Exhibit 4: March 22, 2012 ISP Revegetation Progress Report

San Francisco Estuary
Invasive *Spartina* Project

2012

California Clapper Rail Habitat Enhancement Program Progress Report

Prepared by:

Olofson Environmental Inc.

For:
California Coastal Conservancy
1330 Broadway
Oakland, CA 94612

May 16, 2012

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For the

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May 16, 2012

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Cover photo of freshly planted *Spartina foliosa* on the upper transition zone of a mudflat.

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1 INTRODUCTION

The State Coastal Conservancy (Conservancy) and the U.S. Fish and Wildlife Service (USFWS) initiated the Invasive *Spartina* Project (ISP) in 2000 to address the spread of four introduced species of *Spartina*, and invasive hybrid forms (*S. alterniflora* x *foliosa*) that were threatening the tidal marsh ecosystem of the San Francisco Estuary. After several years of planning and monitoring, the ISP began full-scale, regionally coordinated treatment in July 2006. Between 2000 and 2006, the extent of non-native *Spartina* in the estuary had increased several fold, so that when control started, the net area was over 800 acres, affecting large areas of shoreline and nearly every tidal marsh restoration project in the Central and South San Francisco Bay. In parts of the East Bay where the hybrid invasion had started, native vegetation such as perennial pickleweed (*Sarcocornia pacifica*, formerly *Salicornia virginica*) and marsh gumplant (*Grindelia stricta stricta*) had been displaced by the hybrid, and the native *Spartina*, *Spartina foliosa* was displaced as well as assimilated by hybridization, effectively extirpating it from the region. Attracted and supported by dense stands of hybrid *Spartina*, however, local populations of California clapper rail (*Rallus longirostris obsoletus*), an endangered marsh bird, increased during this time.

Between 2006 and 2010, the ISP control program successfully reduced the area of invasive *Spartina* by 90%, to about 80 net acres Estuary-wide, and markedly lessened its spread into new areas. As had been anticipated, this left some marshes clearly lacking important marsh structure, and most notably in some areas, native S*partina foliosa*. Also, a significant decline in California clapper rail populations was noted between 2007 and 2009, particularly at locations where rail populations had become elevated during the hybrid *Spartina* invasion.

ISP initiated experimental planting of *Spartina foliosa* in two marshes in 2010, in preparation for a revegetation program that would reintroduce the native to regions where it had been extirpated, once hybrid was sufficiently controlled. In February 2011, the USFWS determined that the decline in California clapper rail numbers at sites where hybrid *Spartina* had been removed was significant, and in Spring 2011, they required the Conservancy to prepare and implement an accelerated, large scale plan to enhance clapper rail habitat to measurably increase population numbers.

The Conservancy quickly committed funding, along with the Wildlife Conservation Board, and began an accelerated program for marsh revegetation consistent with Section 7 Endangered Species Act permit requirements from USFWS. They also began investigating opportunities for other work specified by USFWS, including deployment of experimental “floating islands” to serve as nesting habitat for clapper rails, and construction of marsh features (including “earthen islands”) to provide high-tide refugia for clapper rails. The ISP and restoration partners initiated the first large scale plantings in December 2011 within selected tidal marshes, which proceeded through March 2012. In January 2012, the Conservancy completed the San Francisco Estuary Invasive Spartina Project California Clapper Rail Habitat Enhancement, Restoration, and Monitoring Plan (“Clapper Rail Plan”; Olofson Environmental, Inc. 2012), which

laid out a five year plan for accomplishing the goal of rapidly providing increased support for clapper rail. The plan included the following objectives[1] for achieving the program goal:

1. Deploy artificial floating islands to provide near-term habitat cover for California clapper rail.
2. Construct features with appropriate marsh elevations for high-tide flood refugia and other habitat features to benefit California clapper rail.
3. Promote predator control actions that may benefit California clapper rail populations.
4. Initiate intensive planting of native vegetation to rapidly establish enhanced cover, nesting, and high tide refugia habitat for California clapper rail.
5. Continue and complete the Bay-wide eradication of invasive *Spartina* to minimize short- and long-term adverse effects for California clapper rail and to protect the native ecosystem.

Additional details regarding the establishment, spread, and treatment of invasive *Spartina*, and the response of the ecosystem and California clapper rail to all of these, are provided in the Clapper Rail Enhancement Plan, which is available on the ISP website at: www.spartina.org/project_documents/2012_CLRA_Plan.pdf. Please also see the Plan itself for other details regarding the Program.

This report describes the considerable progress made on initiating a large-scale revegetation program at selected ISP treatment sites in the very short period of time between July 2011 and March 2012. Section 2 focuses on the revegetation efforts, which were a major focus of the ISP during this period. Section 3 describes progress that was made in other areas of the Program, including floating islands, constructed islands/features, and predator control. Section 4 describes plans for continued implementation for 2012-13.

[1] The objectives shown here are abbreviations of the actual text. For a full description of the objectives, see the plan itself (Olofson Environmental, Inc. 2012)

2 ISP 2011-2012 REVEGETATION PROGRAM PROGRESS

2.1 Revegetation Plan

> **Program Objective** (from 2012 Clapper Rail Plan): *Initiate intensive planting of Grindelia stricta, Spartina foliosa and other native vegetation in strategic locations at or near invasive Spartina eradication sites, in an effort to rapidly establish enhanced cover, nesting and high tide refugia habitat for California clapper rails.*

The ISP developed the Revegetation Plan (as a component of the California Clapper Rail Plan) collaboratively over the course of a number of months in the summer and fall of 2011. The plan was written by ISP/OEI staff and reviewed and informed by expert opinion from a Technical Advisory Committee (TAC) and associated workgroups that includes regional tidal marsh restoration ecologists, PRBO Conservation Science, USGS, CDFG and USFWS (TAC details and participants are included in the Clapper Rail Plan). The Revegetation Plan was finalized Jan 7, 2012. The ISP Revegetation Plan focused on patch-based, high density revegetation plantings at sites with existing populations of clapper rail and where there is potential to sustain or support increased rail populations. The primary species planted included *Grindelia stricta*, *Spartina foliosa* and appropriate upland transition zone plant species including *Artemisia californica, Baccharis douglasii, Baccharis pilularis, Euthamia occidentalis, Eriophyllum staechadifolium, Distichlis spicata , and Leymus triticoides.* Additional marsh plain species were planted opportunistically including *Triglochin maritima, Frankenia salina* and *Jaumea carnosa*.

2.2 2011-2012 Revegetation Sites

The five-year Revegetation Plan identified a number of invasive *Spartina* treatment sites where revegetation could benefit California clapper rail through enhancement of nesting and high tide refugia habitat. **Table 1** as well as **Figures 1** and **2** show the 2011–2012 revegetation sites managed by the ISP and by restoration partners including Save The Bay, Romberg Tiburon Center, and Friends of Corte Madera Creek. Most of the ISP revegetation sites were selected primarily because there were existing clapper rail populations that would benefit in the near term from habitat enhancement. Additional sites were selected based on the presence of restoration work already underway by project partners, and in one case, on the opportunity to develop field-based propagation techniques and establish propagule sources that will be needed in subsequent years. In addition, future sites have been added where revegetation will occur per Section 7 Endangered Species Act permit requirements from USFWS. This progress report will primarily focus on the work accomplished by the ISP in 2012.

Table 1. Current and Future Revegetation Sites (work to be conducted by Conservancy contractors or grantees unless otherwise indicated).

Sites Initiated in 2011/2012 Sites (n=25)	Potential Future Sites (2013 – 2016) (n=22)
Alameda Flood Control Channel (01a, 01b, & 01c)	Alameda Flood Control Channel - Pond 3 (01f)
Arrowhead Marsh (17c) [1]	Alviso Slough (15a) [5]
Bair Island – B2 North (02c) [5]	Bair Island – B2 South (02d) [5]
Bothin (23j)[1]	Belmont Slough Mouth (02a) [4, 5]
Cogswell - Quad A (20m)	Bird Island (02a.3) [5]
Cogswell - Quad C (20o)	Calaveras Marsh (05a) [5]
Colma - San Bruno Marsh Complex (18a, , 18f, 18g)[3]	Cogswell - Quad B (20n) [4]
Creekside Park (4g)[2]	Cooley Landing (16) [5]
Damon Marsh (17d) [1, 5]	Corte Madera Creek Mouth – North Bank (04j)[5]
East Creek Slough (17d.3)[1]	Fan Marsh (17j) [5]
Eden Landing - Cargill Mitigation Marsh (13f)	Ideal Marsh South (21b)
Eden Landing – Eden Creek Marsh (13l)[1]	Muzzi Marsh (23n)
Eden Landing – Mt. Eden Creek (13j)	Old Alameda Creek - North and South Bank (13a,c)
Eden Landing – North Creek Marsh (13k)	Ravenswood Slough (02i)
Eden Landing - Old Alameda Creek Island (13b)	Robert's Landing - Bunker Marsh (20g) [4]
Eden Landing - Whale's Tail North (13d)	Robert's Landing - Citation Marsh (20d) [4]
Eden Landing - Whale's Tail South (13e)	Robert's Landing - Dogbone Marsh (20c) [4]
Elsie Roemer (17a)[3]	Robert's Landing – East Marsh (20e) [4]
Faber/Laumeister (15b) [1]	Robert's Landing - North Marsh (20f) [4]
Greco Island North (2f)	Robert's Landing - San Lorenzo Creek Mouth (20h)
MLK Restoration Marsh (17h)[1]	San Pablo Marsh – East (22b) [5]
Oro Loma East (7b)	Seal Slough Mouth (19p) [4, 5]
Oro Loma West (7a)	
Palo Alto Baylands (08)[1]	
Ravenswood Open Space Preserve – SF2 (02j)[1]	

Notes:

1. Revegetation to be conducted by Save The Bay
2. Revegetation to be conducted by Friends of Corte Madera Creek Watershed
3. Revegetation to be conducted by Romberg Tiburon Center and ISP
4. Revegetation pending approval for Spartina treatment at the site
5. Potential planting of proposed earthen islands

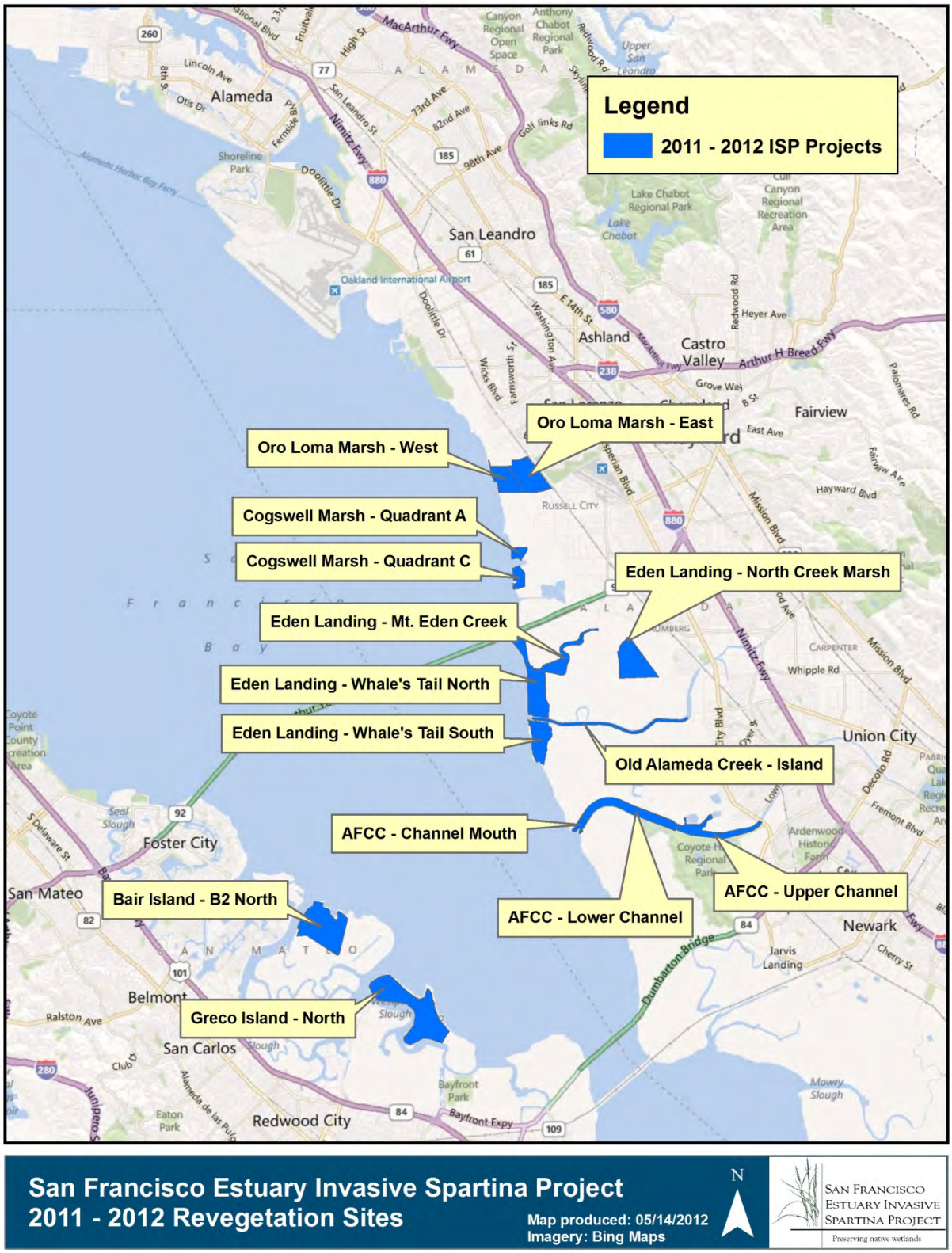


Figure 1. 2011-2012 ISP Revegetation Projects (partner projects not shown)

Figure 2. 2011-2012 ISP and Restoration Partner Revegetation Projects

2.3 2011-2012 Site Specific Revegetation Plans

After the general Revegetation Plan was established, site specific plans including site specific palettes, GIS-based planting area maps and planting patch designs were created. A master Site Specific Revegetation Matrix (Revegetation Matrix) was developed to manage site parameters (e.g., landowner permissions) as well as planting plan details including plant species, species number, access issues, installation crews details, number of estimated planting days, and planting dates. **Appendix 1** includes a version of the Revegetation Matrix that includes a summary of all 2011-2012 ISP managed plant installation by species and area. **Appendix 2** is a summary table of 2011-2012 ISP and restoration partner revegetation sites showing total number of plants by site as well as some program management details.

2.3.1 Plant Propagation

The initial GIS-based planting area maps and Revegetation Matrix identify the estimated plant numbers for each site. These early estimates informed the native plant nursery propagation planning. Bay Area nurseries were researched and inquiries made for available plant material for the 2011-2012 installation.

Propagation contracts were established with The Watershed Nursery (TWN) and Central Coast Wilds (CCW). TWN built eight, 5’ x 10’ raised beds for *Spartina foliosa* propagation and ISP biologists collected vegetative plant material to populate the beds from two source sites: Golden Gate Fields and Port Sonoma Marina. Plant samples from the collection were genetically tested to confirm species collected to be pure *Spartina foliosa*. Beds of two densities were planted, 150 ramets per bed and 300 ramets per bed (ramets are defined here as 1-3 plant stems with an associated rhizome). TWN also propagated *Grindelia stricta* from seed previously collected by Pacific Coast Seed. 10,000 *Grindelia stricta* were planted into D16s and 384 into 1-gallon pots for outplanting. TWN also provided an additional 1,666 seedling plants including: *Baccharis douglasii, Distichlis spicata, Frankenia salina* and *Triglochin maritima* as well as 900 *Leymus triticoides* propagated in raised beds. Central Coast Wilds grew 5,000 *Grindelia stricta in* super cells. Additional plant material was bought “off the shelf” from Oaktown Nursery, The Watershed Nursery and North Coast Native Nursery. A key partner in the revegetation program was Save The Bay, who provided approximately 7,200 additional seedlings for the ISP revegetation program. The species provided by Save The Bay included: *Grindelia stricta, Artemisia californica, Baccharis douglasii, Baccharis pilularis, Euthamia occidentalis, Eriophyllum staechadifolium, Distichlis spicata and Triglochin maritima.*

2.3.2 Revegetation Site Maps

During the 2011-2012 winter, site-specific GIS maps were further refined and specific channels and berms best suited for planting were selected and digitized. The planting areas were ground-truthed and additional areas determined to be appropriate for planting were mapped in the field by ISP biologists. The goal was to have the planting areas finalized to refine the number of plants needed from each of the nurseries and to guide the installation contractors. The best efforts were made to map and flag the planting areas several days in advance of installation, but given the fast pace and limited preparation time available, some ground truthing and flagging took place just ahead of the installation crews.

2.3.3 2011-2012 Site and Zone Specific Planting Designs

As noted in the introduction, the primary planting areas were selected with the goal to maximize potential nesting habitat and potential high tide refugia for clapper rail. The planting plan was reviewed and informed by a Technical Advisory Committee that met in November 2011 and reviewed the draft Revegetation Plan. The planting designs developed were patch-based clusters of high density plantings. The primary species planted were *Grindelia stricta*, *Spartina foliosa* and an appropriate mix of species for areas of upland transition zone. A few sites included some patches of other marsh plain species: *Triglochin maritima, Frankenia salina* and *Jaumea carnosa.* These species were included as part of the earlier proposed planting palette that aimed to increase marsh diversity. As the program goal evolved to provide habitat support for clapper rail, the species palette focused on plant species that can provide nesting and high tide refugia.

The *Grindelia stricta* planting design focused on planting small (secondary and tertiary) channels in the marsh plain that if planted densely with *Grindelia stricta* could provide potential nesting habitat. Potential planting areas or channels were selected or digitized initially using GIS. Linear patches 1 meter by 4 meters in length were mapped throughout the marsh plain. Both sides of the channel were planted primarily with *Grindelia stricta* at 0.25 meters and 0.5 meters from the channel edge totaling 20 plants per patch. Existing patches of *Grindelia stricta* or *Frankenia salina* acted as guides for appropriate elevation for the planting areas. Primarily three pot sizes (D16s, stubbies or super cells) of *Grindelia* were planted **(Figure 3)**. When available, gallons of *Grindelia* and/or *Distichlis spicata* were included in the patch design. **Figures 5** and **6** (pages 12-15) illustrate the site and zone specific planting designs that were developed for the program.

The upland transition zone or ecotone patch design varied by site and by available plant species. Three sites included upland ecotone patches: Cogswell Marsh A, Bair Island (B2 North) and Whale's Tail South. Cogswell A had two "islands" in the marsh interior that were planted at the elevation of the existing

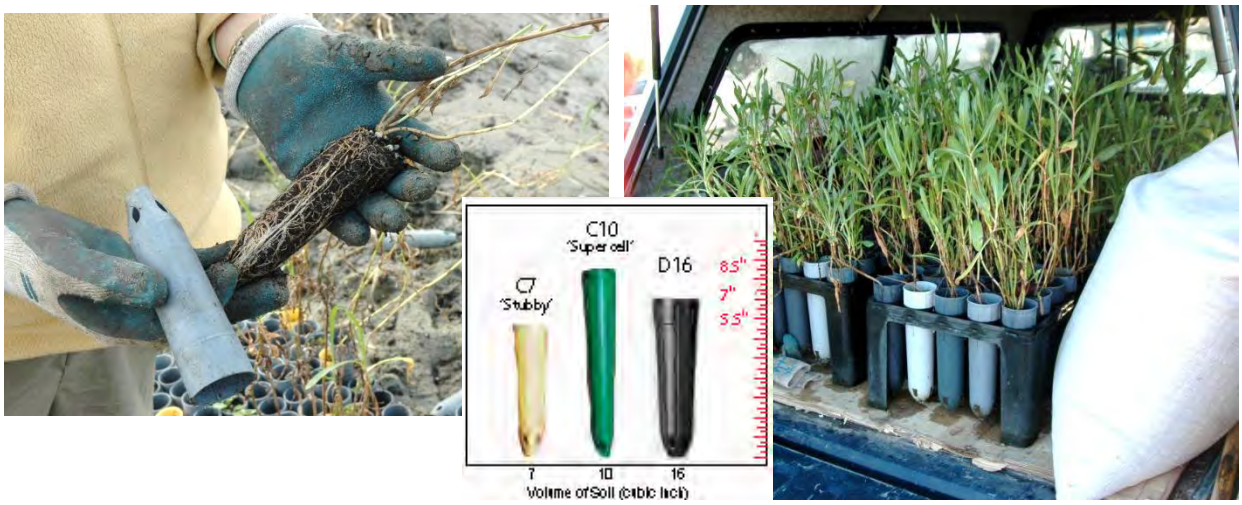


Figure 3. Examples of container sizes used in ISP revegetation work. *Left*: a *Grindelia* plant decanted from a C7 "stubby"; *Right*: a truck load of D16s in transport racks; *Center*: Comparison of three common container sizes – The number refers to the volume of the container in cubic inches.

Grindelia stricta. A berm or subsided levee at outer Bair Island was planted also using existing *Grindelia stricta* or *Frankenia salina* patches as indicators of appropriate transition zone elevation. The levee between Whale's Tail South and Cargill Mitigation Marsh was planted, again using existing *Grindelia stricta* or *Frankenia salina* patches as indicators of appropriate elevation on the levee edge. As noted above the primary species planted in this zone of the marsh included: *Artemisia californica, Baccharis douglasii, Baccharis pilularis, Euthamia occidentalis, Eriophyllum staechadifolium, Distichlis spicata, and Leymus triticoides.* **Figure 5** (page 12-14) illustrates the varied patch design for each of the upland transition/ecotone plantings.

Spartina foliosa patches were placed primarily at the transition between the marsh plain and mudflats. **Figure 6** (page 15) illustrates the patch and treatment design developed in collaboration with researcher Whitney Thornton at the SFSU Romberg Tiburon Center (RTC). The two *Spartina foliosa* sources planted were propagated in 5' x 10' raised beds by The Watershed Nursery. The sources for native *Spartina foliosa* vegetative material were Golden Gate Fields in Albany and Port Sonoma Marina, higher and lower salinity sites respectively. *Spartina foliosa* plugs were either planted as bare root or wrapped in burlap and tied off with twist ties (**Figure 4**). Patches of 5 or 9 plugs per source and/or installation treatment were planted in parallel. A sub-set of *Spartina foliosa* patches were caged with PVC pipe and string to prevent goose herbivory (grazing). Ms Thornton is also experimenting with more extensive planting patch design, direct field transplants (rather than nursery bed propagated plugs), installation treatments including rock and bamboo as well as additional caging methods. Her research findings will inform future *Spartina foliosa* patch design and installation requirements that should improve *Spartina foliosa* planting survivorship.

Spartina foliosa patches were also placed along cut banks within larger interior marsh channels or along the main channel of some creeks (e.g., Old Alameda Creek and Mt.

Figure 4. Foliosa planting treatments. *Left*: Bare root method; *Right*: experimental burlap-wrapped method. The burlap treatment tended to be preferred by contractors because the plants were easier to handle, and they are showing superior survivorship and growth when compared to bare root plantings, in the early months after installation.

Key for plant codes used in designs below:

4 letter code	*Species*	*4 letter code*	*Species*
ARCA	*Artemisia californica*	**FRSA**	*Frankenia salina*
BADO	*Baccharis douglasii*	**GRST**	*Grindelia stricta*
BAPI	*Baccharis pilularis*	**JACA**	*Jaumea carnosa*
DISP	*Distichlis spicata*	**LETR**	*Leymus triticoides*
ERST	*Eriophyllum staechadifolium*	**SPFO**	*Spartina foliosa*
EUOC	*Euthamia occidentalis*	**TRMA**	*Triglochin maritima*

1. *Grindelia* Patches

i. 10 plants 1 x 4 meters in length on both sides of flagged marsh planned channel).
   1. 4 plants per 1 m2
   2. Alternating 0.25 m and 0.5 m from channel edge

❑ = GRST (0.25 m from channel)
■ = GRST (0.5 m from channel)

A----------(4.0 m)----------D
A-(0.5m)-B-(1.0 m)-C

Row 1 (0.25 from channel edge) ❑ ❑ ❑ ❑ ❑

(0.25m) **I** **I**

Row 2 (0.5 m from channel edge) ■ ■ ■ ■ ■

2. *Grindelia* Patches with Gallons and *Distichlis*

i. 20 plants 1 x 5 meters in length (on both sides of channel).
   1. 4 plants per 1 m2

ii. Alternating 0.25 m and 0.5 m from channel edge
   2. Distichlis: 4 plants/patch or 1 plant per 1 m2 of Grindelia

iii. Center of *Grindelia*, 0.5 m from channel edge

❑ = GRST
❖ = GRST (1 gallon)
◆ = DISP

A----------(4.0 m)----------D
A-(0.5m)-B-(1.0 m)-C

Row 1 (0.25 from channel edge) ❑ ❑ ❑ ❑ ❑

Row 2 (0.3 m from channel edge) ◆ ◆ ◆ ◆

Row 3 (0.5 m from channel edge) ❖ ❖ ❖ ❖ ❖

A-------(1.0 m)------C

Figure 5. Grindelia and Ecotone Planting Patch Designs

3. *Triglochin/Frankenia/Jaumea* Patches

i. 10 plants per linear patch (block)
ii. 0.25 m apart in two rows

● = TRMA/FRSA/JACA

A----(0.25 m)--------B

Row 1 ● ● ● ● ●
I I (0.25m)
Row 2 ● ● ● ● ●

4. Upland Transition/Ecotone Patches (designed for 3 locations)

a. Bair Island Berm edge planting design:

i. 10 plants 1 x 5 meters in length (both sides of channel).
ii. 4 plants per 1 m^2

Possible palette:

❑ = BADO (BAPI)
❖ = GRST
● = ARCA
■ = EUOC
❍ = ERST
♦ = LETR

A----------(4.0 m)----------D
A-(0.5m)-B-(1.0 m)-C

Row 1 (upland side edge) ❑ ● ■ ❍ ❑
I I (1.0 m)
Row 2 (marsh plain side) ❖ ❖ ❖ ❖ ❖

Alternate plan if flat berm top (rather that berm edge):`

A----------(4.0 m)----------D
A-(0.5m)-B-(1.0 m)-C

Row 1 (upland side edge) ❑ ❖ ■ ❖ ❑
I I (1.0 m)
Row 2 (marsh plain side) ❖ ● ❖ ❍ ❖

Figure 5. (continued). Grindelia and Ecotone Planting Patch Designs

b. Cogswell (Duck Island) and Whales Tail South Berm Upland Ecotone Patch Design

i. 10 plants 1 x 4 meters in length
ii. 4 plants per 1 m2
iii. Due to limited supply of DISP and possibly LETR – an addition as available

Possible palette:

❑ = BADO (BAPI alternate in same position at Whales Tail South)
⌘ = BADO gal (alternate in same position for designated patches)
❖ = GRST
▽ = GRST gal (alternate in same position for designated patches)
■ = EUOC
● = ARCA (alternate in same position for designated patches/where available)
♦ = LETR (plant 3 plugs per point)
☒ = DISP

A----------(4.0 m)----------C

A---------(0.5m)--------B(1.0m)

Row 1 (upland side) ❑/⌘ ■ ❖/● ■ ❑/⌘

(0.5 m) ☒ ♦
(1.0 m betw rows) ♦♦
Row 2 (marsh plain side) ❖/▽ ❖/▽ ❖/▽ ❖/▽ ❖/▽

c. North Creek Marsh Upland Ecotone Patch Design

i. 10 plants 1 x 4 meters in length
ii. 4 plants per 1 m2

Possible palette:

❑ = BAPI
❖ = GRST (or no plant if not suitable elevation in Row 1)
■ = EUOC
♦ = LETR (plant 3 plugs per point)

A--------(1.0m)---------**B**--------(1.0m)---------**C**---------(1.0m)-------**D**--------(1.0m)--------**E**

Row 1 (upland side) ❑ ■ ❖ ■ ❑

(1.0 m betw rows) (0.5 m)♦(0.5 m) (0.5 m)♦(0.5 m)

Row 2 (marsh plain side) ❖ ❖ ❖ ❖ ❖

Figure 5. (continued). Grindelia and Ecotone Planting Patch Designs

1. Source and Wave Action Treatments :
   - Source: Old Alameda Creek, Alameda Flood Control Channel and Mt. Eden Creek

1. Installation Treatment:
   - Plug installation treatment: Bare root vs. Burlap
     - Source: Whale's Tail North, Whale's Tail South and North Creek

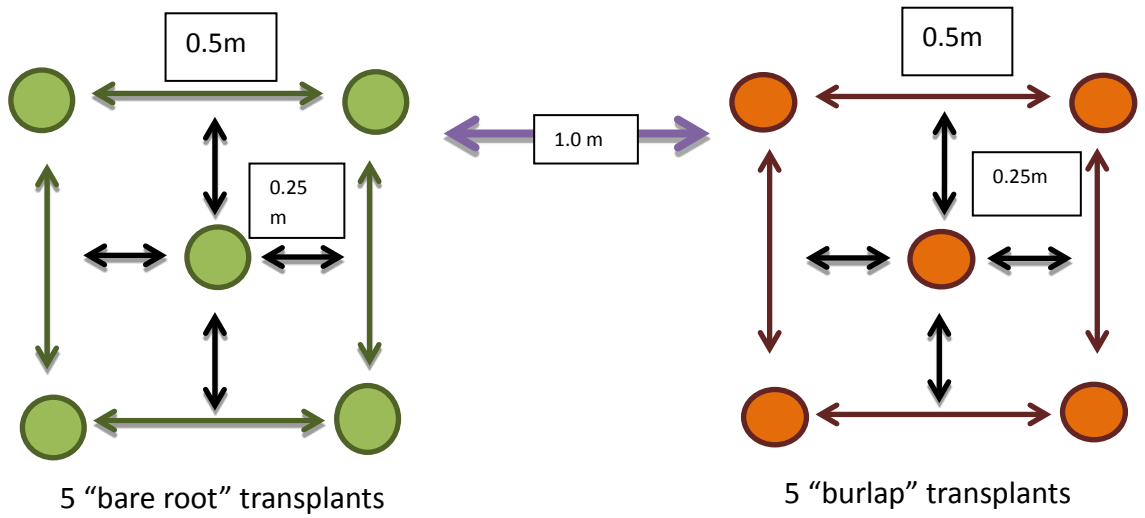


Figure 6. Spartina foliosa Planting Patch Design (developed w W. Thornten, Researcher, Romberg Tiburon Center

Eden Creek) that were selected for planting. At sites, including Old Alameda Creek and Alameda Flood Control Channel, *Spartina foliosa* patches were often paired with *Grindelia stricta* patches. Available elevation data was also used to guide the placement of the *Spartina foliosa* patches. Much of the available mudflat at North Creek Marsh was determined to be appropriate elevation for *Spartina foliosa* plantings.

The *Triglochin maritima* patch locations were selected based on limited information available from published literature and from anecdotal survivorship data from plantings with Save The Bay at Arrowhead Marsh. Patches were placed in areas with mixed vegetation that included a small patchwork of microhabitats. The anecdotal evidence from Arrowhead Marsh revegetation by Save The Bay/ISP suggested not planting in either bare areas or dense *Sarcocornia pacifica* patches, but rather planting within mixed patches of existing vegetation. Existing vegetation guided the location of the plantings. Locations of existing *Limonium californica,* which has similar growing tolerances to *Triglochin maritima*, were used to inform appropriate elevation and site conditions for planting. Existing *Jaumea carnosa* and *Grindelia stricta* or *Frankenia salina* zones were also used to inform and select appropriate planting locations. Patches of 10 individuals were planted across an elevation gradient. Areas often chosen were at the edge of *Jaumea carnosa* patches that transition into *Sarcocornia pacifica*.

At one site, Eden Landing's North Creek Marsh, *Frankenia salina* and *Jaumea carnosa* patches were planted in patches of 10 individuals, using thesame patch design as *Triglochin maritima*. Any available natural occurrences of *Frankenia salina* or *Jaumea carnosa* at the site guided the locations of the patch plantings. An area heavily used for access into the marsh by duck hunters and during revegetation was also selected for planting a number of patches of these mixed marsh plain species.

2.4 Site Preparation

Two of the three sites that included upland ecotone planting, Cogswell Marsh A and Whales Tail South, received some pre-installation weeding treatment. The weeding treatment was done by West Coast Wildlands under the supervision of ISP biologists. The weeding treatment took place 5 days prior to planting. The weeding treatment included mowing and raking followed by a targeted herbicide application of the aquatic herbicide (Aquamaster 2%) in combination with the aquatic surfactant (Liberate 0.5%), applied directly to weedy plants. A berm at Bair Island did not receive any weeding treatment prior to planting given limited access and timing.

2.5 Plant Installation

Three installation contractors were contracted for revegetation outplantings in 2012; Shelterbelt Builders Inc., West Coast Wildlands, and Aquatic Environments Inc. Plant installations took place primarily in January, prior to the California clapper rail nesting season and into mid-February where California clapper rail were determined to not be present.

Sites were mapped and flagged to guide the plant installation by the contractors. Site access was planned in advance and coordinated with the landowners. Most sites were accessible by levee. However, several sites required boats, airboats and/or 'Jon Boats' for access (**Figure 7**). The specific access requirements are noted in the planning matrix in Appendix 1. While maps and access issues were shared

Figure 7. Examples of boats used by crews to access revegetation sites. Left: Airboat piloted by East Bay Regional Parks District; Right: A Jon Boat ferry provided by Shelterbelt Builders.

with the installation contractors in advance of planting, ISP biologists still provided daily on-site planting guidance and supervision (**Figure 8**). ISP biologists also mapped all plantings using GPS units during installation. An extensive revegetation geodatabase was developed by the ISP in the process.

Table 2 is a summary of all plantings installed and managed by the ISP in 2011-2012. In collaboration with partners (STB, RTC, and FOCMC) a total of 58,913 plants *(*with *Spartina foliosa* counted as a plug, where 1 plug = 5 stems) (or 68,389 if *Spartina foliosa* is counted as stems) were planted in 2011-2012. ISP managed the planting of 20,997 (or 29,209 if *Spartina foliosa* is counted as stems) plants of that total at 12 sites. These plants were installed over 1.12 acres in 36 planting days (average planting crew of 6). This section also includes revegetation site planting summaries, maps and photos.

An installation timeline was developed in conjunction with the Revegetation Plan and site specific planting plans. The general installation timeline for 2011-2012 is illustrated in **Table 3**. Lack of rain allowed for intensive plantings in January, however, the drought conditions likely reduced survivorship, particularly for the upland transition zone plantings. Rain slowed, and in some cases postponed, late season plantings that extended into early March at three sites (Alameda Flood Control Channel, North Creek Marsh, and Old Alameda Creek Island).

Figure 8. Morning briefings were held daily to assure installation contractors and monitors were prepared for the day's work.

Sections 2.5.1 through 2.5.12 provide maps, summary tables, and photographs of the work that was completed at each site in 2011-12.

Table 2. Summary of Plant Types and Numbers installed by ISP at each site in 2011-2012*

	Cogswell A	**Cogswell C**	**Alameda Flood Control Channel**	**Greco Island North**	**Bair B2 North Quad**	**Whales Tail South**	**Whales Tail North**	**North Cr Marsh**	**Mt. Eden Creek**	**Old Alameda Creek Island**	**Oro Loma East**	**Oro Loma West**
Grindelia stricta	1310	750	800	2600	627	1971	1398	500	512	700	610	540
Grindelia stricta (gal)	100	50	0	300	0	127	50	0	0	0	0	0
Distichlis spicata	403	95	0	0	0	320	0	139	0	0	0	0
Triglochin maritima	160	110	0	0	0	340	0	189	0	0	0	0
Jaumea carnosa	0	0	0	0	0	0	0	25	0	0	0	0
Limonium californicum	0	0	0	0	0	0	0	50	0	0	0	0
Frankenia salina	0	0	0	0	0	0	0	342	0	0	0	0
Spartina foliosa (plugs, with 1 plug = 5 stems on average)	0	0	410	0	0	260	156	705	84	438	0	0
Spartina foliosa (stems)	0	0	2050	0	0	1300	780	3525	420	2190	0	0
Ecotone: all species	974	0	0	0	339	2333	0	180	0	0	0	0
TOTAL PLANTS INSTALLED (with *Spartina foliosa* counted as stems)	**2947**	**1005**	**2850**	**2900**	**966**	**6391**	**2228**	**4950**	**932**	**2890**	**610**	**540**
Total planted area (acres)	0.148	0.044	0.053	0.156	0.066	0.28	0.09	0.05	0.03	0.05	0.032	0.031
Number of Installation days	5	2	3	4	2	8	3	3	2	2	1	1

* Note: This table does not show plantings by ISP partners, including W. Thornton/RTC (Colma Creek/San Bruno Marsh and Elsie Roemer Marsh), Save The Bay (Arrowhead Marsh, Damon Slough, MLK Restoration Marsh, Palo Alto Baylands, Faber/Laumeister, and Ravenswood Open Space Preserve), and Friends of Corte Madera Creek (Creekside Park). Appendix 1 includes a summary of work by these partners.

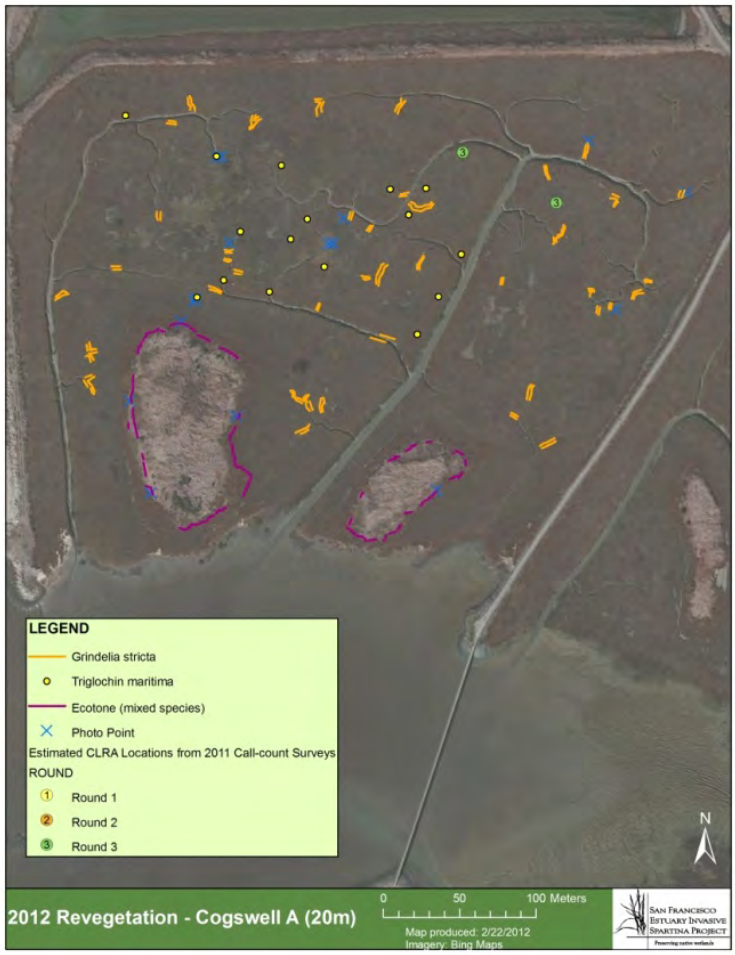
Table 3. 2011-2012 ISP Revegetation Program Plant Installation Timeline[1]

2011-12	December	January	February	March	April
Revegetation Program					
Prepare planting plans	Plans completed				
Order plants from Nursery	(done Sep-Oct 2011)				
Prepare sites (weeding)	weeding		followup		
Contracting	prepare SOWs & assist CWF as needed				
Installation		Plant Install		>>>	
Prepare "as built" maps					Prepare as built maps
Habitat Assessment Monitoring					
Photopoints					
Survivorship Monitoring					
Planting Method Assessment					
Maintenance	Maintenance activities				
Write Reveg Progress Report					
Final Reveg Progress Report					

[1] Tasks are listed in this table that do not occur during the months shown (e.g., survivorship monitoring will occur in September and October)

2.5.1 Cogswell Marsh A Summary

i. Map:



Total Plantings:	**2947**
GRST:	**1310**
GRST (gal):	**100**
DISP:	**403**
TRMA:	**160**
Ecotone:	**974**

	Cogswell A (20m)
Outplanting Contractor	West Coast Wildlands & Shelterbelt
Access notes	Levee: truck, foot
Installation dates	Jan 3-5, 2012 & Jan 30-1, 2012
Owner/Manager	EBRPD

ii. Photos:

Cogswell A: Installation Numbers:

	Cogswell A (20m)
Installed – Grindelia	1310
Installed - Grindelia (gal)	100
Installed - Distichlis spicata	403
Installed - Triglochin maritima	160
Installed - Jaumea carnosa (gal)	0
Installed - Limonium californicum (gal)	0
Installed - Frankenia salina	0
Installed- *Spartina foliosa* (plugs)	0
Installed - *Spartina foliosa* (stems)	0
Installed Ecotone: Baccharis douglasii	141
Installed Ecotone: Baccharis pilularis	0
Installed Ecotone: Grindelia stricta	424
Installed Ecotone: Grindelia stricta gallon	0
Installed Ecotone: Artemisia californica	0
Installed Ecotone: Euthamia occidentalis	136
Installed Ecotone: Eriophyllum staechadifolium	0
Installed Ecotone: Distichlis spicata	66
Installed Ecotone: Leymus triticoides	207
Installed Ecotone: all species	974
TOTAL PLANTS INSTALLED TO DATE	**2947**

2.5.2 Cogswell Marsh C Summary

i. Map:

Total Plantings:	**1005**
GRST:	**750**
GRST(gal):	**50**
DISP:	**95**
TRMA:	**110**

	Cogswell C (20o)
Outplanting Contractor	West Coast Wildlands & Shelterbelt
Access notes	Levee: truck, foot
Installation dates	Jan 4-5, 2012
Owner/Manager	EBRPD

ii. Photos

Cogswell C: Installation Numbers:

	Cogswell C (20o)
Installed – Grindelia	750
Installed - Grindelia (gal)	50
Installed - Distichlis spicata	95
Installed - Triglochin maritima	110
Installed - Jaumea carnosa (gal)	0
Installed - Limonium californicum (gal)	0
Installed - Frankenia salina	0
Installed- *Spartina foliosa* (plugs)	0
Installed - *Spartina foliosa* (stems)	0
Installed Ecotone: Baccharis douglasii	0
Installed Ecotone: Baccharis pilularis	0
Installed Ecotone: Grindelia stricta	0
Installed Ecotone: Grindelia stricta gallon	0
Installed Ecotone: Artemisia californica	0
Installed Ecotone: Euthamia occidentalis	0
Installed Ecotone: Eriophyllum staechadifolium	0
Installed Ecotone: Distichlis spicata	0
Installed Ecotone: Leymus triticoides	0
Installed Ecotone: all species	0
TOTAL PLANTS INSTALLED TO DATE	**1005**

2.5.3 Oro Loma East Summary

i. Map:

Total Plantings:	**610**
GRST:	**610**

	Oro Loma East (07a)
Outplanting Contractor	Shelterbelt
Access notes	airboat for access
Installation dates	January 12, 2012
Owner/Manager	EBRPD

ii. Photos

Oro Loma East: Installation Numbers:

	Oro Loma East (07a)
Installed – Grindelia	**610**
Installed - Grindelia (gal)	**0**
Installed - Distichlis spicata	**0**
Installed - Triglochin maritima	**0**
Installed - Jaumea carnosa (gal)	**0**
Installed - Limonium californicum (gal)	**0**
Installed - Frankenia salina	**0**
Installed- *Spartina foliosa* (plugs)	**0**
Installed - *Spartina foliosa* (stems)	**0**
Installed Ecotone: Baccharis douglasii	**0**
Installed Ecotone: Baccharis pilularis	**0**
Installed Ecotone: Grindelia stricta	**0**
Installed Ecotone: Grindelia stricta gallon	**0**
Installed Ecotone: Artemisia californica	**0**
Installed Ecotone: Euthamia occidentalis	**0**
Installed Ecotone: Eriophyllum staechadifolium	**0**
Installed Ecotone: Distichlis spicata	**0**
Installed Ecotone: Leymus triticoides	**0**
Installed Ecotone: all species	**0**
TOTAL PLANTS INSTALLED TO DATE	**610**

2.5.4 Oro Loma West Summary

i. Map:

Total Plantings:	**540**
GRST:	**540**

	Oro Loma West (07b)
Outplanting Contractor	Shelterbelt
Access notes	airboat for access and staging of plants
Installation dates	January 13, 2012
Owner/Manager	EBRPD

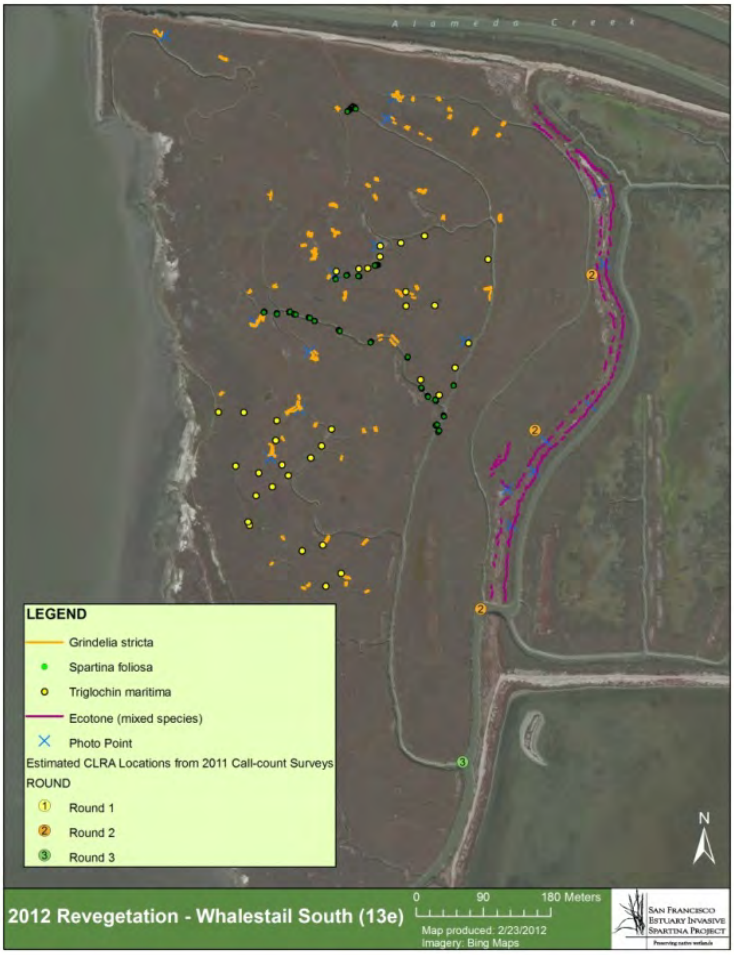
iii. Photos

Oro Loma West: Installation Numbers:

	Oro Loma East (07a)
Installed – Grindelia	**610**
Installed - Grindelia (gal)	**0**
Installed - Distichlis spicata	**0**
Installed - Triglochin maritima	**0**
Installed - Jaumea carnosa (gal)	**0**
Installed - Limonium californicum (gal)	**0**
Installed - Frankenia salina	**0**
Installed- *Spartina foliosa* (plugs)	**0**
Installed - *Spartina foliosa* (stems)	**0**
Installed Ecotone: Baccharis douglasii	**0**
Installed Ecotone: Baccharis pilularis	**0**
Installed Ecotone: Grindelia stricta	**0**
Installed Ecotone: Grindelia stricta gallon	**0**
Installed Ecotone: Artemisia californica	**0**
Installed Ecotone: Euthamia occidentalis	**0**
Installed Ecotone: Eriophyllum staechadifolium	**0**
Installed Ecotone: Distichlis spicata	**0**
Installed Ecotone: Leymus triticoides	**0**
Installed Ecotone: all species	**0**
TOTAL PLANTS INSTALLED TO DATE	**610**

2.5.5 Whales Tail South Summary

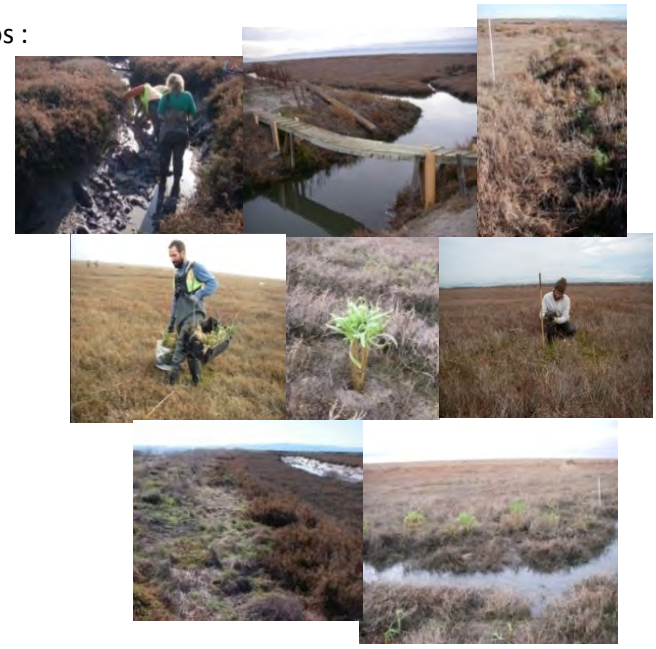
i. Map:



Total Plantings:	**6391**
SPFO (stems):	**1300**
GRST:	**1971**
GRST (gal):	**127**
DISP:	**320**
TRMA:	**340**
Ecotone:	**2333**

	Whales Tail South (13e)
Outplanting Contractor	West Coast Wild Lands & Shelterbelt
Access notes	Levee: truck, foot
Installation dates	Jan 16, 18-19, 2012 & Jan 30-Feb 3, 2012
Owner/Manager	CDFG

iv. Photos :



Whales Tail South: Installation Numbers:

	Whales Tail South (13e)
Installed – Grindelia	1971
Installed - Grindelia (gal)	127
Installed - Distichlis spicata	320
Installed - Triglochin maritima	340
Installed - Jaumea carnosa (gal)	0
Installed - Limonium californicum (gal)	0
Installed - Frankenia salina	0
Installed- *Spartina foliosa* (plugs)	260
Installed - *Spartina foliosa* (stems)	1300
Installed Ecotone: Baccharis douglasii	197
Installed Ecotone: Baccharis pilularis	156
Installed Ecotone: Grindelia stricta	971
Installed Ecotone: Grindelia stricta gallon	175
Installed Ecotone: Artemisia californica	81
Installed Ecotone: Euthamia occidentalis	372
Installed Ecotone: Eriophyllum staechadifolium	1
Installed Ecotone: Distichlis spicata	201
Installed Ecotone: Leymus triticoides	179
Installed Ecotone: all species	2333
TOTAL PLANTS INSTALLED TO DATE (with *S. foliosa* counted as stems)	**6391**

2.5.6 Whales Tail North Summary

i. Map:

Total Plantings:	**2228**
SPFO (stems):	**780**
GRST:	**1398**
GRST (gal):	**50**

	Whales Tail North (13d)
Outplanting Contractor	Shelterbelt
Access notes	airboat for staging of plants and Jon boat to cross channel for planting
Installation dates	Jan 23-25, 2012
Owner/Manager	CDFG

ii. Photos:

Whales Tail North: Installation Numbers:

	Whales Tail North (13d)
Installed – Grindelia	1398
Installed - Grindelia (gal)	50
Installed - Distichlis spicata	0
Installed - Triglochin maritima	0
Installed - Jaumea carnosa (gal)	0
Installed - Limonium californicum (gal)	0
Installed - Frankenia salina	0
Installed- *Spartina foliosa* (plugs)	156
Installed - *Spartina foliosa* (stems)	780
Installed Ecotone: Baccharis douglasii	0
Installed Ecotone: Baccharis pilularis	0
Installed Ecotone: Grindelia stricta	0
Installed Ecotone: Grindelia stricta gallon	0
Installed Ecotone: Artemisia californica	0
Installed Ecotone: Euthamia occidentalis	0
Installed Ecotone: Eriophyllum staechadifolium	0
Installed Ecotone: Distichlis spicata	0
Installed Ecotone: Leymus triticoides	0
Installed Ecotone: all species	0
TOTAL PLANTS INSTALLED TO DATE (with *S. foliosa* counted as stems)	**2228**

2.5.7 Mt. Eden Creek Marsh Summary

i. Map:

Total Plantings:	**932**
SPFO (stems):	**420**
GRST:	**512**

	Mt. Eden Creek (13j)
Outplanting Contractor	West Coast Wild Lands
Access notes	Levee: truck, foot
Installation dates	Jan 26-27, 2012
Owner/Manager	CDFG

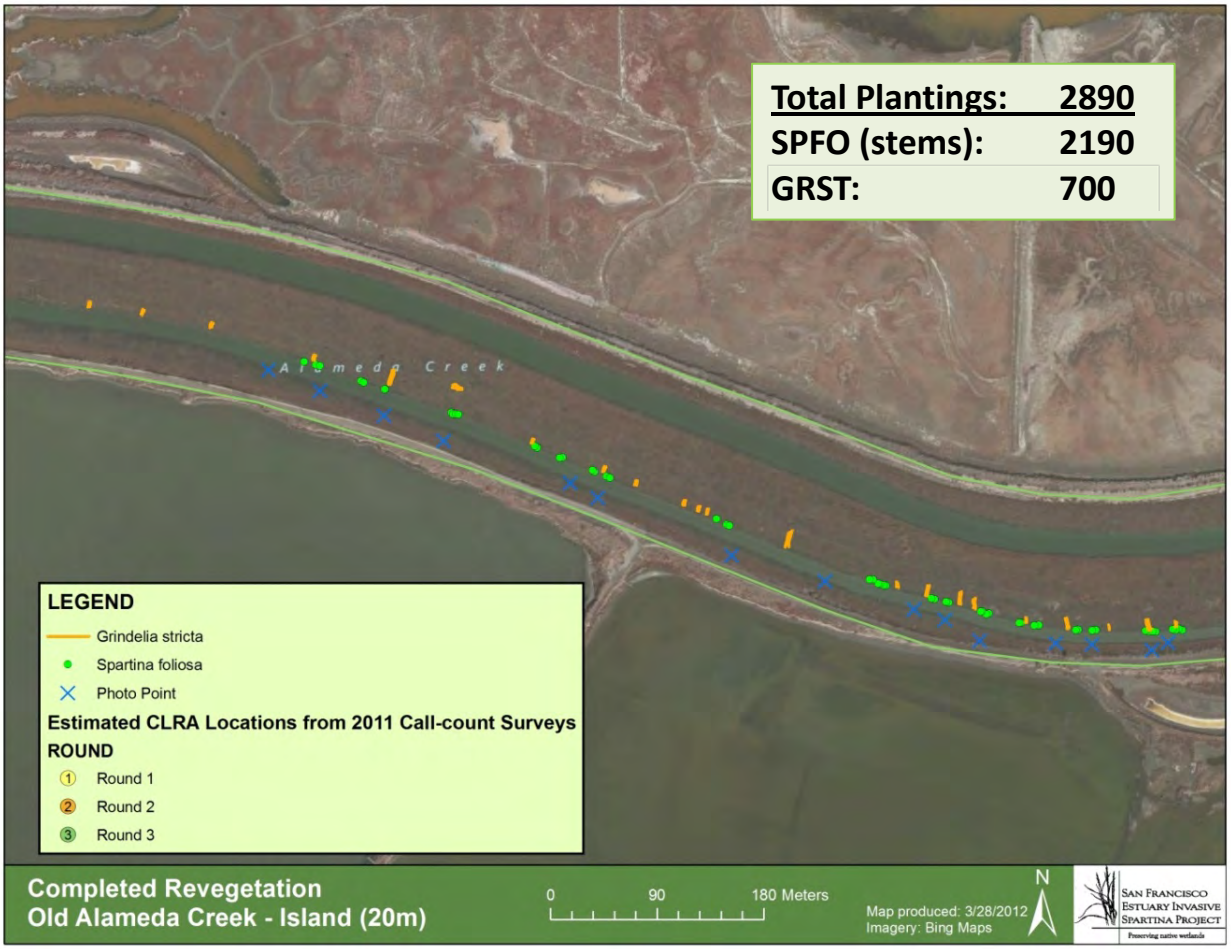
ii. Photos:

Mt. Eden Creek: Installation Numbers:

	Mt. Eden Creek (13j)
Installed – Grindelia	512
Installed - Grindelia (gal)	0
Installed - Distichlis spicata	0
Installed - Triglochin maritima	0
Installed - Jaumea carnosa (gal)	0
Installed - Limonium californicum (gal)	0
Installed - Frankenia salina	0
Installed- *Spartina foliosa* (plugs)	84
Installed - *Spartina foliosa* (stems)	420
Installed Ecotone: Baccharis douglasii	0
Installed Ecotone: Baccharis pilularis	0
Installed Ecotone: Grindelia stricta	0
Installed Ecotone: Grindelia stricta gallon	0
Installed Ecotone: Artemisia californica	0
Installed Ecotone: Euthamia occidentalis	0
Installed Ecotone: Eriophyllum staechadifolium	0
Installed Ecotone: Distichlis spicata	0
Installed Ecotone: Leymus triticoides	0
Installed Ecotone: all species	0
TOTAL PLANTS INSTALLED TO DATE (with *S. foliosa* counted as stems)	**932**

2.5.8 Old Alameda Creek - Island Summary

i. Map:



i. Photos :

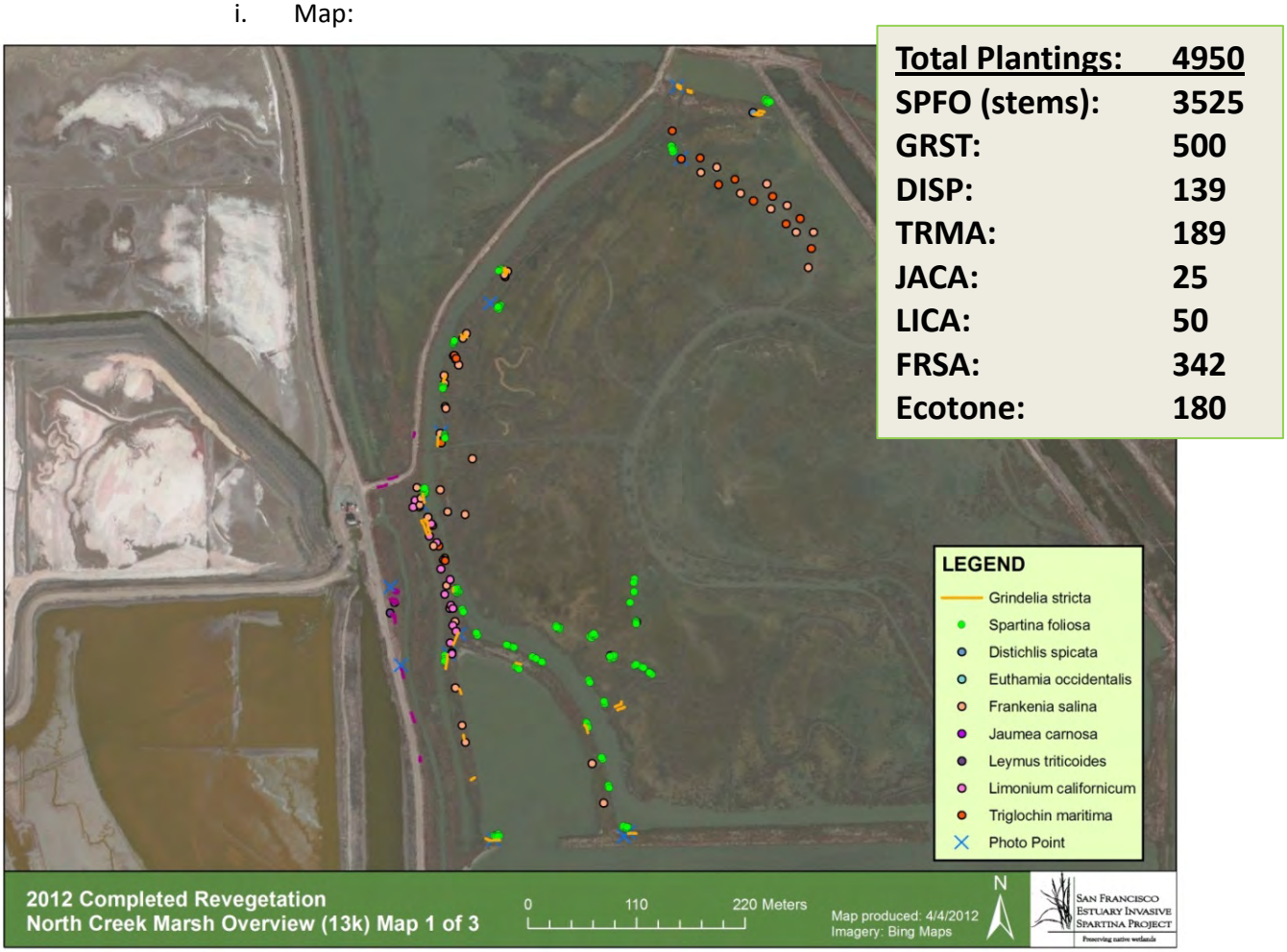
	Old Alameda Creek Island (13b)
Outplanting Contractor	West Coast Wild Lands
Access notes	boat to cross channel
Installation dates	Feb 27 & March 8 , 2012
Owner/Manager	CDFG

Old Alameda Creek Island Installation Numbers:

	Old Alameda Creek Island (13b)
Installed – Grindelia	700
Installed - Grindelia (gal)	0
Installed - Distichlis spicata	0
Installed - Triglochin maritima	0
Installed - Jaumea carnosa (gal)	0
Installed - Limonium californicum (gal)	0
Installed - Frankenia salina	0
Installed- *Spartina foliosa* (plugs)	438
Installed - *Spartina foliosa* (stems)	2190
Installed Ecotone: Baccharis douglasii	0
Installed Ecotone: Baccharis pilularis	0
Installed Ecotone: Grindelia stricta	0
Installed Ecotone: Grindelia stricta gallon	0
Installed Ecotone: Artemisia californica	0
Installed Ecotone: Euthamia occidentalis	0
Installed Ecotone: Eriophyllum staechadifolium	0
Installed Ecotone: Distichlis spicata	0
Installed Ecotone: Leymus triticoides	0
Installed Ecotone: all species	0
TOTAL PLANTS INSTALLED TO DATE (with *S. foliosa* counted as stems)	**2890**

2.5.9 North Creek Marsh Summary

i. Map:



i. Photos :

	North Cr Marsh (Eden Landing Reserve South) (13k)
Outplanting Contractor	Shelterbelt
Access notes	Levee: truck, foot
Installation dates	March 13, 15-16, 2012
Owner/Manager	CDFG

North Creek Marsh Installation Numbers:

	North Cr Marsh (Eden Landing Reserve South) (13k)
Installed – Grindelia	**500**
Installed - Grindelia (gal)	**0**
Installed - Distichlis spicata	**139**
Installed - Triglochin maritima	**189**
Installed - Jaumea carnosa (gal)	**25**
Installed - Limonium californicum (gal)	**50**
Installed - Frankenia salina	**342**
Installed- *Spartina foliosa* (plugs)	**705**
Installed - *Spartina foliosa* (stems)	**3525**
Installed Ecotone: Baccharis douglasii	**0**
Installed Ecotone: Baccharis pilularis	**40**
Installed Ecotone: Grindelia stricta	**0**
Installed Ecotone: Grindelia stricta gallon	**0**
Installed Ecotone: Artemisia californica	**0**
Installed Ecotone: Euthamia occidentalis	**140**
Installed Ecotone: Eriophyllum staechadifolium	**0**
Installed Ecotone: Distichlis spicata	**0**
Installed Ecotone: Leymus triticoides	**0**
Installed Ecotone: all species	**180**
TOTAL PLANTS INSTALLED TO DATE (with *S. foliosa* counted as stems)	**4950**

2.5.10 Bair Island Summary

i. Map:

Total Plantings:	**966**
GRST:	**627**
Ecotone:	**339**

	Bair B2 North Quadrant (02c.1)
Outplanting Contractor	Aquatic Environments
Access notes	airboat need to access
Installation dates	Jan 18, 2012 & Jan 26, 2012
Owner/Manager	USFWS Refuge

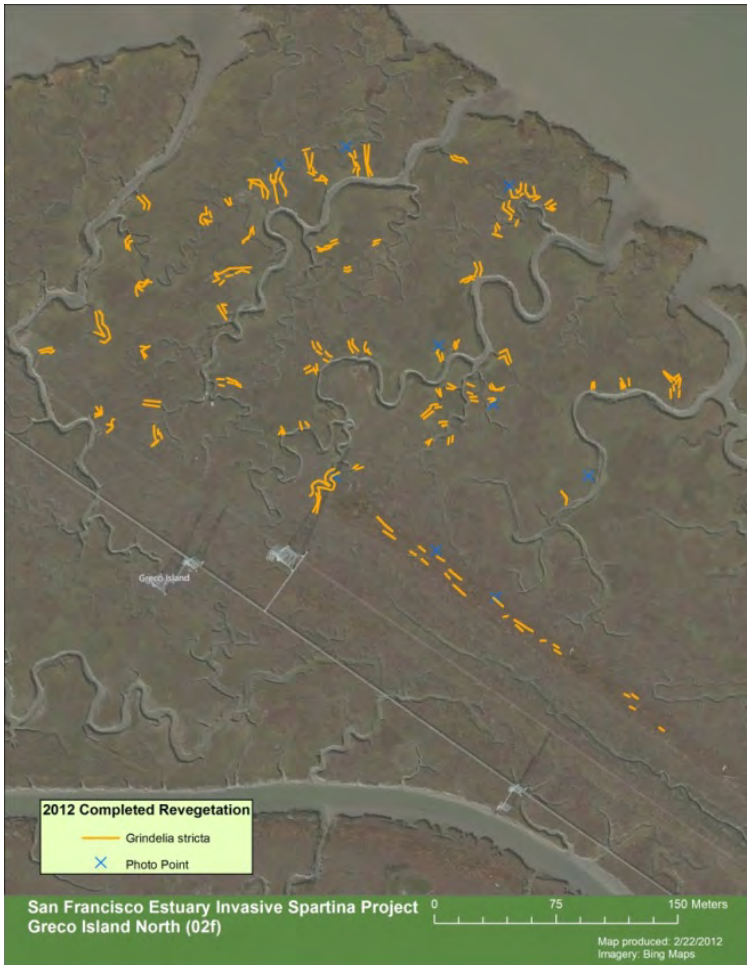
ii. Photos :

Bair Island Installation Numbers:

	Bair B2 North Quadrant (02c.1)
Installed – Grindelia	**627**
Installed - Grindelia (gal)	**0**
Installed - Distichlis spicata	**0**
Installed - Triglochin maritima	**0**
Installed - Jaumea carnosa (gal)	**0**
Installed - Limonium californicum (gal)	**0**
Installed - Frankenia salina	**0**
Installed- *Spartina foliosa* (plugs)	**0**
Installed - *Spartina foliosa* (stems)	**0**
Installed Ecotone: Baccharis douglasii	**71**
Installed Ecotone: Baccharis pilularis	**0**
Installed Ecotone: Grindelia stricta	**205**
Installed Ecotone: Grindelia stricta gallon	**0**
Installed Ecotone: Artemisia californica	**26**
Installed Ecotone: Euthamia occidentalis	**37**
Installed Ecotone: Eriophyllum staechadifolium	**0**
Installed Ecotone: Distichlis spicata	**0**
Installed Ecotone: Leymus triticoides	**0**
Installed Ecotone: all species	**339**
TOTAL PLANTS INSTALLED TO DATE	**966**

2.5.11 Greco Island Summary

i. Map:



Total Plantings:	**2900**
GRST:	**2600**
GRST (gal):	**300**

	Greco Island North (02f)
Outplanting Contractor	Aquatic Environments
Access notes	airboat need to access
Installation dates	Jan 31- Feb 3, 2013
Owner/Manager	USFWS Refuge

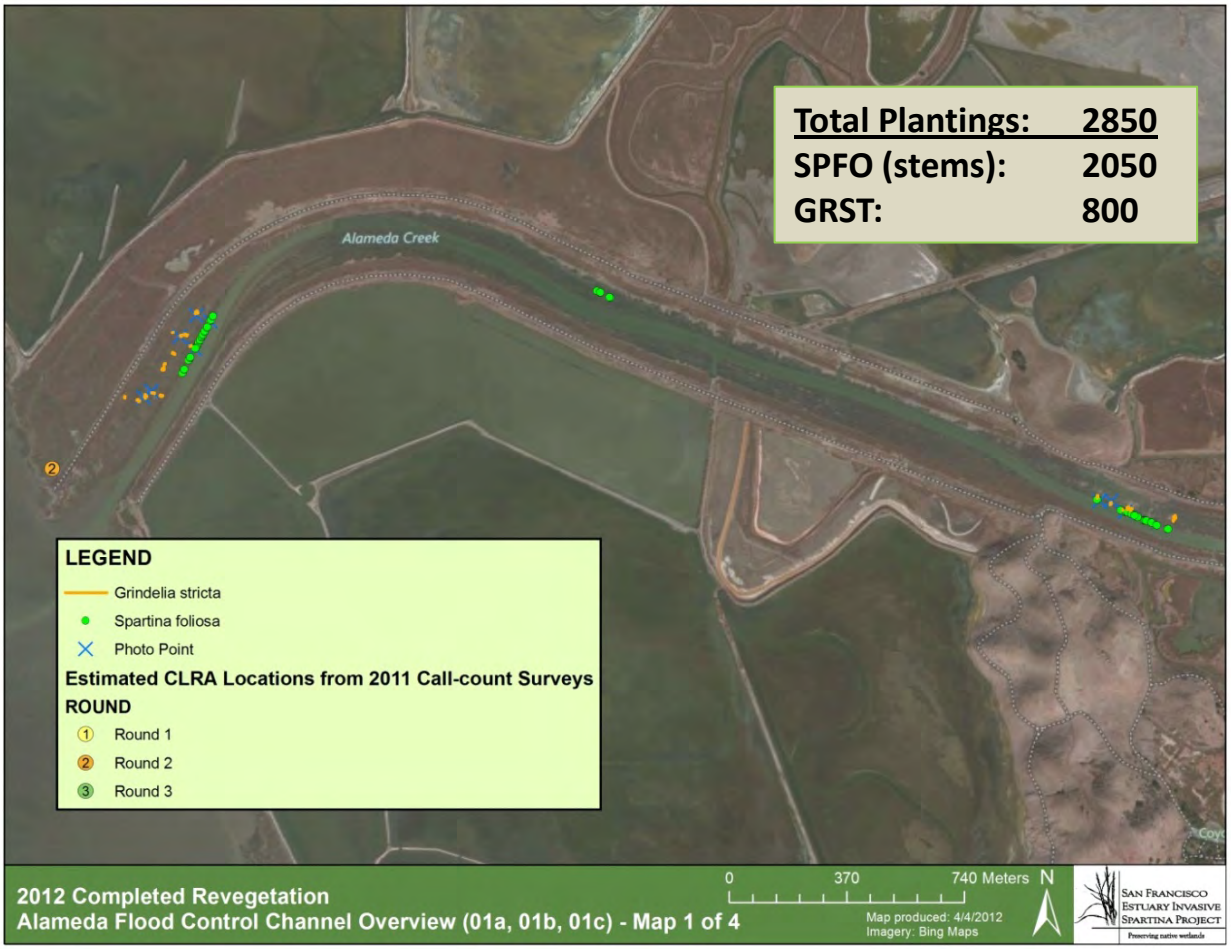
ii. Photos :

Greco Island Installation Numbers:

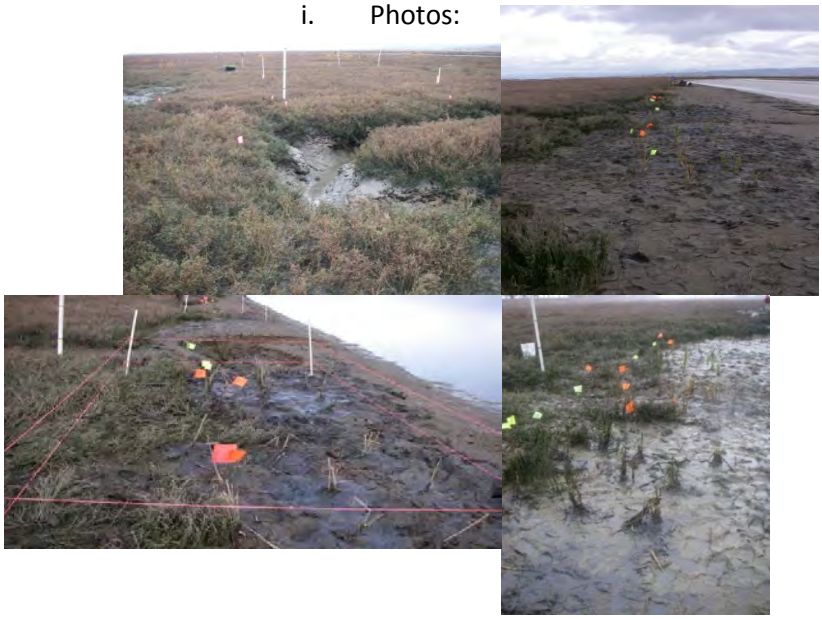
	Greco Island North (02f)
Installed – Grindelia	2600
Installed - Grindelia (gal)	300
Installed - Distichlis spicata	0
Installed - Triglochin maritima	0
Installed - Jaumea carnosa (gal)	0
Installed - Limonium californicum (gal)	0
Installed - Frankenia salina	0
Installed- *Spartina foliosa* (plugs)	0
Installed - *Spartina foliosa* (stems)	0
Installed Ecotone: Baccharis douglasii	0
Installed Ecotone: Baccharis pilularis	0
Installed Ecotone: Grindelia stricta	0
Installed Ecotone: Grindelia stricta gallon	0
Installed Ecotone: Artemisia californica	0
Installed Ecotone: Euthamia occidentalis	0
Installed Ecotone: Eriophyllum staechadifolium	0
Installed Ecotone: Distichlis spicata	0
Installed Ecotone: Leymus triticoides	0
Installed Ecotone: all species	0
TOTAL PLANTS INSTALLED TO DATE	**2900**

2.5.12 Alameda Flood Control Channel Summary

i. Map:



i. Photos:



	Alameda FC Channel
Out planting Contractor	Aquatic Environments
Access notes	Levee: truck, foot
Installation dates	Feb 28-March 1, 2012
Owner/Manager	AFCD

Alameda Flood Control Channel Installation Numbers:

	Alameda FC Channel Mouth, Lower & Upper (01a, b & c)
Installed – Grindelia	800
Installed - Grindelia (gal)	0
Installed - Distichlis spicata	0
Installed - Triglochin maritima	0
Installed - Jaumea carnosa (gal)	0
Installed - Limonium californicum (gal)	0
Installed - Frankenia salina	0
Installed- *Spartina foliosa* (plugs)	410
Installed - *Spartina foliosa* (stems)	2050
Installed Ecotone: Baccharis douglasii	0
Installed Ecotone: Baccharis pilularis	0
Installed Ecotone: Grindelia stricta	0
Installed Ecotone: Grindelia stricta gallon	0
Installed Ecotone: Artemisia californica	0
Installed Ecotone: Euthamia occidentalis	0
Installed Ecotone: Eriophyllum staechadifolium	0
Installed Ecotone: Distichlis spicata	0
Installed Ecotone: Leymus triticoides	0
Installed Ecotone: all species	0
TOTAL PLANTS INSTALLED TO DATE (with *S. foliosa* counted as stems)	2850

2.6 2011-2012 Challenges and Lessons Learned

The pace of work for the 2011-2012 revegetation planting season, including time for planning, fundraising, contracting, and implementation, was extremely fast. In addition, the rapidly evolving development of the Revegetation Plan to a plant palette that would specifically support California clapper rail nesting habitat and high tide refugia presented early challenges for the Program. However, the program adapted and kept up with the pace that was set as needed. Ideally, more ground truthing, advanced planning and contracting, and mapping and flagging of the planting areas could have facilitated the work for the plant installation and nursery contractors. In all, ISP revegetation partners were very flexible, and all participants involved adapted and were committed to the success of the program. An end-of-season installation working group meeting was held at the ISP office on April 24, 2012. Present were ISP and the Conservancy staffs, installation crew managers, and representatives from the nurseries and California Wildlife Foundation (CWF). ISP shared the summary results and maps from the 2011-2012 planting season. Discussion focused on reviewing the specific lessons learned in 2011-2012 including: site specific marsh access, best planting tools, installation techniques, pot size, etc. All lessons learned last season and from this working group meeting will be applied this next season, at new sites as well as old. An additional Technical Advisory Committee meeting is also scheduled for May 22, 2012. The information gathered from the experts at the working group meetings, experience and lessons learned will expedite and facilitate planning and installation for future planting seasons.

The 2012-2013 revegetation season will include a higher number of plantings as well as some additional planting treatments. This coming year will likely also include more caging treatments to prevent herbivory as well as watering treatments should there be another drought year. This coming year may also include installation of earthen islands, planted with *Grindelia stricta (*see Section 3 for more detail on earthen islands). Lessons learned from this year will inform the planting designs and techniques applied for the earthen islands. With advanced planning, more time for mapping and installation, and with partnerships, contracts and plans already underway, it is anticipated that the next planting season will run more smoothly and efficiently.

3 PROGRESS IN OTHER PROGRAM AREAS

3.1 Floating Islands

Program Objective (from 2012 Plan): *Deploy artificial floating islands at strategic locations at or near invasive Spartina eradication sites to provide near-term habitat cover for California clapper rails, including refuge habitat during December and January winter high tide events, and potentially nesting habitat from February 1 through August 30.*

The Conservancy and the ISP have been working with USGS to continue studies on clapper rail use of floating islands and to determine the best strategy to employ floating islands as interim high-tide refugia during *Spartina* control. As part of their ongoing research, USGS installed 10 "high tide refugia" islands and 25 smaller "nesting" islands at Arrowhead Marsh, and 25 nesting islands at Greco Island in winter 2011-12 (**Figure 9**).

At the request of USFWS, the Conservancy funded purchase of 25 audio recorders to be installed on the islands at Arrowhead Marsh, as part of a study by UC Davis. These autonomous recording units (ARUs) will be deployed in order to improve presence/absence surveys for rails, model occupancy, detect presence in hard to access marshes, and document colonization of new march restoration sites. These units will be deployed throughout the breeding season and will provide data addressing several management questions. By recording clapper rail call activity throughout the day and throughout the season it will be possible to identify periods of peak call activity both within days as well as across the breeding season.

Figure 9. Examples of artificial floating islands. Left: Floating island for nesting habitat at Bunker Marsh, Robert's Landing Complex; Right: Floating island for high tide refugia at Arrowhead Marsh

This data can then be correlated with weather to help understand the interaction between weather and clapper rail calling activity. Together these data may be applied to current call count surveys that take place throughout the year in a variety of weather conditions and allow for better interpretation of call count data.

Also implemented this year, but using funding from the Conservancy, USGS deployed 25 islands at each of three additional locations:

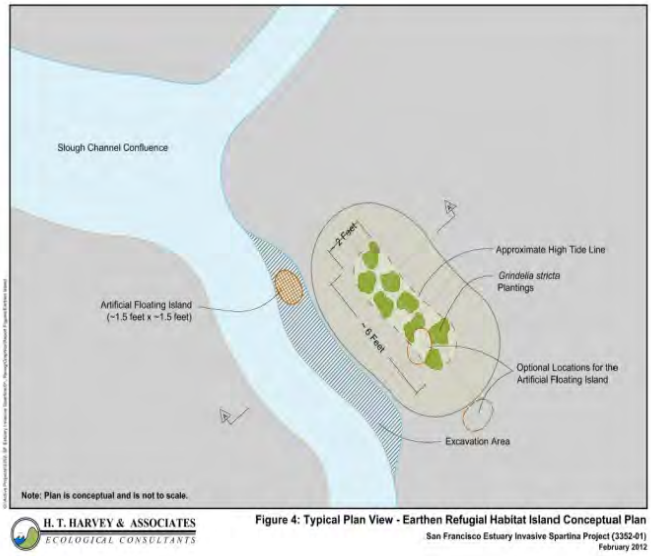
- Robert's Landing Complex including North, Citation, and Bunker Marshes and the San Lorenzo Creek Mouth (City of San Leandro)
- Cogswell Marsh in Hayward (East Bay Regional Park District)
- Whale's Tail North Marsh in Union City (CA Department of Fish and Game)

A total of 135 floating islands have been installed in five general locations around the Bay. USGS is monitoring and maintaining all of these islands. Island monitoring will include passive and active techniques. Passive monitoring will use time elapse and infra-red triggered motion sensing cameras to record island use. Cameras will be placed on 12 islands per site with reserve cameras available for placement when nesting or other activity is discovered on an island. Time elapse photos will be taken once every 5 minutes. Motion sensing will include one second intervals for 10 seconds with a 20 minute "sleep" period between triggers. All photos will be interpreted within 1 week of weekly maintenance checks.

3.2 Constructed High Marsh Elevations

> ***Program Objective*** (from 2012 Plan)*: Evaluate opportunities for, and implement as feasible, near-term construction of appropriate marsh elevations for high-tide flood refugia and other habitat features to benefit California clapper rail in existing tidal marshes and restoration projects at or near invasive Spartina eradication sites. Also investigate opportunities for modifying hydrologic regimes in diked marshes to enhance California clapper rail habitat; for example, by increasing flow in marshes that lack sufficient tidal inundation (e.g., East Marsh in San Leandro and Pond B3 in Hayward), or by decreasing (damping) flow in marshes where high tides are otherwise too high to allow adequate refugia for clapper rail (as occurs at La Riviere Marsh in Fremont).*

Environmental consulting firm, H.T. Harvey & Associates (HTH), was contracted to prepare a preliminary conceptual plan and cost estimate for design and construction of small earthen islands that could be installed in existing tidal marsh to provide high-tide refugia for rails (**Figure 10**). Because of the small size of the islands (about 12 ft^2 area), the plan envisions that construction could be done with manual labor, and using soil/sediment acquired on-site from the areas in immediate proximity to the island. Construction of the islands would require acquisition permits from U. S. Army Corps of Engineers (USACE), Regional Water Quality Control Board (RWQCB), and Bay Conservation and Development Commission (BCDC), and they would likely qualify for the USACE Nationwide Permit 27 for restoration projects. The cost of design and construction (not including permitting), was estimated at roughly $3,500 per island.



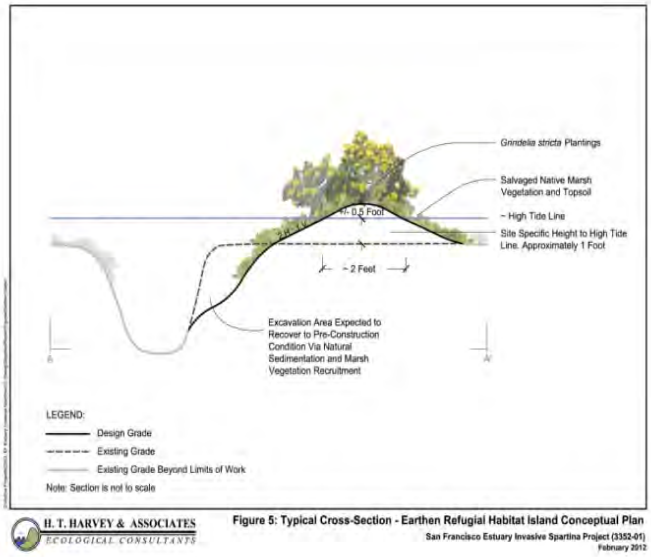


Figure 10. Left: conceptual drawing of proposed "earthen islands" that could be installed at strategic locations within tidal marsh plains. The islands would be densely planted with *Grindelia stricta*, and would be intended provide refuge for California clapper rail and other wildlife during extreme high tide events. *Right*: Cross section of an earthen island. The actual elevation will be determined based on site conditions, with the goal of having an area of about 12 square feet above Mean High Tide.

The Conservancy, ISP, and HTH staff worked iteratively with feedback from USFWS to try to identify and prioritize sites at which these islands might provide a real benefit to existing clapper rail populations, be feasible and cost-effective to construct, and meet changing requirements of USFWS. The current consensus within the project is that a total of 40 islands may be needed to meet USFWS requirements under the 2012 Biological Opinion, but that only 15 or 20 islands should be constructed this year, as a pilot project to inform additional future island installation.

3.3 Predator Control

> **Program Objective** (from 2012 Plan)*: Coordinate or assist predator control actions in locations where predation by land mammals has a potentially significant impact on California clapper rail populations.*

The Conservancy, ISP and HTH have considered what predator control enhancement in and around non-native *Spartina* treatment sites might benefit the clapper rail. A tall wooden piling used by raptors during hunting was removed from Arrowhead Marsh with assistance from East Bay Regional Parks District. Several other raptor perches have been identified and are proposed for removal this year.

Exhibit 4: March 22, 2012 ISP Revegetation Progress Report

4 PLANS FOR 2012-2013

4.1 2012-2013 Revegetation Program Plans

Planning for 2012-2013 revegetation began in March 2012. Progress has been made on site selection, revegetation maps, total plant number estimates and allocations by site, and propagation contracts. Plant material collections are underway and *Spartina foliosa* propagation in raised beds started in April 2012. **Figure 11** is a map illustrating the proposed 2012-2013 revegetation sites. The number of sites to be revegetated will depend on project funding, and the amount of plant material that can be produced by the nurseries (see discussion below). The Conservancy is working with The Watershed Nursery and other nurseries for propagation of *Spartina foliosa* and *Grindelia stricta.* The proposed plant numbers at a minimum will be 70,000 seedlings. They will include the following:

- *Spartina foliosa*: 29,000
- *Grindelia stricta*: 25,000
- *Leymus triticoides*: 8,000
- *Distichlis spicata*: 8,000

Table 4 shows the proposed 2012-2013 Revegetation Program timeline.

There will be less of a focus on ecotone/upland transition zone plantings, and an increased focus on *Spartina foliosa* and *Grindelia stricta* marsh plain plantings to enhance habitat for clapper rail. Save the

Table 4. Proposed 2012-2013 Revegetation Program Timeline

2012-13	May	June	July	August	September	October	November	December	January	February
Revegetation Program										
Prepare planting plans	Prepare planting plan									
Order plants from Nursery	Order plants									
Prepare sites (weeding)						clearing/weeding?			followup?	
Contracting			prepare SOWs & assist CWF as needed							
Installation							Plant Install (GRST first, SPFO secoı >>>			
Prepare "as built" maps										
Habitat Assessment Monitoring	Hab Assess Mon: wrap up									
Photopoints					Photopoint monitoring		Baseline photopoints			
Survivorship Monitoring					Survivorship monitoring					
Planting Method Assessment					Planting method assessment					
Maintenance						Maintenance activities must be scheduled on a site specific basis, according				
Write Reveg Progress Report	Report of progress through April 30				Report of progress through Aug 31					
Final Reveg Progress Report							Final Rept Oct 31			

Figure 11. Potential Revegetation Sites for 2012-2013.

Bay, Friends of Corte Madera Creek and other restoration partners will continue to restore ecotone habitats at selected sites. ISP will continue to work with and collaborate on revegetation with Save The Bay.

4.1.1 2012-2013 Propagation and Collection

The Watershed Nursery has built 30 additional raised beds for propagation of *Spartina foliosa*, for a total of 36 raised beds: 30 beds at 5 ft x 10 ft and 6 beds at 5 ft x 5 ft. All of the beds were constructed by TWN with the assistance of West Coast Wildlands. All beds were planted with 200 "plants" (a plant is defined here as several stems and at least one rhizome), with the end goal of producing 1000 plants. 800 of these plants will be for out-planting next season, and 200 will be held in the beds to re-populate them.

The ISP and West Coast Wildlands conducted the field collection of *Spartina foliosa* for the beds. 7,200 plants were required to fill the 36 beds. A collection of this size led to the development of a *Spartina foliosa* collection protocol written by the ISP. The collection protocol took into account a number of considerations to ensure the plants collected were pure *Spartina foliosa*, to maximize genetic diversity as well as to utilize any local adaptation to site conditions, and to minimize collection impacts on any one marsh throughout the San Francisco Estuary. The collection began in April and continued into early May 2012. Spartina foliosa was collected from eight source sites including the following marshes:

- Golden Gate Fields
- Port of Sonoma
- Seminary Cove
- Permanente Creek
- Alviso Slough
- Coyote Creek
- Napa River
- Starkweather Cove

The collection protocol is provided as **Appendix 3**.

As noted above, 20% (200 plants) will be held back to re-populate the beds the following season with the goal to reduce field collection of additional plant material in following planting years.

The Watershed Nursery is also vegetatively propagating *Leymus triticoides* and *Distichlis spicata* in raised beds, and propagating 20,000 *Grindelia stricta* in containers (18,000 D40s and 2,000 1-gallon size pots). The plants will be grown from *Grindelia stricta* seed collected from Newark Slough marshes by Pacific Coast Seed in the fall of 2011. Additional "left over" plant material from the 2011-2012 planting season is also being transferred from D16 to D40 and 1-gallon size pots. All plants will be salt hardened for 8 weeks prior to out planting.

Additional nurseries will propagate 5,000 more *Grindelia stricta* into D40s using the same growing conditions and treatments as TWN, including the salt hardening treatment.

4.1.2 2012-2013 Next Steps

The next steps in the Revegetation Program will be to refine the 2012-2013 site specific plans, estimated plant numbers, estimated number of planting days and associated site maps. This information will be integrated into the installation planning.

Ground truthing and 2011-2012 survivorship monitoring will begin this summer where breeding clapper rail are not present. However, the majority of the sites have rail present and the bulk of the ground truthing and monitoring will take place outside of the clapper rail breeding season. This information will inform the site specific plans, plant numbers and planting area maps.

Installation will begin in November and continue into January. In preparation for 2012-2013 installation, final specific salt hardening and planting schedules will be coordinated with the nurseries and installation contractors. Final coordination, site plans, and access routes will be planned in partnership with all land owners. Just prior to installation, planting areas and access routes will be flagged for the installation contractors, and updated site maps and species numbers will be provided to the contractors. Where rail are not present, planting will continue into February with the goal of wrapping up the 2012-2013 planting season as early as possible.

In preparation for 2013-14 plant propagation, plant numbers and palettes will need to be estimated. The needed seed collection for 2013 propagation will be planned and contracted in the summer for fall 2012 seed collection.

4.2 2012-2013 Floating Islands

The Conservancy is in the process of obtaining permits from USFWS for all ISP activities from June 1, 2012 through May 31, 2013. USFWS has requested roughly 40 additional floating islands at a variety of sites, to be installed in January 2013 to provide artificial nesting habitat at the sites from February 1 through August 31. The Conservancy is in the process of fundraising and planning for the implementation of these additional floating islands. USGS, the TAC, and other key partners will help to inform the methods and approach.

4.3 2012-2013 Constructed Islands and Refugia

USFWS has requested roughly 40 earthen islands at a variety of sites, to be installed after the 2013 treatment season. The Conservancy plans to pilot 15-20 earthen islands in November 2012 to learn more about best approach and locations for the islands. The Conservancy is in the process of fundraising and planning for the implementation of these additional floating islands. HT Harvey and Associates, the TAC, and other key partners will help to inform the methods and approach.

4.4 2012-13 Predator Control

The Conservancy, ISP, and HT Harvey and Associates have identified multiple site-specific predator issues and are working with land owners and the San Francisco Bay Joint Venture to develop a plan and approach with partners.