Environmental Compliance

Invasive *Spartina* Control Plan
ATTACHMENT 3

This section includes the following documents:

- Impact Identification Checklist
- Impact Mitigation Checklist
- Spartina Control Impact Evaluation Matrix Summary
- Required Permits and Authorizations Table

May 2005

SITE-SPECIFIC PROJECT IMPACT EVALUATION

Site Name: Point Pinole Regional Shoreline, Contra Costa County TSN: ISP-2004-10

*Impact**	*Appli-cable to Site*	*Applicable Mitigations* (by Treatment Method used at Site)*			*Comments/Analysis of Residual Impact at Site*	*Additional Mitigation Required*
		Herbicide				
GEO-1: Erosion or deposition of sediment at treatment site	NA/NE				NA/NE - Proposed activities are not ground disturbing and will not elevate erosion above ambient levels	None
GEO-2: Erosion or topographic change of marsh and mudflat by vehicles used in eradication	NA/NE				NA/NE - Proposed activities are not ground disturbing and will not elevate erosion above ambient levels. Any vehicle traffic will be confined to existing access roadways	None
GEO-3: Remobilization of sand in cordgrass-stabilized estuarine beaches	NA/NE				NA/NE - Proposed activities will not disturb sub-surface vegetation, providing residual erosion resistance	None
GEO-4: Increased demand for sediment disposal and potential spread of invasive cordgrass via sediment disposal.	NA/NE				NA/NE - No dredging/sediment disposal proposed	None
GEO-5: Increased volume and velocity of tidal currents in channels due to the removal of invasive cordgrass.	A	None			No adverse impact (see PEIS/R GEO-5 discussion). Site conditions consistent with those anticipated in the PEIS/R	No mitigation required
GEO-6: Increased depth and turbulence of tidewaters impounded in salt marsh pans.	NA/NE				NA/NE - Proposed activities will not take place within salt marsh pans	None
WQ-1: Degradation of water quality due to herbicide application	A	WQ-1			LTS/NLTAE - Potential impacts mitigated to less than significant. Site conditions consistent with those anticipated in the PEIS/R	None

Key: * Impact and mitigation numbering from ISP Control Program Programmatic EIS/R, August 2003

NA/NE – Not Applicable/No Effect

LTS/NLTAE – Less Than Significant impact/Not Likely to Adversely Effect

SU – Significant but unmitigable impact

USFWS BO – US Fish & Wildlife Service Biological Opinion

*Impact**	*Appli-cable to Site*	*Applicable Mitigations* (by Treatment Method used at Site)*			*Comments/Analysis of Residual Impact at Site*	*Additional Mitigation Required*
		Herbicide				
WQ-2: Degradation of water quality due to herbicide spills	A	WQ-2			LTS/NLTAE - Potential impacts mitigated to less than significant. Site conditions consistent with those anticipated in the PEIS/R	None
WQ-3: Degradation of water quality due to fuel or petroleum spills	A	WQ-3			LTS/NLTAE - Potential impacts mitigated to less than significant. Site conditions consistent with those anticipated in the PEIS/R	None
WQ-4: Degradation of water quality due to contaminant remobilization	NA/NE				NA/NE - No dredging or other sediment mobilizing activities proposed	None
WQ-5: Water quality effects resulting from sediment accretion	NA/NE				NA/NE - This impact only applies to PEIR/S Alternative 3	None
BIO-1.1: Effects on tidal marsh plant communities affected by salt-meadow cordgrass and English cordgrass.	NA/NE				NA/NE - Field surveys found no salt-meadow cordgrass or English cordgrass at this site	None
BIO-1.2: Effects on tidal marsh plant communities affected by Atlantic smooth cordgrass and its hybrids.	A	BIO-1.2			LTS/NLTAE - Potential impacts mitigated to less than significant. Site conditions consistent with those anticipated in the PEIS/R	None
BIO-1.3: Effects on tidal marsh plant communities affected by Chilean cordgrass.	A	BIO-1.3			LTS/NLTAE - Potential impacts mitigated to less than significant. Site conditions consistent with those anticipated in the PEIS/R	None
BIO-1.4: Effects on submerged aquatic plant communities.	NA/NE				NA/NE - Field surveys found no eelgrass or other submerged aquatic plants at the site	None
BIO-2: Effects on special-status plants (Soft bird's beak and/or Suisun thistle) in tidal marshes	A	BIO-2			LTS/NLTAE - Potential impacts mitigated to less than significant. Site conditions consistent with those anticipated in the PEIS/R	None

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		Herbicide				
BIO-3: Effects on shorebirds and waterfowl.	A	BIO-3			LTS/NLTAE - Potential impacts mitigated to less than significant. Site conditions consistent with those anticipated in the PEIS/R	None
BIO-4.1: Effects on the salt marsh harvest mouse and tidal marsh shrew species.	A	BIO-4.1 as modified by the USFWS BO			LTS/NLTAE - Potential impacts mitigated to less than significant (per PEIS/R, Impact/Mitigation BIO-4.1). Site conditions consistent with those anticipated in the PEIS/R	None
BIO-4.2: Effects on resident harbor seal colonies of San Francisco Bay.	NA/NE				NA/NE - No harbor seal colonies at or near site	None
BIO-4.3: Effects on the southern sea otter.	NA/NE				NA/NE - Outside of the range of southern sea otters	None
BIO-5.1: Effects on the California clapper rail.	A	BIO-5.1 as modified by the USFWS BO			LTS/NLTAE – At site - Potential project impacts mitigated at site SU cumulative impacts addressed in PEIS/R and CEQA findings	None
BIO-5.2: Effects on the California black rail.	A	BIO-5.2			LTS/NLTAE - Potential impacts mitigated to less than significant. Site conditions consistent with those anticipated in the PEIS/R	None
BIO-5.3: Effects on tidal marsh song sparrow subspecies and the salt marsh common yellowthroat.	A	BIO-5.3			LTS/NLTAE - Potential impacts mitigated to less than significant. Site conditions consistent with those anticipated in the PEIS/R	None
BIO-5.4: Effects on California least terns and western snowy plovers.	NA/NE				NA/NE - Outside of the range of least terns and snowy plovers.	None

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		Herbicide				
BIO-5.5: Effects on raptors (birds of prey).	NA/NE				NA/NE - No aerial applications proposed for this site	None
BIO-6.1: Effects on anadromous salmonids (winter-run and spring-run Chinook salmon, steelhead).	A	BIO-6.1- mini-mize spraying			LTS/NLTAE - Potential impacts mitigated to less than significant. Site conditions consis-tent with those anticipated in the PEIS/R	None
BIO-6.2: Effects on delta smelt and Sacramento splittail.	NA/NE				NA/NE - Project site outside of delta smelt and Sacramento splittail range	None
BIO-6.3: Effects on the tidewater goby.	NA/NE				NA/NE - Project site outside of tidewater goby range	None
BIO-6.4: Effects on estuarine fish populations of shallow submerged intertidal mudflats and channels.	A	BIO-6.4- mini-mize spraying			LTS/NLTAE with additional mitigation BIO-6.4(b) No mowing proposed for this site	BIO-6.4(b)- R-11 will not be used adjacent to channels to minimize any potential adverse impacts on estuarine fish.
BIO-7: Effects on California red-legged frog and San Francisco garter snake.	NA/NE				NA/NE - Outside of known range of Califor-nia red-legged frog and San Francisco gar-ter snake.	None
BIO-8: Effects of regional invasive cordgrass eradication on mosquito production.	NA/NE				NA/NE - Site activities will not create addi-tional mosquito habitat	None
BIO-9: Effects on tiger beetle spe-cies.	NA/NE				NA/NE - No adverse impact. Site conditions consistent with those anticipated in the PEIS/R	None
AQ-1: Dust emissions.	A	AQ-1			LTS/NLTAE - Potential impacts mitigated to less than significant. Site conditions consis-tent with those anticipated in the PEIS/R	None

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		Herbicide				
AQ-2: Smoke emissions.	NA/NE				NA/NE - No burning proposed	None
AQ-3: Herbicide effects on air quality.	NA/NE				NA/NE - No aerial applications proposed for this site	None
AQ-4: Ozone precursor emissions.	NA/NE				LTS/NLTAE without mitigation	None
AQ-5: Carbon monoxide (CO) emissions.	NA/NE				LTS/NLTAE without mitigation	None
N-1: Disturbance of sensitive re-ceptors	A	N-1			LTS/NLTAE - Potential impacts mitigated to less than significant. Site conditions consis-tent with those anticipated in the PEIS/R	None
HS-1: Worker Injury from acci-dents associated with manual and mechanical cordgrass treatment.	NA/NE				NA/NE - No manual or mechanical treatment proposed	None
HS-2: Worker health effects from herbicide application.	A	HS-2			LTS/NLTAE - Potential impacts mitigated to less than significant. Site conditions consis-tent with those anticipated in the PEIS/R	None
HS-3: Health effects to the public from herbicide application.	A	HS-3			LTS/NLTAE - Potential impacts mitigated to less than significant. Site conditions consis-tent with those anticipated in the PEIS/R	None
HS-4: Health effects to workers or the public from accidents associ-ated with treatment.	A	HS-4			LTS/NLTAE - Potential impacts mitigated to less than significant. Site conditions consis-tent with those anticipated in the PEIS/R	None
VIS-1: Alteration of views from removal of non-native cordgrass infestations.	A	VIS-1			LTS/NLTAE - Potential impacts mitigated to less than significant. Site conditions consis-tent with those anticipated in the PEIS/R	None

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		Herbicide				
VIS-2: Change in views from native marsh, mudflat, and open water to non-native cordgrass meadows and monocultures.	NA/NE				NA/NE - Applies only to PEIS/R Alternative 3 (No Action)	None
LU-1: Land use conflicts between herbicide use and sensitive receptors	A	LU-1			LTS/NLTAE - Limited to less than significant by HS, N and AQ mitigations.	None
LU-2: Land use conflicts from mechanical and burning treatment methods	NA/NE				NA/NE - Methods not proposed for the site	None
CUL-1: Disturbance or destruction of cultural resources from Access and Treatment.	NA/NE				NA/NE - No manual or mechanical methods proposed for this site	None
CUL-2: Loss of Cultural Resources from Erosion.	NA/NE				NA/NE - No erosion-producing activities proposed for this site	None
CUM-1- Effects of wetland restoration projects on spread of non-native cordgrass	NA/NE				NA/NE - No restoration projects proposed on this site	None
CUM-2- Cumulative damage to marsh plain vegetation	NA/NE				NA/NE - No Mosquito Abatement Districts working on this site	None

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Date___/___/___

SITE-SPECIFIC PROJECT MITIGATION

Site Name: Point Pinole Regional Shoreline TSN: ISP-2004-10

Impact	*Applicable Mitigation*	*Herbicide*	*Implementation Timing*	*Verification Signatures*		*Notes*
				Implementing Entity	*ISP Field Supervisor*	
WQ-1: Degradation of water quality due to herbicide application	Apply herbicide directly to plant at low tide and according to label. (WQ-1;CM-3,4)	X	During treatment			
WQ-2: Degradation of water quality due to herbicide spills	Apply under supervision of trained applicator (WQ-2CM-3)	X	During treatment			
	Implement spill and containment plan provided or approved by ISP (WQ-2;CM-17)	X	During treatment			
WQ-3: Degradation of water quality due to fuel or petroleum spills	Implement spill and containment plan provided or approved by ISP(WQ-3;CM-17)	X	During treatment			
BIO-1.2: Effects on tidal marsh plant communities affected by Atlantic smooth cordgrass and its hybrids.	Minimize entry and re-entry into marsh (BIO-1.2;CM-1)	X	During treatment			
	Avoid staging in high, dense vegetation such as gumplant or pickleweed (FWS GL)	X	During treatment			
	Avoid herbicide application to non-target vegetation adjacent to treatment area (BIO-1.2;CM-3,4)	X	During treatment			
	Cover adjacent non-target special-status vegetation with temporary fabric as needed (BIO-1.2)	X	During treatment			
BIO-1.3:Effects on tidal marsh plant communities by Chilean cordgrass	Minimize entry and re-entry into marsh (BIO-1.3;CM-1)	X	During treatment			

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Mitigations are from corresponding numbered mitigation in the same document,
Also included are the USFWS general and site-specific biological opinions Conservation Measures (CM).

Impact	*Applicable Mitigation*	*Herbicide*	*Implementation Timing*	*Verification Signatures*		*Notes*
				Implementing Entity	*ISP Field Supervisor*	
	Avoid herbicide application to non-target vegetation adjacent to treatment area (BIO-1.3;CM-3,4)	X	During treatment			
	Cover adjacent non-target special-status vegetation with temporary fabric as needed (BIO-1.3)	X	During treatment			
BIO-2: Effects on special-status plants (Soft bird's beak and/or Suisun thistle) in tidal marshes	Pre-project surveys for *Cordylanthus mollis mollis* and *Circium hydrophilum hydrophilum*(BIO-2;CM-22)	X	Pre-treatment			
	Field crews will be instructed on ID and avoidance of *Cordylanthus mollis mollis* and *Circium hydrophilum hydrophilum* (BIO-2)	X	Pre-treatment			
	On site qualified botanical supervision (BIO-2;CM-23)	X	During treatment			
	Cover non-target *Cordylanthus mollis mollis* and *Circium hydrophilum hydrophilum* with fabric during spray work (BIO-2)	X	During treatment			
BIO-3: Effects on shorebirds, waterfowl & marshland birds.	Avoid working within 1,000 feet of occupied mudflats during peak Pacific Flyway stopovers (BIO-3)	X	During treatment			
	Occupy treatment area soon after high tide, before mudflats emerge (BIO-3)	X	During treatment			
	Haze shorebirds to minimize potential direct contact with herbicide drift (BIO-3)	X	During treatment			

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Impact	*Applicable Mitigation*	*Herbicide*	*Implementation Timing*	*Verification Signatures*		*Notes*
				Implementing Entity	*ISP Field Supervisor*	
BIO-4.1: Effects on the salt marsh harvest mouse and tidal marsh shrew species.	Use shortest possible access route through any pickleweed habitat. Flag areas of repeated access (BIO-4.1;CM-15)	X	During treatment			
	Use protective mats or other covering over pickleweed in areas or repeated access (BIO-4.1;CM-15)	X	During treatment			
	Assume presence of SMHM on all suitable sites (CM 14)	X	During treatment			
	Whenever possible, schedule work after mass mortality events caused by extreme high tides (CM 16).	X	Pre-treatment			
BIO-5.1: Effects on the California Clapper rail.	Perform work only during Sept 1 thru Feb 1 to avoid CLRA breading season (BIO-5.1;CM-18)	X	During treatment			
	For work within the Clapper Rail breeding season, call counts will be performed in the early spring according to FWS protocols (CM-18)	X	Pre treatment			
	Provide CLRA Field biologist supervision (BIO-5.1)	X	During treatment			
	Assure that field personnel are trained in general CLRA biology and CLRA identification and call detection (BIO-5.1)	X	Pretreatment and during treatment			
	Report any CLRA activity immediately to ISP Field Supervisor and in post-treatment report (BIO-5.1)	X	During and post treatment			

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Also included are the USFWS general and site-specific biological opinions Conservation Measures (CM).

Impact	*Applicable Mitigation*	*Herbicide*	*Implementation Timing*	*Verification Signatures*		*Notes*
				Implementing Entity	*ISP Field Supervisor*	
BIO-5.2: Effects on the California Black rail	Perform work only during Sept 1 thru Feb 1 to avoid CABR breeding season (BIO-5.2)	X	During treatment			
	For work within the CABR breeding season, call counts will be performed in the early spring according to FWS protocols (BIO-5.2)	X	Pre-treatment			
	Provide CABR Field Biologist Supervision (BIO-5.2)	X	Pre-treatment and During treatment			
	Assure that field personnel are trained in general CABR biology and identification as well as call detection (BIO-5.2)	X	Pre-treatment and During treatment			
	Report any CABR activity immediately to ISP Field Supervisor and in post-treatment report (BIO-5.2)	X	During treatment and Post-treatment			
BIO-5.3: Effects on tidal marsh song sparrow subspecies and the salt marsh common yellowthroat.	Implement CLRA timing restriction (most restrictive)	X	During treatment			
	Report any SMSS and SCYE activity immediately to ISP Field Supervisor and in post-treatment report (BIO-5.3)	X	During and post treatment			
	Avoid spraying or removing Grindelia plants in the marsh	X	During treatment			
	Watch for Song Sparrow presence in the work area during early season treatment work (pre-August), especially in the smaller, upper reaches of channels.	X	During treatment			

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Mitigations are from corresponding numbered mitigation in the same document,
Also included are the USFWS general and site-specific biological opinions Conservation Measures (CM).

Impact	*Applicable Mitigation*	*Herbicide*	*Implementation Timing*	*Verification Signatures*		*Notes*
				Implementing Entity	*ISP Field Supervisor*	
BIO-6.1: Effects on anadromous salmonids (winter-run and spring-run Chinook salmon, steelhead).	Target herbicide applications to minimize herbicide use near channel (BIO-6.1).	X	During treatment			
	Avoid use of alylphenol ethoxylate surfactants Dec 1 thru April 1 to avoid steelhead spawning. (BIO-6.1)	X	During treatment			
BIO-6.4: Effects on estuarine fish populations of shallow submerged intertidal mudflats and channels.	Bio-6.4 – minimize spraying near channels (BIO-6.4)	X	During treatment			
	Avoid use of alylphenol ethoxylate surfactants adjacent to channel to minimize any potential adverse affects on estuarine fish.	X	During treatment			
AQ-1: Dust emissions	Limit speeds on dirt roads to 15 miles per hour (AQ-1)	X	During treatment			
N-1: Disturbance of sensitive receptors	Comply with all local noise ordinances (N-1)	X	During treatment			
HS-2: Worker health effects from herbicide application.	Follow handling and application procedures as identified on product label (HS-2;CM-3)	X	During treatment			
HS-3: Health effects to the public from herbicide application.	Minimize drift according to ISP drift management plan (HS-3;CM-3,4)	X	During treatment			
	Post appropriate signage (see attached signage requirements) a minimum of 24 hours pre-treatment (HS-3)	X	Pre-treatment			
	Avoid scheduling herbicide application near high public use areas during weekends or holidays, or close public access to area 24 hours before and after treatment. (HS-3)	X	Pre-treatment and during treatment			

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Impact	*Applicable Mitigation*	*Herbicide*	*Implementation Timing*	*Verification Signatures*		*Notes*
				Implementing Entity	*ISP Field Supervisor*	
HS-4: Health effects to workers or the public from accidents associated with treatment.	Maintain ISP or approved equivalent Site Safety and Spill Prevention plan on site (HS-4;CM-3,4,17)	X	During treatment			
VIS-1: Alteration of views from removal of non-native cordgrass Infestations.	Post appropriate signage according to ISP signage protocols (VIS-1)	X	Pre-treatment, during treatment, post-treatment			
CM-7: Invasive species	Monitor cleared patches for recruitment of invasive plant species including perennial pepperweed until native vegetation has become dominant (CM-7)	X	Post treatment			

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Mitigations are from corresponding numbered mitigation in the same document,
Also included are the USFWS general and site-specific biological opinions Conservation Measures (CM).

Non-Native *Spartina* Control Impact Evaluation Matrix (SCIE-M)

Estimating the impact of *Spartina* control on the California clapper rail carrying capacity of San Francisco Bay tidal marshes

May 2005

E.K. Grijalva, Invasive *Spartina* Project
J.D. Albertson, US Fish & Wildlife Service, Don Edwards San Francisco Bay NWR

I. Introduction

Staff from the Invasive *Spartina* Project (ISP) and the Don Edwards San Francisco Bay National Wildlife Refuge (Refuge) have developed the *Spartina* Control Impact Evaluation Matrix (SCIE-M) to quantify temporary impacts to marshland habitat that will occur as a result of non-native *Spartina* Control through four years of anticipated treatment activities – 2005-2008, and to assess whether these impacts will affect California clapper rail (clapper rail) populations. This document summarizes the results of this analysis for the purposes of assessing and quantifying potential affects to clapper rail populations in the Bay due to temporary habitat loss, both on a site-specific and a regional basis. Affects are quantified in terms of clapper rail *carrying capacity* of marshes, as detailed below.

II. Summary of Methods

Potential habitat impacts were determined through the analysis of existing site conditions, proposed treatment regimes, proposed treatment methods, efficacies associated with each treatment method, and post-treatment habitat values of successfully treated *Spartina* stands. The potential temporary impact to the clapper rail carrying capacity of treated marshes was determined based on the pre- and post-treatment habitat values for treated marshes, current and historic clapper rail populations in treated marshes, and estimated habitat acreage requirements for breeding clapper rails based on home range core-use area size as determined through radio-telemetry (Albertson 1995). Section IV (below) provides a detailed analysis of methods used to determine efficacy, post-treatment habitat values, and impacts to clapper rail carrying capacity.

III. Results

Twenty-two sites containing 132 sub-areas are slated for *Spartina* control over the four years (2005-2008) analyzed in the SCIE-M. According to 2005 survey data, 45 of these sub-areas are uninhabited by clapper rail. Of the remaining 87 sub-areas, post-treatment carrying capacity on treated marshes exceeds the pre-treatment population numbers for the marsh on all but 21 sub-areas. This means that post-treatment acreage within these sub-areas has been determined to be more than sufficient to support the current rail populations there. When the remaining 21 sub-areas were analyzed in context with adjacent usable habitat within the site and between contiguous sites, only the following three sites showed a net loss of carrying capacity following treatment:

1) Site 17: San Leandro Bay Complex, Alameda County,
2) Site 19: Colma Creek Complex, San Mateo County, and,
3) Site 20 (Sub-Areas m-o): Cogswell Marsh.

As with each of the sites (and sub-areas) addressed in the SCIE-M, these three sites were analyzed over the entire four-year scope of the model[1]. Table 1 summarizes the estimated reduction in clapper rail carrying capacity at each of these sites each year over that four-year period.

[1] The SCIE-M incorporates estimated expansion rates of the non-native *Spartina* on each site (50% increase of untreated or surviving plants per year), as well as phasing of treatment methods over four years. Phasing of treatments aims to minimize impacts to clapper rail in any given season, while achieving a level of *Spartina* control sufficient to keep the infestation from expanding within or between sites. See Section IV D.

Table 1: Changes in clapper rail carrying capacity at sites showing net loss of carrying capacity over four years of Spartina treatment [G1]

Site	Initial estimated rail carrying capacity	Change per treatment year			
		2005	2006	2007	2008
17. San Leandro Bay	125.0	+6.22	-7.23	-7.72	+2.09
19. Colma Creek Complex	82.0	-8.12	-16.89	-12.71	-3.80
20. Cogswell Marsh (sub-areas m-o)	85.0	+9.15	-2.62	+16.78	+16.78
Total	**292.0**	-8.12	-26.74	-20.42	-3.8

Over the four-year scope of the SCIE-M analysis, the majority of the estimated decrease in clapper rail carrying capacity will occur during years two and three of treatment activities. Treatment in the last season of control will result in a loss of carrying capacity on only one of the three sites. Only in the second year of treatment (2006) will all three sites identified above show a net decrease in carrying capacity. In the first and fourth years (2005 and 2008 respectively), only Site 19 will show a net decrease in carrying capacity[G2]. Change in carrying capacity is only summed across sites where there are decreases in carrying capacity on individual sites. In other words, a carrying capacity figure that shows a net positive amount of carrying capacity remaining following treatment, has not been used to buffer negative carrying capacity numbers from other disparate locations.

IV. Detailed Analysis

A) Efficacy

The ISP and Refuge staffs have assigned each planned *Spartina* treatment method a specific efficacy (removal success) based on observations from local and Willapa Bay, WA *Spartina* treatment work. Each estimated efficacy represents the higher end of the range of efficacies possible with each treatment. This more conservative approach therefore attempts to identify the maximum possible impact to vegetative cover in treated areas. It is likely that actual on the ground efficacies will be less than those estimated given the variables of leaf-surface silt deposition, tidal windows, growth stage, weather, and other factors which may inhibit maximum translocation of applied herbicides. Table 3 shows the estimated efficacies of various *Spartina* treatment methods.

Individual sites slated for *Spartina* treatment were then evaluated for the appropriateness of any or all of the above treatment methods. The acres treated by each treatment method on a site were then multiplied against the efficacy of that method, and the resulting values of each method added together to arrive at the overall adjusted treatment acreage. For example:

> The *Bair & Greco Islands Complex, Sub-Area 2c - B2 North Quadrant* has 540.8 total marsh acres, with 45 net acres of non-native *Spartina* to be treated. Treatment on this site involves the use of backpack sprayers (1 acre), boats with spray equipment (9 acres), and aerial treatment via helicopter (35) acres. With this information, the amount of vegetation that would be effectively removed by each herbicide can be calculated as follows:
>
> For glyphosate: 1(0.50) + 9(0.60) + 35(0.30) = 16.4 ac. of vegetation effectively removed
> = 36% of treated *Spartina*
> = 3% of the site's total marsh area
>
> For imazapyr: 1(0.75) + 9(0.80) + 35(0.80) = 36.0 ac. of vegetation effectively removed
> = 80% of treated *Spartina*
> = 7% of the site's total marsh area

B) Post-Treatment Habitat Values

The "vegetation removal" estimates above (16.4 ac. for glyphosate and 36.0 ac. for imazapyr), considered the efficacy of the treatment method, but they do not reflect what habitat value the "devege-

Table 2. Estimated efficacies of various Spartina treatment methods

Method	***Efficacy****	
Non-chemical control methods		
Cover with fabric	95%	
Manual digging	95%	
Mechanical Excavation	95%	
Chemical control methods		
	Glyphosate	*Imazapyr*
Conventional spray truck	60%	80%
Backpack sprayer	50%	75%
Amphibious tracked vehicle	60%	80%
Boat with spray tank/hose	60%	80%
Aerial (Helicopter)	30%	80%
* "60% efficacy" means that 60% of the target vegetation is killed and 40% is expected to be unaffected or will re-grow the following year.		

tated" area might still provide. Observations of treated *Spartina* infestations in San Francisco Bay, including sites in the Don Edwards San Francisco Bay National Wildlife Refuge, indicate that considerable habitat value is maintained post-treatment in successfully treated stands of non-native *Spartina*. In fact, studies show an average of 56 - 82% relative cover of standing dead *Spartina* and native vegetation in the year following the first treatment (USFWS unpubl. data, Zaremba 2001), and, as will be described further below, these areas continued to provide habitat for breeding clapper rails and other species. Following treatment, the aboveground, standing wrack of non-native *Spartina* typically remains until mid-winter on exposed sites and longer in more sheltered sites. On sites of higher elevation, once the standing *Spartina* wrack begins to diminish, seedling recruitment under the dying *Spartina* canopy typically begins, with annual and perennial pickleweeds (*Salicornia europaea* and *S. virginica* respectively), gumplant (*Grindelia stricta*), and other native marsh plants dominating. Following treatment on lower sites, open mudflats are restored, enhancing foraging grounds. In the absence of continued invasion pressure from adjacent untreated stands of non-native *Spartina*, treated marshland areas begin natural, native successional patterns soon after the treated *Spartina* thins and is eventually removed.

Because of these phenomena, the estimates of vegetation removal described in the previous section should not be used alone to evaluate the impact to habitat caused by removal of non-native *Spartina*. *The area of Spartina removed does not equal the amount of habitat that is removed from use by marshland animal species on the site.* Treatment of non-native *Spartina* infested areas is not analogous to paving a parking lot, where the post-project habitat value approaches zero. Rather, a non-native-dominated marsh assemblage is transitioned to a native-dominated marsh assemblage, beginning almost immediately following treatment and continuing over several growing seasons

To accommodate this occurrence, a "post-treatment habitat value" was factored into the impact estimation model used in the SCIE-M. Based on past observations by ISP and Refuge staffs, the post-treatment habitat value for treated marshes estimated across function (foraging, shelter, breeding, etc.) and across time (1st, 2nd & 3rd year post-treatment), was determined to be 40% of pre-treatment levels. For the purposes of the SCIE-M, the pre-treatment habitat value of the non-native *Spartina*-infested marsh was assumed to be 100%, rather than some reduced or elevated amount. To incorporate post-treatment habitat value into the model, the acreage of "vegetation effectively removed" calculated in the previous section was reduced by 40% to provide an estimate of "habitat value ef-

fectively removed." Continuing the example started above, the adjusted "removed habitat" values are calculated as follows:

For glyphosate:	16.4 acres x 0.60 =	9.84 ac. of vegetated habitat removed
	=	1.8% of the site's total marsh area
For Imazapyr:	36.0 acres x 0.60 =	21.6 acres of vegetation to be removed
	=	4% of the site's total marsh area

C) Carrying capacity and quantifying potential impacts to California clapper rail

The net acreages of "vegetated habitat removed" (calculated above) were then considered in conjunction with the known populations of clapper rail in these marshes and calculated core-use and homerange areas to estimate the potential exposure of rail to temporary habitat loss. For the purposes of this analysis, affects to rails were defined in terms of potential loss of clapper rail *carrying capacity* of marshes. The population data used for this analysis came from recent surveys, and from the ISP-coordinated Bay-wide clapper rail survey conducted in January-March 2005 (including new data by East Bay Regional Parks District, California Department of Fish and Game, Point Reyes Bird Observatory, Avocet Research, ISP, and Refuge).

1) Homerange and Core-use areas

Albertson (1995) estimated that a California clapper *rail pair* requires approximately 3.44 acres (1.39 hectares) of core-use habitat for successful breeding based on radio telemetry studies. This number represents the average size of the *overall core-use area* of a rail territory throughout the 11-month study period in Mowry Marsh, the marsh with the largest determined core-use area in this study. A core-use area is the highly defended portion of a homerange that is nearly exclusive to a rail pair. There is little overlap between core-use areas of adjacent rail pairs within a marsh. Core-use areas are defined as the area of a minimum convex polygon (MCP) containing 50% of the rail relocations in a telemetry study (Anderson 1982, White and Garrott 1990, Albertson 1995). In contrast, the homerange, which contains 95% of the rail relocations, has been found to overlap considerably between adjacent individuals (Zembal et al. 1989, Albertson 1995). Overall core-use area is defined as the minimum convex polygon area that includes 50% of the rail relocations throughout a year. Albertson (1995) also determined core-use area sizes for different seasons of the year.

To be conservative in our impacts assessment, we assume a core-use area size of 3.4 acres *per rail* (not per pair), which is twice the size of the largest estimated overall core-use area in Albertson (1995). This equates to a rail population density of 0.29 rails/acre (0.73 rails/hectare), which is considered a medium rail density for a marsh. Our approach allows for some differences in core-use area movements between males and females of a pair and accounts for portions of treated marshes where habitat may be less than optimal. The analysis allows for 6.8 acres of exclusive marsh habitat per rail pair (2.75 hectares), which is nearly the same size as some seasonal homeranges (95% MCP) in the Albertson study, and more than sufficient core area acreage to support a rail pair. Realistically, there is probably at least a 50% overlap between male and female core areas, which would result in a 5.1-acre core area for the pair (or 2.55 acres/bird).

2) Carrying Capacity

Using the core-use area estimate of 3.4 acres per rail, the existing clapper rail carrying capacity in targeted marshes was estimated by dividing the total marsh acreage by 3.4. The results of that calculation were used as the carrying capacity for the marsh *unless* the observed carrying capacity (i.e. the current rail population) in the marsh exceeded this number, in which case we used the current rail population number as the carrying capacity value in our calculations. Post-treatment carrying capacities were estimated using the same criteria, then compared to pre-treatment carrying capacity levels to determine potential impacts to clapper rail. It is important to note that the use of the current rail population number as the carrying capacity value creates the assumption that the carrying capacity has been reached in that marsh and that any habitat loss will cause rail impacts. This, in

fact, may not be true in all marshes. So, in summary, negative carrying capacity values represent maximum rail impacts that could be reached if the carrying capacity in a marsh has already been reached and that carrying capacity will be reduced as a result of habitat loss from *Spartina* control activities.

However, if carrying capacity has not actually been reached in a marsh, then the calculated lost carrying capacity may not represent actual lost carrying capacity, because some (or all) of the rails in the lost acreage may be able to be absorbed into the remaining habitat on site. For this reason, an assessment of the validity of all negative carrying capacity values will be done on a site-by-site basis, looking at both historic rail numbers in those marshes and/or comparing known clapper rail breeding densities in similar marshes around the San Francisco Bay. As a result of such an assessment, it may be determined that fewer rails will be impacted in certain marshes.

Note: When rail density in a sub-area marsh was determined to be equal to or less than 0.04 rails/acre, the sub-area carrying capacity values were not included in our summed carrying capacity values for the site or Bay-wide. Such a low rail density in a sub-area strongly indicates very low habitat value for rails and it cannot be assumed that 3.4 acres of this habitat would support a rail. When the 0.04 rails/acre density is converted to terms of carrying capacity, this would mean that each rail would need 25 acres of core-use habitat. In reality, rails using low value marshes do not use all areas of the marsh, but instead use the wider, higher portions, leaving much of the marsh uninhabited. Since rails are not likely to use much of the marsh acreage within these sub-areas, carrying capacity values would be artificially inflated and would give a much larger estimate for suitable breeding habitat than actually exists. For this reason, we excluded these very low rail density marshes from our analysis.

To be conservative, the SCIE-M assumed that imazapyr would be the preferred treatment method, as it has greater efficacy than glyphosate and would therefore have greater potential to impact the marsh habitat values and clapper rail carrying capacity.

Continuing the example started above for the 540.8-acre north quadrant of Baer Island, and using the most recent survey data for the site (10 clapper rails present) the change in clapper carrying capacity would be calculated as follows:

Pre-treatment carrying capacity:	540.8 ac. marsh site ÷ 3.4 ac. per rail =	159.1 rails
Post-treatment habitat:	540.8 ac. site - 21.6 ac. of habitat removed =	519.2 acres
Post-treatment carrying capacity:	519.2 ac. post-treatment habitat ÷ 3.4 ac. per rail =	152.7 rails
Change in carrying capacity:	159.1 pre-treatment capacity - 152.7 post-treatment capacity =	- 6.4 rails

In this example, since the pre-treatment population was 10 clapper rails, a post-treatment carrying capacity of 124.9 rails shows that ample habitat remains for the birds following treatment. In other cases where the post-treatment carrying capacity becomes less than is necessary for existing rail populations, a 'take' may be indicated. Before a take is assumed for any of the sub-areas analyzed however, the sub-area is further scrutinized to see how it fits into any adjacent habitats suitable as refugia for clapper rail subject to take at a given sub-area. Thus, *a take would not be generated unless the post-treatment carrying capacity of geographically contiguous sites resulted in a carrying capacity insufficient to maintain current population levels on the site* (also see the note above for discussion of actual lost carrying capacity in areas where negative carrying capacity is calculated).

D) Phased Treatment Approach

As mentioned above in the Results section, three main areas are called out as having a net decrease in CC during at least one of the control seasons covered in this analysis. Impacts on these sites do not assume a single season treatment of all non-native *Spartina* present. Rather, these numbers are

derived from a phased treatment approach on each of the sites. *Spartina* treatment on any site must proceed rapidly enough to outpace the estimated expansion rate of the non-native *Spartina* in each of these marshes, while minimizing the impacts to rails. Table 3 details the percent of non-native *Spartina* treated in each year under the phased approach and the total *Spartina* acres on the site as calculated via efficacy of the previous years' treatment, treated acreage, and expansion rate of the infestation:

Table 3: Net area of non-native *Spartina* to be treated per site, per year, under the phased treatment approach

	Treatment Year						
	2005			2006			
Site	Acres of *Spartina* within Site	Acres of *Spartina* Treated	% of *Spartina* Treated	Acres of *Spartina* within Site	Acres of *Spartina* Treated	% of *Spartina* Treated	
17 San Leandro Bay	88.5	36.3	41.0%	89.9	66.5	74.0%	
18 Colma Creek Complex	56.0	26.5	47.3%	52.3	41.8	79.9%	
20 (m-o) Cogswell Marsh	144.4	75.0	51.9%	114.6	114.6	100.0%	
	Treatment Year						
	2007			**2008**			**2009**
Site	**Acres of Spartina within Site**	**Acres of Spartina Treated**	**% of Spartina Treated**	**Acres of Spartina within Site**	**Acres of Spartina Treated**	**% of Spartina Treated**	**Remaining Spartina**
17 San Leandro Bay	54.4	50.4	93.0%	21.4	21.4	100.0%	6.5
18 Colma Creek Complex	28.3	28.3	100.0%	8.5	8.5	100.0%	2.6
20 (m-o) Cogswell Marsh	34.4	34.4	100.0%	10.3	10.3	100.0%	3.1

The results of Table 1 and Table 3 indicate that as the amount of *Spartina* on each site decreases each year as a result of treatment, so too does the potential impact to clapper rail habitat. Each individual year's *Spartina* acreage estimates are estimates of both untreated and surviving *Spartina* within the marsh multiplied by the estimated expansion rate. These plants may be growing within dead stands of the previous year's *Spartina* infestation (resprouts), or in newly establishing clones adjacent to treated areas.

V. Update on rail populations in 2004 treated marshes

In 2004, *Spartina* control was conducted in a number of marshes in South San Francisco Bay. Comparisons of 2004 and 2005 rail populations from breeding season call counts conducted in 2004 treated marshes shows no reduction in rail numbers, even though some rail impacts were predicted and quantified using the 2004 method of impacts analysis. In fact, preliminary rail numbers for treated sites show increased rail numbers between 2004 and 2005: Site 1 (Alameda Flood Control Channel) increased from 33 to 43 rails, Site 13a-c (Old Alameda Creek) increased from 18 to 24 rails, and Site 5d (LaRiviere Marsh) increased from 12 to 18 rails. Although vegetation surveys have not been conducted in these treated marshes yet, substantial standing vegetation is visible in the marshes, consisting of both standing dead *Spartina* and native species. In addition, rail call counts show that distribution of rails within these marshes has not changed substantially between 2004 and 2005.

VI. Discussion of SCIE-M method of rail impact analysis

We used the 2004 rail population numbers and compared the impacts calculated with both the 2004 impacts analysis and the 2005 SCIE-M analysis. We then looked at the 2005 rail population data to see if how well results of each analysis compared to the actual number of rails counted.

For example, in Old Alameda Creek Island (Subarea 13b), where 16 acres of cordgrass were treated (20 % of the marsh), the 2004 model predicted an impact to 2.24 rails. In comparison, using the 2005 SCIE-M method of impacts analysis for assessing this 2004 data, no rail carrying capacity reduction is predicted since the estimated carrying capacity of the marsh exceeds the current population by 10. In fact, data show that rail numbers in this subarea remained stable at 14 rails between 2004 and 2005. In this case, the SCIE-M model gives the accurate result.

In LaRiviere Marsh (Subarea 5d), where 25 acres of cordgrass were treated (25% of the marsh), the 2004 model predicted an impact to 1.8 rails. In comparison, the 2005 SCIE-M model predicts that a value of 10 rail carrying capacity units will still remain. Data show that rail numbers actually increased in LaRiviere from 12 rails in 2004 to 18 rails in 2005. Again, the SCIE-M model gives a more accurate result.

In comparing the results of the two models, we must remember that the 2004 impacts analysis is a simple model, which quantifies impacts using density of rails in a marsh multiplied by the number of acres of treated *Spartina*. The model assumes that rails are evenly spread throughout the marsh, utilizing the entirety of the marsh. While this method of analysis gives a rough quantification of impacts, it probably greatly overestimates impacts in most low to mid-density marshes because rails actually utilize defined homeranges within a larger area, and do not expand homerange sizes indefinitely to "fill" unused spaces in the marsh. In fact, most rail activity, including nesting and calling, occurs in the core home range of about 3.4 acres, with additional areas of the homerange (95% MCP) used for foraging. The core homerange is the only part of the homerange that is highly defended and exclusive of other rail pairs. The remainder of the homerange may be shared between adjacent rail pairs. Extent of overlap of this undefended portion of the homerange between adjacent pairs is higher in higher density rail marshes.

In comparison, the 2005 SCIE-M model incorporates post-treatment habitat values and information about rail core home range size, which was lacking from the 2004 impacts analysis. It also takes into account rate of *Spartina* spread for untreated acreages within sites, and provides a mechanism for phasing treatment in a way that minimizes rail impacts each control year and cumulatively, while still reaching *Spartina* Control Program control objectives with four years of treatment.

As a result of these comparisons, the *Spartina* Control Program is proposing to use the SCIE-M method of rail impact analysis in 2005 because we believe it provides a more accurate quantification of potential habitat loss-related impacts to rails than the rail impact analysis conducted in the Biological Assessment for the 2004 *Spartina* Control Program.

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Page: 2
[G1]Add initial carrying capacity and net change numbers. Also, check the numbers for Cogswell 07 & 08.

Page: 2
[G2]What is the relevance of calling out these particular numbers? Are there more revealing numbers to discuss?

Required Permits and Authorizations

Point Pinole Regional Shoreline, Contra Costa County
TSN:ISP-2004-10

Permit/Action	Agency	Required for work at this site
Clean Water Act Sect/ 404	ACOE	No
Rivers & Harbors Act Sect. 10	ACOE	No
Endangered Species Act Sect 7 (Biological Opinion)	USFWS	Yes
Clean Water Act Sect 402 (NPDES)	ACOE	Yes
Clean Water Act Sect. 401 (Water Quality Certification)	ACOE	No
California Water Code Sect. 13360 (Waste Discharge Requirements)	SFBRWQCB	No
Bay Conservation & Development Commission Authorization	BCDC	No
Streambed Alteration Agreement	CDFG	No
State Fully Protected Species Act	CDFG	Yes
National Environmental Protection Act (Environmental Assessment)	USFWS	Yes
California Environmental Quality Act	EBRPD	Yes
State Historic Preservation Office & National Historic Preservation Act (Cultural Resources Review)	USFWS	Yes

ACEO – Army Corps of Engineers
USFWS – United States Fish and Wildlife Service
SFBRWQCB – San Francisco Bay Region Water Quality Control Board
BCDC – Bay Conservation and Development Commission
CDFG – California Department of Fish and Game