EXECUTIVE SUMMARY

INTRODUCTION

The San Francisco Bay Estuary (Estuary) supports the largest and most ecologically important expanses of tidal mudflats and salt marshes in the contiguous western United States. This environment supports a diverse array of native plants and animals. Over the years, many non-native species of plants and animals have been introduced to the Estuary, and some now threaten to cause fundamental changes in the structure, function, and value of the Estuary's tidal lands. Among these threatening invaders are several species of salt marsh cordgrass (genus *Spartina*). In recent decades, populations of non-native cordgrasses were introduced to the Estuary and began to spread rapidly. Though valuable in their native settings, these introduced cordgrasses are highly aggressive in this new environment, and frequently become the dominant plant species in areas they invade.

One of the non-native cordgrass species in particular, Atlantic smooth cordgrass, and its hybrids (formed when this species crosses with the native Pacific cordgrass) are now threatening the ecological balance of the Estuary and are likely to eventually cause the extinction of native Pacific cordgrass, choke tidal creeks, dominate newly restored tidal marshes, and displace thousands of acres of existing shorebird habitat. Once established in this Estuary, invasive cordgrasses could rapidly spread to other estuaries along the California coast through seed dispersal on the tides. Non-native invasive cordgrasses dominate greater than 500 acres of San Francisco Estuary mudflats and tidal marsh – on State, Federal, municipal, and private lands – and are spreading rapidly. The *Spartina* Control Program (Control Program) proposes to implement a coordinated, region-wide eradication program, comprising a number of on-the-ground treatment techniques to stave off this invasion. The Control Program will be focused within the nearly 40,000 acres of tidal marsh and 29,000 acres of tidal flats that comprise the shoreline areas of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, Sonoma, and Sacramento counties.

The California State Coastal Conservancy (Conservancy), as the lead agency under the California Environmental Quality Act (CEQA), and the U.S. Fish and Wildlife Service (Service or USFWS), as the lead agency under the National Environmental Policy Act (NEPA), have jointly prepared this Environmental Impact Statement/Report EIS/R to address the environmental impacts of the proposed Control Program. This document is a "Programmatic" EIS/R (NEPA Regulations Section 1508.18 and CEQA Guidelines Section 15168) because it analyzes the potential effects of implementing treatment methods for a regional program, rather than the impacts of an individual treatment project.

PURPOSE AND NEED

The purpose of the *Spartina* Control Program is to arrest and reverse the spread of invasive non-native cordgrass species in the Estuary to preserve and restore the ecological integrity of the Estuary's intertidal habitats and estuarine ecosystem.

The Control Program is needed to prevent further degradation and loss of the natural ecological structure and function of the Estuary. Within decades, half of the existing intertidal flats are likely to be replaced with dense, invasive non-native cordgrass marsh, and much of the native diverse

salt-marsh vegetation replaced with nearly single-species stands of invasive non-native cordgrass marsh.

Potential effects of non-native cordgrass invasion include:

- Genetic assimilation and extinction of native Pacific cordgrass;
- Extensive regional loss of tidal flats;
- Elimination of critical foraging habitat for migratory shorebirds;
- Failure of efforts to restore native tidal marsh vegetation in diked baylands;
- Interference with natural sedimentation processes to support restoration of diked baylands;
- Regional loss of tidal sloughs and channels;
- Stabilization of estuarine beaches and beach-forming processes;
- Marginalization of endangered California clapper rail habitat;
- Reduction or elimination of endangered salt marsh harvest mouse habitat;
- Interference with recovery of endangered California sea-blite;
- Increased need for dredging and flood control;
- Production of massive piles of vegetative debris; and,
- Spread of non-native cordgrasses to other California estuaries.

Arresting and reversing the invasion of non-native cordgrasses may become infeasible once these species have spread and become established, due to the aerial extent of the invasion and the effects of hybridization. Therefore, the Control Program will take immediate and aggressive action to optimize the potential for success.

PROGRAM ALTERNATIVES

The lead agencies evaluated a number of approaches and a variety of treatment methods that may achieve the project goal. Three alternatives were ultimately selected for full evaluation. The two "action alternatives," Alternatives 1 (Regional Eradication Using All Available Control Methods) and 2 (Regional Eradication Using Only Non-Chemical Control Methods), would employ a variety of manual and mechanical treatment methods, including:

- Hand-pulling and manual excavation;
- Mechanical excavation and dredging;
- Pruning, burning, and mowing;
- Smothering (blanketing); and
- Drowning.

In addition to these methods, Alternative 1, the preferred alternative, would also employ application of herbicides in suitable situations.

Both Alternatives 1 and 2 would incorporate a modified Integrated Vegetation Management (IVM) approach. The IVM approach will integrate scientific information regarding cordgrass and the estuarine ecosystem with awareness of the likely economic, ecological, and sociological consequences

of the cordgrass invasion, to assure a program that is effective, economical, and protective of public and environmental health.

Consistent with NEPA and CEQA requirements, a no-action alternative, Alternatives 3, also was developed and evaluated. Under Alternative 3, no regional program to control non-native invasive cordgrasses would be adopted, however the current approach of limited uncoordinated control efforts would continue. **Table S-1** provides an abbreviated description of the three alternatives for reference.

ENVIRONMENTAL IMPACTS, AND MITIGATION MEASURES

The environmental impacts of the project and alternatives are summarized on **Table S-2** and are briefly described by topic below.

Geomorphology and Hydrology

Manual and mechanical treatment under Alternatives 1, 2, and 3 could have adverse effects of increased erosion (in some limited circumstances) and competition for limited sediment disposal sites during treatment. These impacts would either be less than significant or could be mitigated to less than significant levels by implementation of mitigation measures identified in this EIS/R. These alternatives would have a beneficial effect on flows of water in tidal channels.

Water Quality

Implementation of Alternatives 1 and 3 could adversely affect water quality due to herbicide application, spills of herbicides and petroleum products, and remobilization of contaminants in sediments. Alternative 2 would not have herbicide-related impacts, but would share approximately the same level of other water quality-related potential impacts as Alternatives 1 and 3. Under all of the alternatives, impacts to water quality would either be less than significant or could be mitigated to less than significant levels by implementation of mitigation measures identified in this EIS/R.

Biological Resources

In general, Alternatives 1 and 2 would have significant adverse short-term impacts, while Alternative 3 would have significant unavoidable long-term impacts associated with the conversion of habitat resulting from the spread of non-native cordgrasses, as summarized below:

- Alternatives 1, 2, and 3 could have significant but mitigable effects on non-target plant species in infested areas, primarily as a result of disturbance required to eradicate the invasive plants.
- These alternatives also could have short-term adverse significant and mitigable impacts to submerged aquatic plant communities, shorebird and waterfowl habitat, harbor seal haul

Table S-1. Alternatives Analyzed in This EIS/R

Alternative	*Description*
1	Proposed Action/ Proposed Project - Regional Eradication Using All Available Control Methods
2	Regional Eradication Using Only Non-Chemical Control Methods
3	No Action – Continued Limited, Regionally Uncoordinated Treatment

outs, and special status plants. In the long term, Alternatives 1 and 2 would not adversely affect these biotic resources, while Alternative 3 would significantly and unavoidably adversely affect them.

- Alternatives 1, 2, and 3 would have significant short-term impacts to the salt marsh harvest mouse and tidal shrew species due to habitat disturbance resulting from treatment activities. However, long-term spread of non-native cordgrasses significantly adversely affect these species under Alternative 3.
- California clapper rail and black rail populations would be significantly adversely and unavoidably affected in the short-term by treatment activities under Alternatives 1 and 2, and in the long-term under Alternative 3.
- Estuarine fishes and anadromous salmonids would be subject to significant but mitigable adverse short-term impacts from treatment activities under Alternatives 1, 2, and 3, and to significant unavoidable long-term impacts under Alternatives 3.
- San Francisco garter snake, California red-legged frogs, and tidewater gobies would not be significantly affected under any alternatives.
- All alternatives would have either less than significant or significant but mitigable effects on increased mosquito production.

Air Quality

Alternatives 1, 2, and 3 would have less than significant effects on emissions of air contaminants and dust with the exception of herbicides, which could be significant but mitigable under Alternatives 1 and 3.

Noise

Sensitive noise receptors could experience significant but mitigable impacts as a result of noise generated by treatment activities under Alternatives 1, 2, and 3.

Human Health and Safety

Workers involved in herbicide treatment could be subject to significant but mitigable health risks under Alternatives 1 and 3. All other human health and safety impacts would be either less than significant or non-existent under all alternatives.

Visual Resources

Removal of large areas of invasive cordgrass could have significant, unmitigable temporary adverse visual impacts under Alternatives 1, 2, and 3. Conversely, Alternatives 3 would result in long-term, significant, unavoidable visual impacts resulting from elimination of mudflats and the native-like variation in visual character that currently characterizes the Bay margins.

Land Use

Herbicide use under Alternatives 1 and 3 could result in significant adverse temporary land use conflicts with residents and recreational users in the vicinity of the areas to be sprayed. This is mitigable by implementation of notification and herbicide control measures identified in this EIS/R. Alternative 2 would avoid this impact.

Cultural Resources

Treatment activities under Alternatives 1, 2, and 3 could adversely affect historic or prehistoric cultural resources. However these potentially significant impacts could be reduced to less than significant by implementation of monitoring and avoidance measures identified in this EIS/R.

Socioeconomics

None of the alternatives would have a significant effect, either beneficial or adverse, on socioeconomic conditions.

Environmental Justice

None of the alternatives would have a significant effect on environmental justice issues.

Cumulative Impacts

Three types of projects have potential significant cumulative interactions with the Control Program: (1) other aquatic weed control programs in the Bay-Delta (Sacramento-San Francisco River Delta) region; (2) mosquito abatement activities in tidal marshes of the Bay region; and (3) restoration and management projects affecting tidal marshes of the San Francisco Estuary. A risk of significant damage to marsh plain vegetation from cumulative vehicle use from mosquito abatement activities and the Control Program could occur. Mitigations that reduce this impact to less than significant levels are identified in this document.

In addition, proposed wetland restoration projects could accelerate the spread of non-native cordgrass, which in turn, could interfere with the effectiveness of the Control Program. This would result in significant and adverse effects on biological resources, Estuary hydrology, and geomorphology. This is mitigable via proper sequencing of restoration projects and the Control Program.

Unavoidable Significant Impacts

The Control Program would result in significant unavoidable impacts to the salt-marsh harvest mouse, tidal shrew, California clapper rail, California black rail, and short-term visual quality of treated marshes.

COMPARISON OF ALTERNATIVES

There is a strong contrast in the comparisons of alternatives from the perspectives of long-term versus short-term environmental consequences. Normally, with private development or public works projects, the "no action" alternative is associated with more environmentally benign protection or conservation of existing natural resources. In this case, the existing natural resources are undergoing long-term degradation because of "biological pollution" caused by non-native invasive cordgrass species.

Alternatives 1 and 2 cause significantly more adverse short-term, direct, and indirect environmental impacts than the no action Alternative 3, which would still have potentially significant treatment impacts. These short-term impacts are the inevitable consequences of eradication methods that devegetate tidal wetlands invaded by non-native cordgrass. Alternatives 1 and 2, and to a lesser extent Alternative 3 eliminate or displace the wildlife that inhabit them, and cause significant short-term side effects from operation of vehicles and equipment. Alternative 2 would have no short-

term, direct, and indirect impacts related to application of aquatic herbicides, such as operation of helicopters and vehicles, and risk of spray drift, overspray and accidental spillage. However, repeated physical eradication methods that may be necessary to replace chemical herbicides, the potential ground and vegetation disturbance impacts under Alternative 2 would increase. This would shift some impacts from aquatic environments (potential herbicide dispersion impacts) to marsh environments (increased intensity, frequency, and duration of mechanical disturbance). Thus, Alternative 2 could prolong wetland degradation and ultimately exceed the net impact of combined use of manual, mechanical, and chemical methods proposed in Alternative 1. Alternative 3's lack of coordination would exacerbate this impact, compared with Alternative 2.

Alternative 2 also has a higher risk of failure to control and eventually eradicate invasive cordgrasses compared to Alternative 1. If Alternative 2 failed to control these invasives, it eventually would result in the same long-term environmental consequence as described below for Alternative 3. Alternative 3's lack of regional coordination would allow the continued and quickening spread of Atlantic smooth cordgrass. This would result in diminishing local control effectiveness and increasing local costs for non-native cordgrass "maintenance" control over time. Probably within one to two decades, only flood control and navigation interests would have incentives and resources to combat overwhelming invasion rates of Atlantic smooth cordgrass hybrids, especially if tidally restored salt ponds generate vast new hybrid populations and seed sources.

Environmentally Superior (CEQA) and Preferred (NEPA) Alternative

Because the project is, in effect, an environmental restoration and protection project, its primary adverse impacts are short-term, during the treatment process. As described above, Alternatives 2 could have somewhat less environmental impacts than Alternative 1 because it would exclude impacts related to application of aquatic herbicides.. However, these reduced impacts could be offset by the need for additional mechanical treatment if chemicals are not used, and by the potential impacts resulting from repeated treatment under Alternative 2. In addition, Alternative 2 also has a lower probability of achieving the project's ultimate environmental benefits than Alternative 1. Similarly, Alternative 3 would somewhat reduce treatment impacts, but is likely to ultimately fail, resulting in far greater long-term impacts than Alternative 1 and, likely, Alternative 2. Therefore this EIR considers the CEQA Environmentally Superior Alternative to be a mitigated version of Alternative 1 in which all mitigations in this EIS/R have been incorporated into the program. This Environmentally Superior Alternative is identified as the Mitigated Project Alternative.

Similarly, the Federal lead agencies have concluded that Alternative 1 is most likely to achieve long-term protective benefits for California's estuarine environments, and provide the most favorable ratio of environmental costs to benefits. Therefore, Alternative 1 with inclusion of EIS-identified mitigation measures is identified as the NEPA Environmentally Preferred Alternative.

Table S-2. Comparison of Impacts of Project Alternatives*

Impact	***Alternative 1:*** *Regional Eradication Using All Available Control Methods (current/ future)*	***Alternative 2:*** *Regional Eradication Using Non-Chemical Control Methods (current/ future)*	***Alternative 3:*** *No Action – Continued Uncoordinated Treatment (current/ future)*
Hydrology and Geomorphology			
GEO-1: Erosion or deposition of sediment at sites of cordgrass eradication	◑/○	◑/○	◑/○
GEO-2: Erosion or topographic change of marsh and mudflats by vehicles used in eradication	◑/○	◑/○	◑/○
GEO-3: Remobilization of sand in cord-grass-stabilized estuarine beaches	◑/○	◑/○	◑/○
GEO-4: Increased demand for sediment disposal and potential spread of invasive cordgrass via sediment disposal	◑/○	◑/○	◑/○
GEO-5: Increased volume and velocity of tidal currents in channels due to the re-moval of invasive cordgrass	+/○	+/○	+/●
GEO-6: Increased depth and turbulence of tidewaters in salt marsh pans	+/○	+/○	○/◑
Water Quality			
WQ-1: Degradation of water quality due to herbicide application	◔/○	○/○	◔/○
WQ-2: Degradation of water quality due to herbicide spills	◑/○	○/○	◑/○
WQ-3: Degradation of water quality due to fuel or petroleum spills	◑/○	◑/○	◑/○
WQ-4: Degradation of water quality due to contaminant remobilization	◑/○	◑/○	◑/○
Biological Resources			
BIO-1.1: Effects of alternative on salt-meadow cordgrass and English cordgrass infested tidal marsh plant communities	◑/○	◑/○	●/●
BIO-1.2: Effects of alternative on Atlantic smooth cordgrass (and its hybrids) in-fested tidal marsh plant communities	◑/○	◑/○	●/●
BIO-1.3: Effects of alternative on Chilean cordgrass infested tidal marsh plant com-munities	◑/○	◑/○	●/●
BIO-1.4: Effects of alternative on sub-merged aquatic plant communities	◑/○	◑/○	◑/●
BIO-2: Effects of alternative on special status plants	◑/○	◑/○	◑/●

* All Impacts are compared to current (2002) conditions. Impact significance indicated in this table is based on the reasonable worst case effects; some impacts identified as adverse also may have beneficial aspects that are addressed in the EIS/R text.

KEY:

● = Significant and not mitigable impact
◑ = Significant and mitigable impact
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Impact	***Alternative 1:*** *Regional Eradication Using All Available Control Methods (current/ future)*	***Alternative 2:*** *Regional Eradication Using Non-Chemical Control Methods (current/ future)*	***Alternative 3:*** *No Action – Continued Uncoordinated Treatment (current/ future)*
BIO-3: Effects of alternative on non special status shorebirds and waterfowl	◑/○	◑/○	◑/●
BIO-4.1: Effects of alternative on salt marsh harvest mouse and tidal shrew	●/○	●/○	●/●
BIO-4.2: Effects of alternative on resident harbor seal colonies in San Francisco Bay	◑/○	◑/○	◑/●
BIO-4.3: Effects of alternative on the southern sea otter	○/○	○/○	○/●
BIO-5.1: Effects of alternative on California clapper rail	●/○	●/○	◑/●
BIO-5.2: Effects of alternative on California black rail	●/○	●/○	◑/●
BIO-5.3: Effects of alternative on tidal marsh song sparrow subspecies and salt marsh common yellowthroat	◑/○	◑/○	◑/●
BIO-5.4: Effects of alternative on California least terns and western snowy plovers	◑/○	◑/○	◑/●
BIO-5.5: Effects of alternative on raptors	◑/○	◑/○	◐/●
BIO-6.1: Effects of alternative on anadromous salmonids	◑/○	◑/○	◑/●
BIO-6.2: Effects of alternative on delta smelt and Sacramento splittail	◐/○	◐/○	◐/●
BIO-6.3: Effects of alternative on tidewater goby	○/○	○/○	○/○
BIO-6.4: Effects of alternative on estuarine fish populations of shallow submerged intertidal mudflats and channels	◑/○	◑/○	◑/●
BIO-7: Effects of alternative on California red-legged frog and San Francisco garter snake	○/○	○/○	○/○
BIO-8: Effects of alternative on mosquito production	◐/○	◐/○	◐/◑
BIO-9: Effects of alternative on tiger beetle species	+/○	+/○	+/◐
Air Quality			
AQ-1: Dust emissions	◐/○	◐/○	◐/○
AQ-2: Smoke emissions	◑/○	◑/○	◑/○

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AQ-3: Herbicide effects on air quality	◑/○	○/○	◑/○
AQ-4: Ozone precursor emissions	◔/○	◔/○	◔/○
AQ-5: Carbon monoxide emissions	◔/○	◔/○	◔/○
Noise			
N-1: Disturbance of sensitive receptors	◑/○	◑/○	◑/○
Human Health and Safety			
HS-1: Worker injury from accidents associated with manual and mechanical aspects of treatment	◑/○	◑/○	◑/○
HS-2: Worker health effects from herbicide application	◑/○	○/○	◑/○
HS-3: Health effects to the public from herbicide application	◔/○	○/○	◔/○
HS-4: Health effects to the public from accidents associated with chemical treatment	◑/○	○/○	◑/○
Visual Resources			
VIS-1: Alteration of views from removal of non-native cordgrass	●/○	●/○	◔/○
VIS-2: Change in views from native marsh, mudflat, and open water to non-native cordgrass meadows and monocultures	○/○	○/○	○/●
Land Use			
LU-1: Land use conflicts between herbicide use and sensitive receptors	◑/○	○/○	◑/○
LU-2: Land use conflicts from mechanical and burning treatment methods	◑/○	◑/○	◑/○
Cultural Resources			
CUL-1: Disturbance and destruction of cultural resources from access and treatment	◑/○	◑/○	◑/○
CUL-2: Loss of cultural resources from erosion	◑/○	◑/○	◑/○

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Socioeconomics	◐/○	◐/○	◐/○
Environmental Justice	○/○	○/○	○/○
Cumulative Impacts			
CUM-1: Effects of wetland restoration projects on spread of non-native cord-grass.	◐/◑	◐/◑	◐/●
CUM-2: Cumulative damage to marsh plain vegetation.	◑/○	◑/○	◑/○