6	11.2	10.1
Peppergrass	10.4	7.7	6.5	48.6	7.6	7.1	8.8	7.6	7.2	5.8	3.8	3.0	5.0	9.6	9.5
Spearscale	0.0	0.0	0.3	0.5	0.1	0.1	0.0	0.3	0.0	0.0	0.0	0.3	1.0	0.1	0.1
Dead Vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Total Brackish Dominant Species:	**13.3**	**12.0**	**10.3**	**52.3**	**13.5**	**13.7**	**13.7**	**13.6**	**10.8**	**10.5**	**10.9**	**10.1**	**14.7**	**20.9**	**19.7**
Freshwater Marsh Vegetation															
California Bulrush	29.8	30.3	31.3	0.1	38.6	36.2	35.9	34.2	34.0	33.9	32.4	31.2	29.6	27.3	18.3
Cattail	0.2	0.8	1.5	0.2	2.0	1.3	2.1	2.2	4.6	4.4	5.6	7.7	6.5	3.9	14.0
Total Freshwater Dominant Species:	**30.0**	**31.1**	**32.8**	**0.3**	**40.6**	**37.5**	**38.0**	**36.4**	**38.6**	**38.3**	**38.0**	**38.9**	**36.1**	**31.2**	**32.3**
Total Segment Acreage	**48.6**	**47.1**	**45.7**	**52.7**	**55.1**	**51.3**	**51.7**	**50.1**	**49.6**	**50.3**	**50.5**	**50.9**	**51.9**	**52.7**	**52.6**

***Segment 25 not mapped in 1989**

Table C24. Acreage Summary of Segment 26* for 1994/1995, 1996-2008 and 2010.
DOMINANT SPECIES CATEGORY

	Year														
Saline Marsh Vegetation	1994/ 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cordgrass	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pickleweed-Cordgrass Mix	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Peripheral Halophytes	1.3	1.3	0.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Saline Dominant Species:	**1.3**	**1.3**	**0.8**	**0.1**	**0.0**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Brackish Marsh Vegetation															
Alkali Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.2	0.0
Peppergrass	2.5	2.6	0.6	0.1	2.9	3.3	0.5	0.3	0.0	0.9	0.9	1.3	1.5	2.2	2.0
Spearscale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Brackish Dominant Species:	**2.5**	**2.6**	**0.6**	**0.2**	**3.0**	**3.3**	**0.5**	**0.3**	**0.0**	**0.9**	**0.9**	**1.5**	**1.7**	**2.4**	**2.0**
Freshwater Marsh Vegetation															
California Bulrush	17.8	18.7	17.5	18.8	18.0	18.4	18.4	18.8	19.1	17.5	17.0	17.1	16.9	16.6	15.9
Cattail	0.1	0.2	0.4	0.3	0.1	1.0	0.6	0.9	0.4	1.3	2.0	2.1	1.4	1.9	2.8
Water Primrose	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.0
Arundo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Grass-leaved goldenrod	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
Water Primrose	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Total Freshwater Dominant Species:	**17.9**	**18.9**	**17.9**	**19.1**	**18.1**	**19.4**	**19.0**	**19.7**	**19.5**	**18.8**	**19.0**	**19.3**	**18.8**	**18.6**	**18.8**
Total Segment Acreage	**21.7**	**22.8**	**19.2**	**19.4**	**21.1**	**22.8**	**19.5**	**20.0**	**19.5**	**19.7**	**19.9**	**20.8**	**20.6**	**21.0**	**20.8**

***Segment 26 not mapped in 1989**

Table C25. Acreage Summary of Segment 27* for 1996-2008 and 2010.
DOMINANT SPECIES CATEGORY

	Year													
Saline Marsh Vegetation	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	0.0	0.9	0.0	0.0	0.9	1.0	0.8	0.5	0.6	0.0	0.6	0.6	0.3	0.3
Cordgrass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkali Heath	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Peripheral Halophytes	1.0	2.1	2.3	0.0	0.3	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.3
Total Saline Dominant Species:	**1.0**	**3.0**	**2.3**	**0.0**	**1.2**	**1.0**	**0.8**	**0.5**	**0.9**	**0.3**	**0.9**	**1.0**	**0.7**	**0.6**
Brackish Marsh Vegetation														
Alkali Bulrush	11.4	9.1	8.9	7.4	7.7	7.4	7.9	5.4	4.9	5.5	3.0	4.5	1.9	1.9
Peppergrass	0.6	1.7	0.1	1.2	1.9	1.2	1.9	0.0	0.0	0.2	0.2	0.2	0.5	1.9
Spearscale**	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.5	0.0
Dead Vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0
Total Brackish Dominant Species:	**12.0**	**10.8**	**9.1**	**8.6**	**9.6**	**8.6**	**9.9**	**5.6**	**4.9**	**5.7**	**3.2**	**4.7**	**2.9**	**3.8**
Freshwater Marsh Vegetation														
California Bulrush	3.3	4.4	6.7	4.7	5.8	6.2	5.5	5.8	5.3	6.4	6.8	5.8	7.1	6.2
Cattail	7.6	7.8	8.4	10.8	9.8	9.5	8.7	9.3	10.6	9.4	10.9	11.0	11.7	10.9
Smartweed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0
Giant Reed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0
Total Freshwater Dominant Species:	**10.9**	**12.2**	**15.2**	**15.5**	**15.6**	**15.8**	**14.2**	**15.1**	**15.9**	**15.8**	**17.7**	**17.0**	**18.9**	**17.1**
Total Segment Acreage	**23.8**	**26.0**	**26.6**	**36.5**	**26.5**	**25.4**	**24.9**	**21.2**	**21.7**	**21.8**	**21.8**	**22.7**	**22.5**	**21.5**

***Segment 27 not mapped in 1989 and 1994/1995**

****Not a Dominant Species Category in 1996**

Table C26. Acreage Summary of Segment 28* for 1996-2008 and 2010.

DOMINANT SPECIES CATEGORY

	Year														
Saline Marsh Vegetation	1989	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	0.0	0.5	0.2	0.1	0.1	0.0	0.1	0.0	0.1	0.2	0.2	0.1	0.1	1.1	0.2
Cordgrass	8.6	1.6	1.8	0.8	0.0	0.0	1.1	0.0	0.0	0.0	0.2	0.1	1.0	0.3	0.3
Gumplant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
Saltgrass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Alkali Heath	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2
Jaumea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	4.2
Peripheral Halophytes	0.0	0.3	1.4	4.0	3.4	1.6	0.6	0.0	0.0	0.4	0.0	0.2	0.6	0.3	0.0
Total Saline Dominant Species:	**8.6**	**2.4**	**3.4**	**4.8**	**3.5**	**1.6**	**1.8**	**0.0**	**0.1**	**0.6**	**0.4**	**0.4**	**1.7**	**2.3**	**5.0**
Brackish Marsh Vegetation															
Alkali Bulrush	47.7	53.7	49.8	61.9	57.0	55.8	59.2	56.2	52.3	55.9	46.6	13.2	18.3	32.2	38.4
Peppergrass	8.3	9.9	15.8	2.2	10.2	13.6	9.0	16.9	17.7	17.5	18.9	17.2	25.9	26.6	28.2
Spearscale**	0.0	0.0	0.1	0.2	0.0	0.1	0.0	0.0	0.0	0.1	5.0	13.7	5.9	3.2	0.1
Dead vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.7	8.3	1.9	0.0
Total Brackish Dominant Species:	**56.0**	**63.5**	**65.7**	**64.3**	**67.2**	**69.5**	**68.3**	**73.1**	**70.0**	**73.5**	**70.5**	**63.8**	**58.4**	**63.9**	**66.7**
Freshwater Marsh Vegetation															
California Bulrush	0.3	10.5	9.1	15.5	15.6	15.1	9.4	11.0	14.6	12.5	12.9	14.6	14.5	11.6	8.8
Cattail	0.0	0.3	0.4	0.5	0.6	0.5	1.4	0.9	0.7	0.3	1.9	6.4	6.3	3.5	7.8
Grass-leaved Goldenrod	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7	6.9	0.0
Smartweed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0
Total Freshwater Dominant Species:	**0.3**	**10.8**	**9.5**	**16.0**	**16.2**	**15.6**	**10.8**	**11.9**	**15.3**	**12.8**	**14.8**	**21.0**	**26.5**	**22.0**	**16.6**
Total Segment Acreage	**64.9**	**76.7**	**78.6**	**85.1**	**86.9**	**86.8**	**80.9**	**85.0**	**85.4**	**86.9**	**85.7**	**85.2**	**86.7**	**88.2**	**88.3**

***Segment 28 not mapped in 1994/1995**

****Not a Dominant Species Category in 1996**

Table C27. Acreage Summary of Segment 29* for 1989, 1996-2008 and 2010.

DOMINANT SPECIES CATEGORY

	Year														
Saline Marsh Vegetation	1989	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	20.1	14.8	12.1	9.0	9.3	6.6	8.0	14.6	6.3	15.0	12.5	10.8	17.1	30.5	21.7
Cordgrass	14.3	5.6	6.8	4.6	2.3	1.7	5.7	7.7	10.2	6.5	9.9	10.4	11.7	13.7	8.9
Alkali Heath	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.1
Peripheral Halophytes	0.0	2.2	4.3	5.8	5.6	4.4	0.0	4.3	4.8	4.1	2.3	3.5	3.5	0.6	0.9
Dead Vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.8	0.0	0.0
Total Saline Dominant Species:	**34.4**	**22.5**	**23.2**	**19.4**	**17.2**	**12.7**	**13.6**	**26.6**	**21.3**	**25.6**	**24.7**	**24.7**	**43.1**	**44.8**	**31.6**
Brackish Marsh Vegetation															
Alkali Bulrush	24.6	48.4	47.2	58.7	65.5	62.2	61.6	50.5	55.8	46.6	50.4	42.9	23.8	22.9	34.5
Peppergrass	10.8	10.0	9.5	3.9	11.0	13.3	13.2	15.5	17.0	25.6	23.1	24.6	23.4	28.9	34.7
Spearscale**	0.0	0.0	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.6	1.9	4.1	0.6
Dead Vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	6.8	0.0	0.0
Total Brackish Dominant Species:	**35.4**	**58.3**	**57.0**	**62.6**	**76.6**	**75.5**	**74.8**	**66.0**	**72.8**	**72.3**	**73.5**	**71.8**	**55.9**	**55.9**	**69.8**
Freshwater Marsh Vegetation															
California Bulrush	0.0	0.0	0.0	0.0	0.3	0.4	0.0	0.0	0.0	0.5	0.7	1.5	0.6	0.0	0.0
Cattail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.5	0.1	0.1	0.1	0.0	0.0
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.0**	**0.0**	**0.3**	**0.4**	**0.0**	**0.1**	**0.1**	**1.0**	**0.8**	**1.6**	**0.7**	**0.0**	**0.0**
Total Segment Acreage	**69.8**	**80.8**	**80.2**	**82.0**	**94.1**	**88.6**	**88.5**	**92.7**	**94.2**	**98.9**	**99.0**	**98.1**	**99.7**	**100.7**	**101.4**

***Segment 29 not mapped in 1994/1995**

****Not a Dominant Species Category in 1996**

Table C28. Acreage Summary of Segment 30* for 1989, 1996-2008 and 2010

DOMINANT SPECIES CATEGORY

	Year														
Saline Marsh Vegetation	1989	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010
Pickleweed	23.5	26.5	23.1	19.7	21.0	24.7	26.4	32.1	32.8	34.3	27.6	26.5	27.8	37.8	40.6
Cordgrass	15.5	8.0	9.8	10.7	13.0	3.3	12.3	13.5	13.0	14.2	24.6	26.9	26.0	25.4	15.8
Pickleweed-Cordgrass Mix	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Alkali Heath	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Saltgrass	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gumplant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
Peripheral Halophytes	3.1	1.5	2.6	2.9	3.7	2.5	0.3	1.2	2.4	1.9	2.0	2.2	0.2	0.3	0.3
Total Saline Dominant Species:	**42.1**	**36.0**	**35.5**	**33.3**	**37.7**	**32.9**	**39.1**	**46.9**	**48.2**	**51.0**	**54.2**	**55.6**	**54.0**	**63.6**	**56.8**
Brackish Marsh Vegetation															
Alkali Bulrush	0.0	1.5	1.7	6.5	5.5	11.6	4.3	2.5	5.9	6.4	7.8	7.4	8.8	0.9	10.1
Peppergrass	1.3	2.0	0.0	0.0	0.0	1.1	3.3	2.1	0.6	2.2	2.3	1.9	3.7	4.0	3.6
Spearscale**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.7	0.5	0.2
Total Brackish Dominant Species:	**1.3**	**3.4**	**1.7**	**6.5**	**5.5**	**12.7**	**7.6**	**4.6**	**6.5**	**8.6**	**10.1**	**9.9**	**13.2**	**5.4**	**13.9**
Freshwater Marsh Vegetation															
California Bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cattail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Freshwater Dominant Species:	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total Segment Acreage	**43.4**	**39.4**	**37.2**	**39.9**	**43.2**	**45.7**	**46.7**	**51.5**	**54.7**	**59.6**	**64.3**	**65.5**	**67.2**	**69.0**	**70.7**

***Segment 30 not mapped in 1994/1995**

****Not a Dominant Species Category in 1996**

APPENDIX D.
PLANT LIST

Appendix D. Plants Observed in the South Bay Marsh Project Site		
FAMILY NAME	**SCIENTIFIC NAME**	**COMMON NAME**
Aceraceae	*Acer negundo* ssp. *californica*	California box elder
Aizoceae	*Carpobrotus edulis*	iceplant
	Mesembryanthemum nodiflorum	slender-leaved iceplant
	Tetragonia tetragonioides	New Zealand spinach
Alismataceae	*Alisma plantago-aquatica*	water plantain
Apiaceae	*Conium maculatum*	poison hemlock
	Foeniculum vulgare	sweet fennel
Asteraceae	*Baccharis pilularis*	coyote brush
	Carduus pycnocephalus	Italian thistle
	Centaurea solstitialis	yellow star-thistle
	Conyza canadensis	horsetail
	Cotula coronopifolia	brass-buttons
	Euthamia occidentalis	grass-leaved goldenrod
	Grindelia angustifolia	gumplant
	Picris echioides	bristly ox-tongue
	Pluchea odorata	salt-marsh fleabane
Boraginaceae	*Heliotropium curassavicum* var. *oculatum*	heliotrope
Brassicaceae	*Brassica nigra*	black mustard
	Hirschfeldia incana	small-pod mustard
	Lepidium latifolium	perennial peppergrass
	Rorippa nasturtium-aquaticum	water cress
Caryophyllaceae	*Spergularia marina*	sand-spurrey
Chenopodiaceae	*Atriplex semibaccata*	Australian saltbush
	Atriplex prostrata (*Atriplex triangularis*)	Spearscale, fat hen
	Bassia hyssopifolia	five-hook bassia
	Chenopodium sp.	goosefoot
	Salicornia europeae	annual pickleweed
	Salsola soda	Russian thistle
	Salsola tragus	Russian thistle
	Sarcocornia pacifica (*Salicornia virginica*)	common pickleweed
Convolvulaceae	*Cressa truxillensis*	alkali weed
Cuscutaceae	*Cuscuta salina* var. *major*	salt marsh dodder
Cyperaceae	*Bolboschoenus maritimus* (*Scirpus maritimus*)	alkali bulrush
	Eleocharis macrostachya	common spikerush
	Schoenoplectus acutus (*Scirpus acutus*)	tule
	Schoenoplectus americanus (*Scirpus americanus*)	Olney’s bulrush
	Schoenoplectus californicus (*Scirpus californicus*)	California bulrush
	Schoenoplectus robustus (*Scirpus robustus*)	common bulrush
Dipsacaceae	*Dipsacus fullonum*	wild teasel
Equisetaceae	*Equisetum arvense*	common horsetail
Frankeniaceae	*Frankenia salina*	alkali heath
Juglandaceae	*Juglans californica*	California black walnut
Juncaceae	*Juncus balticus*	Baltic rush
	Juncus bufonius	toad rush
	Juncus effusus var. *brunneus*	bog rush
Juncaginaceae	*Triglochin maritima*	seaside arrow-grass

Appendix D. Plants Observed in the South Bay Marsh Project Site		
FAMILY NAME	**SCIENTIFIC NAME**	**COMMON NAME**
Lamiaceae	*Mentha spicata*	spearmint
Malvaceae	*Lavatera assurgentiflora*	malva rosa
Myoporaceae	*Myoporum laetum*	lollypop tree
Plantaginaceae	*Plantago subnuda*	plantain
Plumbaginaceae	*Limonium californicum*	western marsh-rosemary
Poaceae	*Agrostis sp.*	bentgrass
	Arundo donax	giant reed
	Avena fatua	wild oats
	Bromus diandrus	ripgut grass
	Bromus hordeaceus	soft chess
	Cortaderia jubata	pampas grass
	Distichlis spicata	saltgrass
	Hordeum sp.	barley
	Lolium multiflorum	Italian ryegrass
	Parapholis incurva	curved sicklegrass
	Paspalum distichum	knotgrass
	Phragmites australis	common reed
	Puccinellia nutkaensis	Nootka alkaligrass
	Spartina foliosa and *S. alterniflora* and hybrids	cordgrass
Polygonaceae	*Polygonum coccineum* var. *emersum*	water smartweed
	Polygonum punctatum	knotweed
	Rumex crispus	curly dock
Potamogetonaceae	*Potamogeton foliosus*	leafy pondweed
	Ruppia maritima	ditch-grass
Ranunculaceae	*Ranunculus aquatilus*	whitewater crowfoot
Salicaceae	*Populus fremontii*	Fremont's cottonwood
	Salix sp.	willow
	Salix babylonica	weeping willow
Scrophulariaceae	*Kickxia elatine*	fluellin
	Veronica americana	American brooklime
Solanaceae	*Nicotiana glauca*	tree-tobacco
	Solanum americanum	deadly nightshade
Typhaceae	*Typha angustifolia*	narrow-leafed cattail
	Typha latifolia	broad-leaved cattail
The species are arranged alphabetically by family name for all vascular plants encountered during the plant survey. Plants are also listed alphabetically within each family. In some cases it was not possible to accurately identify a particular plant to the species level due to the absence of specific anatomic structures required for identification.		

APPENDIX E.
DOMINANT SPECIES CATEGORIES,
MARSH TYPE, AND VEGETATION ASSOCIATIONS FOR 1989 AND 2010

DOMINANT SPECIES CATEGORY	HABITAT TYPE	VEGETATION ASSOCIATIONS	
		1989	**2010**
Cordgrass	Salt	Cordgrass	Cordgrass Cordgrass/Pickleweed
Pickleweed	Salt	Pickleweed Pickleweed, Alkali Heath, Spearscale (Fat Hen)	Pickleweed Pickleweed/Alkali Bulrush Pickleweed/Alkali Heath Pickleweed/Cordgrass Pickleweed/Gumplant Pickleweed/Jaumea Pickleweed/Peppergrass Pickleweed/Peripheral Halophytes Picleweed/Wrack
Alkali Heath	Salt	•	Alkali Heath Alkali Heath/Alkali Bulrush Alkali Heath/Peppergrass Alkali Heath/Pickleweed Alkali Heath/Spearscale
Gumplant	Salt	•	Gumplant Gumplant/Pickleweed
Jaumea	Salt	•	Jaumea
Peripheral Halophytes	Salt	Spearscale (Fat Hen), Alkali Heath	Peripheral Halophytes Peripheral Halophytes/Alkali Bulrush Peripheral Halophytes/Peppergrass Peripheral Halophytes/Spearscale
Saltgrass	Salt		Saltgrass
Alkali Bulrush	Brackish	Alkali Bulrush	Alkali Bulrush Alkali Bulrush/California Bulrush Alkali Bulrush/Cordgrass Alkali Bulrush/Peppergrass Alkali Bulrush/Peripheral Halophytes Alkali Bulrush/Pickleweed Alkali Bulrush/Spearscale Alkali Bulrush/Wrack
Peppergrass	Brackish	Peppergrass	Peppergrass Peppergrass/Alkali Bulrush Peppergrass/Peripheral Halophytes Peppergrass/Pickleweed Peppergrass/Upland Species Peppergrass/Wrack
Spearscale	Brackish	•	Spearscale Spearscale/Alkali Bulrush Spearscale/California Bulrush Spearscale/Peppergrass Spearscale/Peripheral Halophytes

DOMINANT SPECIES CATEGORY	HABITAT TYPE	VEGETATION ASSOCIATIONS	
		1989	**2010**
			Spearscale/Pickleweed
California Bulrush	Fresh	•	California Bulrush California Bulrush/Alkali Bulrush California Bulrush/Cattail California Bulrush/Wrack
Cattail	Fresh	•	Cattail Cattail/Alkali Bulrush Cattail/California Bulrush
Arundo	Fresh		Arundo
Grass-Leaved Goldenrod	Fresh		Grass-Leaved Goldenrod
Water Primrose	Fresh	•	Water Primrose

• Not a Dominant Species Category in Analysis Year

APPENDIX F.
2010 PHOTOGRAPHS OF VEGETATION
IN REFERENCE AND MAIN STUDY AREA

Figure F-1. Mono-specific Stand of Alkali Bulrush (Brackish Marsh Association) Near the Alviso Marina (Segment 28) (August 2010).

Figure F-2. Mixed Stand of California Bulrush and Cattail (Fresh Marsh Association) in the Reference Area Near Alviso Marina (Segment 27) (August 2010).

Figure F-3. Mono-specific Stands of California Bulrush Growing Along Slough Margins in the Upper Reach (Segment 25) (August 2010).

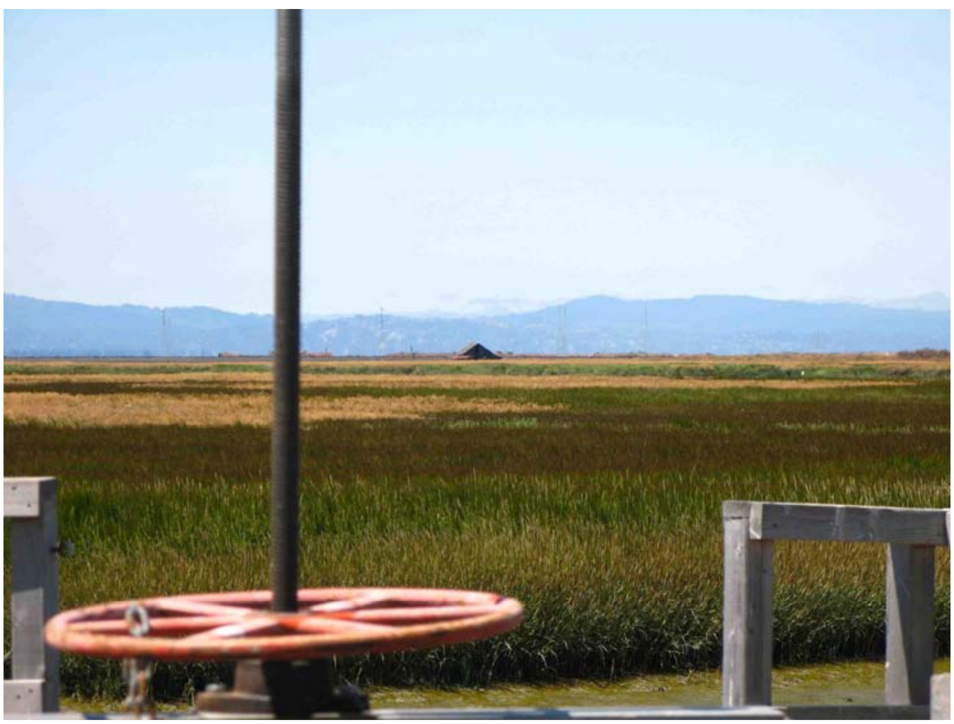

Figure F-4. Typical South Bay Marsh Vegetation Mosaic of Cordgrass (Nearest Slough), Alkali Bulrush (Brown Tops in the Middleground) and Peppergrass (White Tops in the Background) in the Transition Reach (Segment 14) (August 2010).

Figure F-5. Typical South Bay Marsh Vegetation Mosaic of Peppergrass and Alkali Heath (Foreground) and Alkali Bulrush and Pickleweed (Middle and Background) in the Upper Reach (Segment 12) (August 2010).

Figure F-6. Recently Established Pickleweed and Cordgrass Within the Island Ponds Restoration Site of the Transition Reach (Segment 20; Pond A21) (September 2010).

Figure F-7. Salt Marsh Dominants Cordgrass and Pickleweed Growing in and Adjacent to One of the Island Ponds Restoration Site Levee Breaches in the Transition Reach near Coyote Creek (Segment 20) (September 2010).

Figure F-8. Well-established Cordgrass (foreground) with Yellow Mustard (Background) Along Coyote Creek in the vicinity of Drawbridge, CA, in the Upper Reach (Segment 21) (August 2010).

Figure F-9. Salt Marsh Dominants Cordgrass and Pickleweed Along Coyote Creek in the Lower Reach (Segment 3) (September 2010).

Figure F-10. Typical Salt Marsh Vegetation At Or Near High Tide in the Vicinity of Calaveras Point in the Lower Reach (Segment 2) (August 2010).

Figure F-11. Pickleweed Establishing on Newly Deposited Sediments in the Island Ponds Restoration Site in the Transition Reach (Segment 20; Pond A-21) (September 2010).