Spartina Eradication Program
2006 Progress Report

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Photos provided by Dave Heimer and Justin Haug (WDFW), Wendy Brown (DNR) & Dr. Kim Patten (WSU).

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PROGRESS OF THE
2006 *SPARTINA* ERADICATION PROGRAM

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TABLE OF CONTENTS

Executive Summary

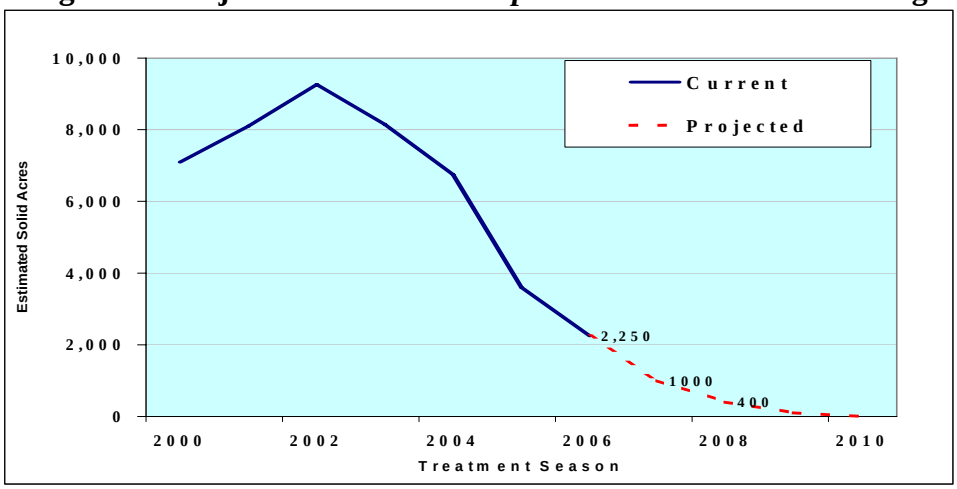
Spartina, commonly known as cordgrass, is an aggressive noxious weed that severely disrupts the ecosystems of native saltwater estuaries in Washington State. *Spartina* out competes native vegetation and converts mudflats into monotypic *Spartina* meadows, destroying important migratory shorebird and waterfowl habitat, increasing the threat of flooding, and severely impacting the state's shellfish industry. *Spartina* spreads by both seed production and below-ground root growth. In 2003, at the height of its invasion in Washington State, *Spartina* infested more than 9,000 acres spread over 25,000 acres.

Since 1995, the Washington State Department of Agriculture (WSDA) has served as the lead state agency for the eradication of *Spartina*. In this role WSDA in 2006 facilitated the continued cooperation of local, state, federal and tribal governments, universities, interested groups and private landowners. WSDA continued to coordinate the Technical Committee meetings as well as the Advisory Committee meetings, which focused on developing work plans for the 2006 season.

Over the past four years, the combined statewide effort to eradicate *Spartina* from the marine waters of Washington State has been extremely successful, reducing the overall statewide infestation from more than 9,000 acres to fewer than 2,250 solid acres, an unprecedented reduction of 75%.

The combined statewide effort has shown that large reductions of *Spartina* are possible and that eradication is an attainable goal. With sustained funding and continued support, WSDA projects that the state's Spartina infestation will be essentially eradicated by the end of 2010 (Figure 1).

Figure 1. Projected solid acres of *Spartina* with sustained funding



Willapa Bay

Monitoring of the program's 2005 effort indicated that fewer than 3,250 solid acres remained in Willapa Bay at the beginning of the 2006 season. This was a significant reduction from

approximately 6,500 solid acres in Willapa Bay at the beginning of the 2005 season. During 2006, an estimated 3,150 solid acres, over 95% of the *Spartina* in Willapa Bay, were treated. A significant milestone was reached during the 2006 treatment season -- for the first time, all known *Spartina* infestation sites in Willapa Bay were treated. WSDA expects that fewer than 2,000 solid acres of *Spartina* will be present in Willapa Bay at the start of the 2007 treatment season.

Grays Harbor

In Grays Harbor, an aerial survey conducted in late 2005 led to the discovery of more *Spartina* than had been previously identified in the Harbor. Directly following the survey, WDFW crews treated many of the newly discovered infestations. During fall 2005, WSDA formed the Grays Harbor Task Force and began planning for the 2006 season. With assistance from concerned local organizations, additional state and federal funding was acquired specifically for Grays Harbor. During the 2006 season, WSDA contracted with WDFW to treat the Grays Harbor *Spartina* infestations. The WDFW crews treated all known infestations at least once and surveyed most of the shoreline of Grays Harbor.

Puget Sound

In Puget Sound, monitoring of the 2005 effort indicated that approximately 350 solid acres remained in Puget Sound at the beginning of the 2006 season. This is reduced from approximately 550 solid acres in Puget Sound at the beginning of the 2005 season. During the 2006 eradication season, an estimated 325 solid acres of *Spartina*, approximately 93% of the infestation, was treated. WSDA expects fewer than 250 solid acres of *Spartina* will be present in Puget Sound at the beginning of the 2007 treatment season. As part of this successful effort, Spartina was eradicated from some of the smaller Puget Sound sites during the last four years.

Table 1 illustrates the total solid acres treated by county from 1997 through 2006.

This tremendous effort was a result of the continued high level of state funding provided to WSDA, Washington Department of Fish and Wildlife (WDFW), and Department of Natural Resources (DNR), and significant grants furnished to two private landowners. Continued federal funding to the U.S. Fish and Wildlife Service (USFWS) in Willapa Bay has also been a key component to success. Also central to this success is continued cooperation of state agencies, universities, USFWS, counties, tribes, private organizations and private landowners.

With the largest infestations significantly reduced, the eradication effort will transition to the remaining scattered infestations that will be found throughout the affected acreage. This will require more crews on the ground to address the same areas that helicopters or large machines previously covered in a relatively short amount of time. The amount of herbicide needed to treat infestations will decline, bringing costs down, however, the number of personnel needed to re-treat these same areas will increase. To meet the goal of *Spartina e*radication, program funding requirements will hold steady over the next four years.

Table 1. Acres of *Spartina* Treated in Washington State – 1997 through 2006

County	*Spartina* Present at Start of 2006	*Spartina* Treated, 1997 - 2006		2006 Treatment Methods
Pacific (Willapa Bay)	Approx. 3250 solid acres spread over 25,000 acres	'97 - approx. 742 solid acres '98 - approx. 450 solid acres '99 - approx. 600 solid acres '00 - approx. 800 solid acres '01 – approx. 900 solid acres	'02 – approx. 1,804 solid acres '03 – approx. 6,000 solid acres '04 – approx. 5,700 solid acres '05 – approx. 5,000 solid acres **'06 – approx. 3,150 solid acres**	Crush/herbicide, herbicide, air and ground, seedling removal, various mechanical controls
Snohomish	Approx. 220 solid acres spread over > 4,500 acres	'97 - approx. 89 solid acres '98 - approx. 126 solid acres '99 - approx. 90 solid acres '00 - approx. 158 solid acres '01 – approx. 75 solid acres	'02 – approx. 238 solid acres '03 – approx. 343 solid acres '04 – approx. 350 solid acres '05 - approx. 374 solid acres **'06 – approx. 215 solid acres**	Mow/herbicide, herbicide, seedling removal, dig, mechanically crush, mow
Island	Approx.120 solid acres spread over >1,000 acres	'97 - approx. 250 solid acres '98 - approx. 160 solid acres '99 - approx. 155 solid acres '00 - approx. 130 solid acres '01 – approx. 72 solid acres	'02 – approx. 300 solid acres '03 – approx. 325 solid acres '04 – approx. 164 solid acres '05 – approx. 134 solid acres **'06 – approx. 99 solid acres**	Mow/herbicide, herbicide, seedling removal, mechanically crush, mow
Skagit	Approx. 10 solid acres spread over > 2,000 acres	'97 - approx. 91 solid acres '98 - approx. 57 solid acres '99 - all treated '00 - approx. 60 solid acres '01 – approx. 33 solid acres	'02 – approx. 37 solid acres '03 – approx. 26 solid acres '04 – approx. 13.5 solid acres '05 – approx. 10 solid acres **'06 – approx. 10 solid acres**	Mow/herbicide, herbicide, seedling removal, dig, mow, fabric covering
Grays Harbor	Scattered clones and seedlings 10 acres in size	'97 - all treated '98 - all treated '99 - all treated '00 - all treated '01 – all treated	'02 – all treated '03 – all treated '04 – all treated '05 – approx. 5 solid acres **'06 – approx. 3.5 solid acres**	Herbicide, seedling removal, mow
Kitsap	5 infestations – approx. 0.5 solid acres total	'97 - all but 2 tribal sites '98 - all treated '99 - all treated twice '00 - all treated '01 – all treated	'02 – all treated twice '03 – all treated twice '04 – all treated twice '05 – all treated twice **'06 – all treated twice**	Herbicide, dig, seedling removal
Jefferson	11 infestations – approx. 0.01 solid acres total	'97 - all treated '98 - all treated twice '99 - all treated twice '00 - all treated three times '01 – all treated three times	'02 – all treated three times '03 – all treated twice '04 – all treated twice '05 – all treated twice **'06 – all treated twice**	Herbicide, dig, seedling removal
Clallam	1 infestation < 0.001 acres in size	'97 - treated twice '98 - treated three times '99 - treated twice '00 - treated four times '01 – treated four times	'02 – treated four times '03 – treated three times '04 – all treated twice '05 – all treated twice **'06 – all treated twice**	Dig
King	1 infestation – single clones and a few seedlings	'97 - monitored '98 - all treated '99 - all treated '00 - all treated twice '01 – all treated twice	'02 – all treated twice '03 – all treated twice '04 – all treated twice '05 – all treated twice **'06 – all treated twice**	Dig
San Juan	5 infestations – approx 0.002 solid acres total.	'97 - all treated '98 - all treated '99 - monitored '00 - all treated '01 – all treated	'02 – all treated '03 – all treated '04 – all treated '05 – all treated once **'06 – all treated twice**	Survey, dig
Whatcom	No Spartina present	'05 – all removed	**'06 – No Spartina present**	Survey

Spartina Eradication Program

Introduction

Why is *Spartina* a problem?

The invasive noxious weed *Spartina* is found in the marine intertidal areas of Washington State. *Spartina* out competes and displaces beneficial native vegetation. *Spartina* destroys migratory shorebird and waterfowl habitat in Willapa Bay, one of the most important estuaries on the West Coast migratory route. *Spartina* also threatens to severely impact a shellfish industry that is extremely important to the economy of Washington State.

What species of *Spartina* occur in Washington State?

There are currently four species of non-native *Spartina* known to occur in Washington state. *Spartina alterniflora* is most widely found in Willapa Bay with fewer than 2,000 solid acres currently infesting the Bay. *Spartina alterniflora* is also known to occur in Skagit, Clallam, Jefferson and Grays Harbor counties. Figure 15 *(see pg. 42)* shows *Spartina alterniflora* invading a mudflat in Willapa Bay.

Spartina patens is known to occur at only one location in Jefferson County. This infestation is controlled with, digging and herbicide applications as determined by yearly surveys. Figure 16 *(see pg. 42)* shows the largest of the *Spartina patens* clumps found in 2001.

Spartina anglica is present in Skagit, Snohomish and Island counties. It has also been found in San Juan, Whatcom, King, Kitsap and Jefferson counties. Figure 17 (*see pg. 43*) shows a *Spartina anglica* clone in Puget Sound. It currently infests fewer than 250 acres in Puget Sound and Hood Canal.

Spartina densiflora is a South American species that was discovered in 2001 in Grays Harbor County and in Island County. Figure 18 (*see pg. 43*) shows *Spartina densiflora* in Grays Harbor.

How was *Spartina* introduced into Washington State?

Spartina alterniflora was unintentionally introduced to Willapa Bay as packing material from the East Coast during the late 1800's. In Puget Sound, various landowners introduced *Spartina alterniflora* to stabilize shorelines. *Spartina anglica* was similarly introduced into the Puget Sound at a farm located in Port Susan in the early 1960's to serve as bank stabilization and as a potential source of feed for cattle. The modes of introduction for *Spartina patens* and *Spartina densiflora* are unknown.

In all, there are eleven counties in western Washington with one or more infestations of *Spartina alterniflora, S. anglica, S. patens* or *S. densiflora*. These include Clallam, Grays Harbor, Island, Jefferson, King, Kitsap, Pacific, San Juan, Skagit, Snohomish and Whatcom counties.

How do we eradicate *Spartina*?

Spartina spreads quickly and is difficult to eradicate. A successful eradication program involves four steps:

1) Preventing an existing infestation from producing seed;

2) Treating an existing infestation for several consecutive years using Integrated Pest Management (IPM) (including mechanical, chemical or manual control, or a combination of these methods);

3) After eradication is achieved, monitoring the area and removing new seedlings to ensure no re-establishment occurs; and

4) Continuing to survey shorelines, educate the public, and follow-up on possible sightings of new infestations.

WSDA *Spartina* Program

In 2006, the WSDA *Spartina* Eradication Program worked collaboratively with partner agencies to continue *Spartina* eradication. WSDA hired, equipped and coordinated a crew to treat all infestations in Clallam, Jefferson, Kitsap and King counties; assisted the Swinomish, Suquamish and Tulalip Tribal communities and the San Juan and Whatcom County Noxious Weed Control Boards with eradication work on their property; and worked cooperatively with WDFW, DNR, USFWS, The Nature Conservancy (TNC), The Shoalwater Tribe, Pacific County, and the aquaculture industry, along with the University of Washington (UW) and Washington State University (WSU) on infestations in Willapa Bay.

WSDA continued to work cooperatively with the Department of Ecology to administer its coverage under the National Pollutant Discharge Elimination System (NPDES) general permit for aquatic noxious weed control and, facilitating the control programs of federal, state and local governmental agencies and other entities.

WSDA provided resources through interagency agreements, personal services contracts, and direct cost-share to state and local government agencies and private landowners. WSDA organized and facilitated the exchange of *Spartina* eradication information through regional planning and informational meetings, and continued to explore more efficient and cost-effective ways to eradicate *Spartina* with partner agencies.

During the 2006 season, WSDA continued working with WDFW, WSU and USFWS to explore the potential for restoration of once-infested tidelands back to functioning shorebird and waterfowl habitat.

Budget

WSDA has allotted $1.76 million of its appropriation from the Aquatic Lands Enhancement Account (ALEA) for *Spartina* activities during the 2005-2007 biennium. Table 2 illustrates how WSDA budgeted this appropriation.

Table 2. Budget Activity by Area – FY06 and FY07

	Puget Sound/Olympic Peninsula		Willapa Bay		Total	
Activity	*FY06*	*FY07*	*FY06*	*FY07*	*FY06*	*FY07*
[1]WSDA Coordination and control activities	$222,581	$222,581	$222,581	$222,581	$445,162	$445,162
[2]Large-scale cost share and IPM	$35,000	$35,000	$237,852	$122,000	$272,852	$157,000
[3]Purchased Services					$220,000	$220,000
Skagit Co.	$40,000	$40,000				
Island Co.	$50,000	$50,000				
Snohomish Co.	$50,000	$50,000				
Swinomish Tribe	$10,000	$10,000				
WDFW			$60,000	$60,000		
Other	$5,000	$5,000	$5,000	$5,000		
Total WSDA Budget	**$412,581**	**$412,581**	**$525,433**	**$409,581**	**$938,014**	**$822,162**
[4]Other State Agency Operational Budgets						
WDFW	$163,085	$163,085	$126,221	$114,441	$289,306	$277,526
WDNR			$291,000	$291,000	$291,000	$291,000
TOTAL State Agency Budgets	**$575,666**	**$575,666**	**$942,654**	**$815,022**	**$1,518,320**	**$1,390,688**

Notes for Table 2:

1. WSDA Coordination and Control Activities: These expenses include agency administrative and control costs including salaries and benefits, travel, attorney fees, public notification expenses and other goods and services.
2. Large-scale cost share and IPM: These are the costs of aerial applications to approximately 1,050 acres (six sites) in Willapa Bay and Puget Sound, and additional herbicide purchases for WDFW, USFWS, and Snohomish and Skagit counties.
3. Purchased Services: WSDA entered into two-year Interagency Agreements with Skagit, Island and Snohomish counties, an Interagency Agreement with WDFW to conduct work in Pacific County, and an Intergovernmental Agreement with the Swinomish Tribal Community to conduct work on its property in Skagit County.
4. These figures represent the *Spartina* eradication operational funds available to the Washington Department of Fish & Wildlife and the Washington Department of Natural Resources. This funding is separate from WSDA's *Spartina* funding.

The budget table does not include the resources utilized by the USFWS for eradication activities. USFWS reports it received $1,400,000 for the 2006 control season.

WSDA also administered three multi-year Landowner Incentive Program (LIP) grants totaling $200,000 for two sites in Willapa Bay and one in Puget Sound. In addition, WSDA received $90,000 in state and federal funding for eradication work specifically in Grays Harbor.

County Activities

In 2006, WSDA continued to allocate funding for resources and *Spartina* work crews in the counties with the majority of the infestations. WSDA provided these resources by entering into interagency agreements with the Skagit, Island and Snohomish County Noxious Weed Control Boards and WDFW in Pacific County. WSDA also provided $10,000 to the Swinomish Tribal Community to help fund its *Spartina* eradication effort. WSDA staff conducted field audits throughout the control season and facilitated coordination meetings to ensure contract priorities were adequately addressed.

Cost Share Program

As authorized in RCW 17.26.007, WSDA offered financial assistance to private landowners for *Spartina* control and eradication in 2006. WSDA provided cost share assistance in the form of herbicide supplied to appropriately licensed private applicators as well as providing control for private landowners through county and state crews. A major component to the 2006 cost share program was the treatment along the Long Beach Peninsula. The treatment included more than 600 different private properties and about 350 different property owners. The options available to interested parties are outlined in Table 3.

Table 3. WSDA Cost Share Options

Eradication/Control Method	WSDA Contribution	Landowner Contribution
County or state work crews mow and/or apply herbicide	WSDA grants county funds to treat priority areas	Must treat once during the season or agree to pay herbicide costs
Direct cost share - Landowner applies herbicide	100% of herbicide costs	100% labor & equipment
Direct cost share - Landowner covers or digs up infestation	100% of pre-approved materials	100% labor
Direct cost share - Landowner uses WSDA pre-approved contractor	50% of contractor cost	50% of contractor cost

Management Plans

WSDA developed a Statewide IPM Plan for the 2006 season. The Statewide IPM plan was a compilation of the five regional IPM work plans.

WSDA has been developing regional work plans since 1998. Copies of the 2006 management plans are available by contacting the WSDA Statewide *Spartina* Eradication Program Coordinator. WSDA will update all IPM work plans prior to the 2007 control season.

2006 Noteworthy Activities and Developments

In 2006, WSDA, state and federal partner agencies, local governments, tribal entities, and private landowners treated approximately 3,500 solid acres of *Spartina* throughout Puget Sound, Grays Harbor and Willapa Bay. In addition to the significant program results from treatment activities, there were several noteworthy activities or developments in 2006.

Supplemental Funding Provided For Increased Effort in Grays Harbor

Near the end of the 2005 treatment season, WSDA, WDFW and DNR conducted an extensive aerial survey of Grays Harbor. An estimated 10 solid acres of newly discovered *Spartina* was identified. WDFW immediately treated 6.5 acres before the end of the treatment season. This discovery highlighted the need for increased funding and focus on Grays Harbor.

Throughout the winter of 2005 and early spring of 2006, WSDA coordinated with WDFW, USFWS, Grays Harbor County, Friends of Grays Harbor (FOGH), TNC, State Parks, Grays Harbor Oyster Growers and the Audubon Society to identify and pursue supplemental funding for Grays Harbor. In 2006, $50,000 in supplemental funding was approved by the State Legislature. In addition, $40,000 of federal funding was made available for *Spartina* eradication for Grays Harbor.

With this level of funding, WSDA and its partners made an aggressive effort in Grays Harbor during the 2006 season. All infestations were treated and extensive surveys of the Grays Harbor shoreline were conducted. WSDA worked with Grays Harbor County to develop an informational flyer which was made available to the public through project partners such as USFWS and FOGH. With assistance from WSDA, FOGH also included *Spartina* information on its Web site.

Pacific County Classifies *Spartina* as a Class B Select Noxious Weed

Spartina alterniflora is on the state noxious weed list, with control required in all parts of the state except Padilla Bay and the bays and estuaries of Pacific County. In these two areas, because the weed is abundant, control requirements are decided by the local county weed board.

In the spring of 2006, the Pacific County Noxious Weed Control Board placed *Spartina alterniflora* on its county noxious weed list as a class B select Noxious Weed.

The new listing will require landowners in the county to ensure that *Spartina* does not spread from their property onto adjacent properties by seed or plant propagules or fragments. WSDA is currently working with USFWS to ensure that *Spartina* will be treated on willing landowners' properties through a cost share program that alleviates the financial burden from the landowner.

The new listing is expected to encourage all landowners to take advantage of the cost share program and encourage any landowners not controlling *Spartina* on their property to become involved.

Coordinated, Cooperative Treatment of the Entire Long Beach Peninsula

In spring 2005, WSDA began working on treatment of the entire Long Beach Peninsula. This required substantial effort, due to the high number of property owners along the peninsula.

The tidelands of the Long Beach Peninsula are almost entirely privately owned. More than 600 separate properties are held in ownership by more than 350 different private property owners. In order for the entire peninsula to be treated in a single season, every property owner needed to be contacted, and permission to enter their property and conduct eradication activities needed to be secured.

WSDA first worked with the Pacific County Noxious Weed Control Board to develop a database of all landowners on the Peninsula. Once the database was created, WSDA began contacting landowners. Over the next year and a half, WSDA sent out multiple mailings to the identified landowners, seeking permission to enter their properties and treat *Spartina*. Virtually all of the necessary permissions were in place by June 2006. Of the over 350 landowners contacted, only one declined permission for WSDA and its partners to treat the *Spartina* on their property.

During the summer of 2006, WSDA, DNR, USFWS and the aquaculture industry worked cooperatively to treat the Long Beach Peninsula. The effort used a wide variety of tools, including aerial applications, ground-based hand-held and broadcast applications, and small-scale mechanical applications. Project partners treated 872 solid acres from Leadbetter Point, at the northern tip of the Peninsula, to Tarlatt Slough at the southern end of the Peninsula.

Restoration of Spartina Impacted Near-shore Habitat

The Washington State Legislature clearly recognized the environmental and economic threat that *Spartina* poses to the remaining near-shore habitat and, in response, has funded a vigorous *Spartina* eradication effort. Agencies are eliminating record amounts of *Spartina*. However, many questions concerning the long-term ecological recovery of eradicated *Spartina* meadows remain.

The agencies have recently secured modest grant funding (Landowner Incentive Program, National Fish and Wildlife Foundation, and Washington Wildlife and Recreation Program) to establish a set of interrelated research projects that monitor sediment dynamics, vegetation change, invertebrate change, and bird and fish use to gauge the effectiveness of different restoration methods. The long-term goal of these projects is to restore previously treated *Spartina* meadows and return ecological functionality to this highly altered mudflat where dense root masses and accumulated sediment remain.

Preliminary research conducted by Dr. Kim Patten (WSU) in Willapa Bay finds bird usage within large untreated *Spartina* meadows, regardless of species, is virtually non-existent. Control of the *Spartina* meadows has resulted in a return of shorebird and waterfowl usage within one to three years after treatment. The speed of recovery for bird usage appears to be dependent on the method of control and post-control sediment treatment.

These research projects will help determine which restoration methods will improve habitat and allow agencies to meet the restoration requirement set by the Legislature.

Cross-Border Drift Card Study Underway

After the interesting results obtained from the Drift Card Study conducted on the Washington and California coasts in 2004 through 2005, a Drift Card Study is underway in North Puget Sound and Canada to help understand where *Spartina* seeds may be drifting.

The year-long drift card release project, jointly funded by the Puget Sound Action Team, Ducks Unlimited of Canada, the Nature Conservancy, and the Washington State Department of Agriculture began in June 2006 and will continue through May 2007. Sites near six major infestations (three in Puget Sound and three in the Georgia Basin, Canada) were selected as card release points. Each month, 100 drift cards are released in the waters near each site. The tide, current, and wind disperse the cards replicating the movement of *Spartina* seed and fragments from the heavily infested sites. Printed on every card is a number, unique to the month and release location, and written instructions guiding those who find the cards on the beach to report the date and location of each found card. At the conclusion of the project, agencies in both the US and Canada hope to have a better understanding of how *Spartina* spreads and where to concentrate detection efforts. The results will also help define the relationship between the Canadian infestation and the infestations in Puget Sound.

2006 Aerial Photos Taken

In June of 2006, DNR conducted an infrared aerial survey of Willapa Bay and Grays Harbor. The result of the survey will be an updated set of aerial infrared photos. DNR has been taking aerial infrared photos of the infestations in Willapa Bay every three years since 1997.

The 2006 photos will be the first set of photos to document the substantial decline of infested acres in large areas of Willapa Bay. The photos will also be converted into ortho-photos for use with computer-based Geographical Information System (GIS) programs, and a new GIS layer will be developed on the infestation. WDFW also took aerial photos of *Spartina*-affected sites in the North Puget Sound in 2006.

2006 Biological Control Program

In 2006, the biological control program was continued at the North Cove biocontrol site in Willapa Bay. All other former biocontrol release sites in Willapa Bay were chemically treated by the cooperating agencies in the *Spartina* Eradication Project.

The North Cove biocontrol site is a 40-acre area on the DNR portion of the North Cove meadow at the north end of Willapa Bay. This site contains a very large and expanding population of *Prokelisia marginata,* an insect known as a plant hopper. Large feeding populations of this insect can cause significant damage to *Spartina.* Releases were first made into the west end of this meadow in 2002. Additional releases were made in 2004 using four different ecotypes of the biocontrol agent, from East Coast and California sources. They were released into four different areas of the meadow. Similar sets of releases were made at four additional replicate sites in other areas of Willapa Bay as an experiment to compare performance of the different ecotypes. At North Cove, as in the other sites, the Rhode Island and California ecotypes had greater population increases in 2004 and 2005. However, by 2006, *P. marginata* densities were

similar at all four release points, apparently because the more prolific populations had spread uniformly throughout the experimental area. The mean population densities measured at the points of release increased from 4,024 in 2004 to 10,871 in 2005 and then declined slightly, but not significantly, to 9,015 in October 2006. Table 4 illustrates these population levels over time.

Table 4. *P. marginata* populations at North Cove in Willapa, 2004-2006

	Proklesia *marginata* abundance *(# per square meter)*		
Source of Agent	**Oct. 2004**	**Oct. 2005**	**Oct. 2006**
Rhode Island	13,174	28,710	8,192
California	1,766	11,038	8,981
Virginia	755	1,692	7,289
Georgia	404	2,044	11,599
Mean	**4,024**	**10,871**	**9,015**

Although mean densities at the points of release remained similar between 2005 and 2006, it is clear that the total population increased greatly during that time because the insects now are at high densities over a much larger area. The area occupied by high densities of *P. marginata,* i.e. causing visible signs of stress to plants, increased from 2 acres in 2005 to approximately 7 acres in 2006.

In Puget Sound, *P. marginata* populations are well established and abundant at West Pass Dike where densities were found to be 28.7 ± 4.4 per stem in October 2006. At Turners Cove, *P. marginata* is present but sparse at the northern site with mean densities of 0.20 ± 0.13 per stem. The insects were not detected at the southern release site in this meadow.

The recent increases in abundance and area occupied by *P. marginata,* as well as the visible damage to the plants, are positive indicators that the biological control program is making a substantive contribution to the control of *Spartina* in both Willapa Bay and Puget Sound. Substantial impacts on seed viability have already been measured at a local scale. Seed heads on stems that had between 100 and 200 insects per stem suffered a 63% reduction in viable seeds and those on stems with more than 200 insects per stem showed an 80% reduction, when compared to seed heads on stems with less than 20 insects.

Program Results by Geographic Area

Spartina Eradication Efforts in Willapa Bay

The water body of this geographic area includes the mouth of Willapa Bay, Willapa Bay, and all the rivers, streams and creeks that feed into the Bay.

Extent of the Infestation in Willapa Bay

WSDA estimates that, at the beginning of the 2006 season, a total of 3,250 solid acres were infested with *Spartina* in Willapa Bay. This estimate was acquired through the use of 2006 treatment data.

The acreage information collected while conducting herbicide applications during the 2006 season provides a reasonably accurate accounting of the total solid acres present in those treated areas. While conducting broadcast applications to sites, the application equipment is calibrated to apply a specific amount of herbicide per treated acre. In addition, most ground-based and all aerial-based broadcast application equipment have the capability of tracking the solid acreage treated through the use of GPS systems on the equipment. While using ground, hand-held application equipment, operators are able to calibrate the amount of herbicide applied per acre as well.

All infested sites were treated during the 2006 season. Managers estimate that fewer than 100 solid acres at these sites went untreated for various reasons during the 2006 season.

Adding the acreage information obtained from treatment data to the minimal acreage estimated as not treated provides a reasonably accurate total solid acre estimate for the beginning of the 2006 treatment season.

Figure 2 (see page 18) is a map showing an overview of the 2006 treatment in Willapa Bay.

Roles of Participating State and Federal Agencies in 2006

In 2006, the participating agencies used a variety of herbicide application systems and mechanical control tools to combat *Spartina*. The following outlines the role each agency assumed in Willapa Bay during the 2006 eradication season.

- **WSDA** – Continued to work with the Department of Ecology to ensure its NPDES coverage was extended to all qualified applicators. Provided resources, equipment and herbicide to WDFW, DNR, USFWS and private property owners to ensure proper treatment of all sites. Worked cooperatively with WDFW and DNR to control North Willapa Bay meadow. Conducted eradication activities on Long Beach Peninsula in cooperation with DNR, USFWS, and property owners. Administered LIP grants for eradication activities in Tokeland and Bay Center. Conducted mechanical restoration activities in Bay Center area in cooperation with WDFW and DNR.

- **DNR** – Conducted control work in Pot Shot, Rose Ranch, Stanley Point, Naselle River and South Willapa River as well as Natural Area Preserves (NAPs). Continued the *Spartina* control-monitoring program in cooperation with WSU, WSDA and WDFW. Provided staff time and airboat assistance for UW-Olympic National Resources Center (ONRC) biocontrol program. Conducted aerial infrared photographic survey of Willapa Bay which will be available as a new GIS layer.

- **WDFW** – Conducted control operations in cooperation with WSDA in North Bay priority areas. Collected data for control monitoring program. Cooperated with WSDA on aerial broadcast applications in North Bay. Assisted with data collection for efficacy monitoring program.

- **USFWS** – Conducted control work in all areas from the mouth of Bay Center south to the northern boundary of the Tarlatt Slough treatment area. Provided airboat support for *Spartina* researchers. Conducted eradication activities on Long Beach Peninsula in cooperation with WSDA and DNR.

- **UW-ONRC –** Continued to manage the biological control release program. Continued to develop tidal elevation prediction maps of various treatment sites to predict the dry-time plants will receive on specific days.

- **WSU –** Continued research to improve efficacy and efficiency of control tools. Continued researching the potential of various mechanical tools for restoration at successfully eradicated sites. Continued research on impacts of *Spartina* to shorebirds and waterfowl.

In 2006, the cooperative *Spartina* eradication effort resulted in treatment of approximately 3,150 solid acres spread throughout more than 25,000 affected acres of Willapa Bay. The acreage treated encompassed over 95% of the overall solid infestation. Of particular note is the increase in overall affected acres treated and decrease in solid acres treated, indicating that the density of the infestation is decreasing. In 2003, approximately 6,000 solid acres were treated over 10,000 affected acres. In 2004, the solid acres treated decreased to 5,700 solid acres while the affected acres increased to almost 13,000 acres. In 2005 approximately 5,000 solid acres were treated in an area encompassing about 20,000 acres. The increase in affected acres treated and the decrease in solid acres treated demonstrates that the overall solid acres in Willapa Bay are being substantially reduced, and that the large meadows are fragmenting.

Highlights of the 2006 Season in Willapa Bay

Table 5 (see page 19) identifies the areas of the Bay treated, who conducted treatment, and what kind of treatment was done. Figures 3 and 4 (see pages 21 and 22) are maps of North Willapa Bay and South Willapa Bay, respectively, including area names.

During the fall of 2005 and winter of 2006, WSDA worked cooperatively with WDFW, DNR, USFWS, Shoalwater Tribe, TNC, WSU, UW and the Willapa Bay/Grays Harbor Oyster Growers Association (Oyster Growers) to develop a 2006 work plan that focused on re-treatment of the

previous year's treatment sites, with the addition of initial treatments on the Long Beach Peninsula and in the Tokeland area.

WDFW/WSDA: The work plan directed WDFW and WSDA to focus on treatments from Wilson Point at the mouth of Bay Center north to South Bend and west from South Bend to the mouth of the Cedar River. Over 180 solid acres in this area were treated aerially. The remaining acreage was treated using a combination of ground-based hand-held and broadcast applications. A majority of these treatments were fourth year re-treatments. Large reductions continue to be evident in this treatment area. Sites such as the Cedar River, Wilson Point and North Willapa Meadow showed huge reductions from last year's infestation's size. WSDA was responsible for all treatments on the Long Beach Peninsula from the Nahcotta Marina South to Tarlatt Slough. These treatments were conducted using ground-based broadcast and hand-held application equipment. WSDA also contracted to aerially treat the Ellan Sands site.

DNR: In 2006, DNR continued its focus on the re-treatments of Pot Shot, Stanley Point and the entire Naselle River, including the cooperative treatment of the Ellsworth Slough with TNC. DNR also conducted the second year of re-treatments to the entire Niawiakum NAP and the third year re-treatment of the Bone River NAP. DNR also treated from the mouth of Bone River to the South Bend boat launch and assisted WSDA and USFWS with follow-up applications on the Long Beach Peninsula. In many of the areas that DNR has been responsible for over the past several years, *Spartina* is becoming very close to eradicated. In particular, Pot Shot, Stanley Point and Chetlo Harbor (mouth of Naselle River) have been substantially reduced over the past three to four years. DNR treated 137 solid acres in Pot Shot and 114 solid acres at Stanley Point in 2003 and treated 107 acres in Chetlo Harbor in 2004. This season, DNR treated 1.5 solid acres in Pot Shot, 11.8 solid acres at Stanley Point and 7 acres at Chetlo Harbor. That equates to reductions of 99%, 90% and 93% of overall *Spartina* infested acres, respectively.

USFWS: The USFWS area of responsibility in 2006 included two new areas of treatment: North Long Beach Peninsula and Tokeland. The North Long Beach Peninsula application was conducted aerially in cooperation with WSDA, and the portion of the Tokeland treatment site that was treated aerially was also a cooperative treatment between WSDA and USFWS. WSDA continued to provide funding for herbicide applications conducted by USFWS in the Bay Center area. USFWS continued to treat from the mouth of Bay Center south to the Tarlatt Slough infestation. USFWS has continued to effectively reduce large infestations over the past four years. At what was once the largest infestation in Willapa Bay, the Porters Point/Tarlatt Slough infestation, over 2,400 solid acres were treated in 2003. During the 2006 treatment season USFWS treated 326 solid acres, a reduction of over 87%. At the North Nemah site, where treatment began in 2004 with 860 solid acres treated, the infestation was down to 228 solid acres in 2006, an overall reduction of 73%.

Shoalwater Tribe: For the 12-year life of the *Spartina* program in Willapa Bay, the Shoalwater Tribe has been an active and supportive partner in the effort to eradicate *Spartina*. Over the years, the tribe has attempted numerous non-herbicide approaches for eradication, such as the use of bio-control agents, and mechanical and manual methods. All of these methods have proven to be ineffective in achieving the results that the Tribe wanted.

Beginning in 2003, the Shoalwater Tribe allowed the state and federal partners to use herbicide on infestations occurring on the many tribally-owned oyster beds outside of the reservation boundaries. However, the Tribe was still not ready to allow the use of herbicides within the reservation boundaries. With the approval of the herbicide imazapyr in 2004, an herbicide with low toxicity to fish, birds and invertebrates, the Tribe reconsidered herbicide use on infestations within the reservation boundaries.

Working closely with the state and federal partners, the Shoalwater Tribe made the decision in the spring of 2006 to allow ground-based applications of imazapyr to infestations within the reservation boundaries. The USFWS agreed to conduct all necessary applications and hired several tribal members to work on the treatment crew tackling the reservation infestations. In total, over 70 solid acres in of *Spartina* were treated within the Shoalwater reservation.

Over the past four years, the combined effort in Willapa Bay has been extremely effective and has reduced the overall infestation from a high of about 8,500 solid acres in 2003 to approximately 3,250 solid acres in the spring of 2006. This is an overall reduction of 62% achieved in three treatment seasons. If the 2006, treatment season has similar success, fewer than 2,000 solid acres of *Spartina* are expected to infest Willapa Bay at the beginning of the 2007 treatment season. This would be a reduction of over 75% achieved in four treatment seasons.

Cooperation between the various agencies and entities involved has continued to improve. During the 2006 season, WSDA, USFWS, DNR and Oyster Growers combined efforts to ensure thorough treatment of the Long Beach Peninsula. Also, WDFW, WSDA and DNR continued to combine efforts and resources to ensure thorough treatment of the entire North Willapa Bay area. In 2006 the effort treated over 95% of the infestation in Willapa Bay. The 2007 plan, if successful, will result in the treatment of all infestations in Willapa Bay with emphasis placed on implementing the most effective control techniques. The effort also continues to focus on restoration potential for successfully eradicated sites. On-going research in this area will help managers determine how best to proceed with restoration projects in the Bay.

WSDA feels confident that reductions will continue in 2007 and eradication will become more of a reality in Willapa Bay. Table 6 (see page 20) compares the treatment data from several sites over the past four years.

Figure 2. Approximate Location of 2006 Interagency Willapa Bay Treatment Sites

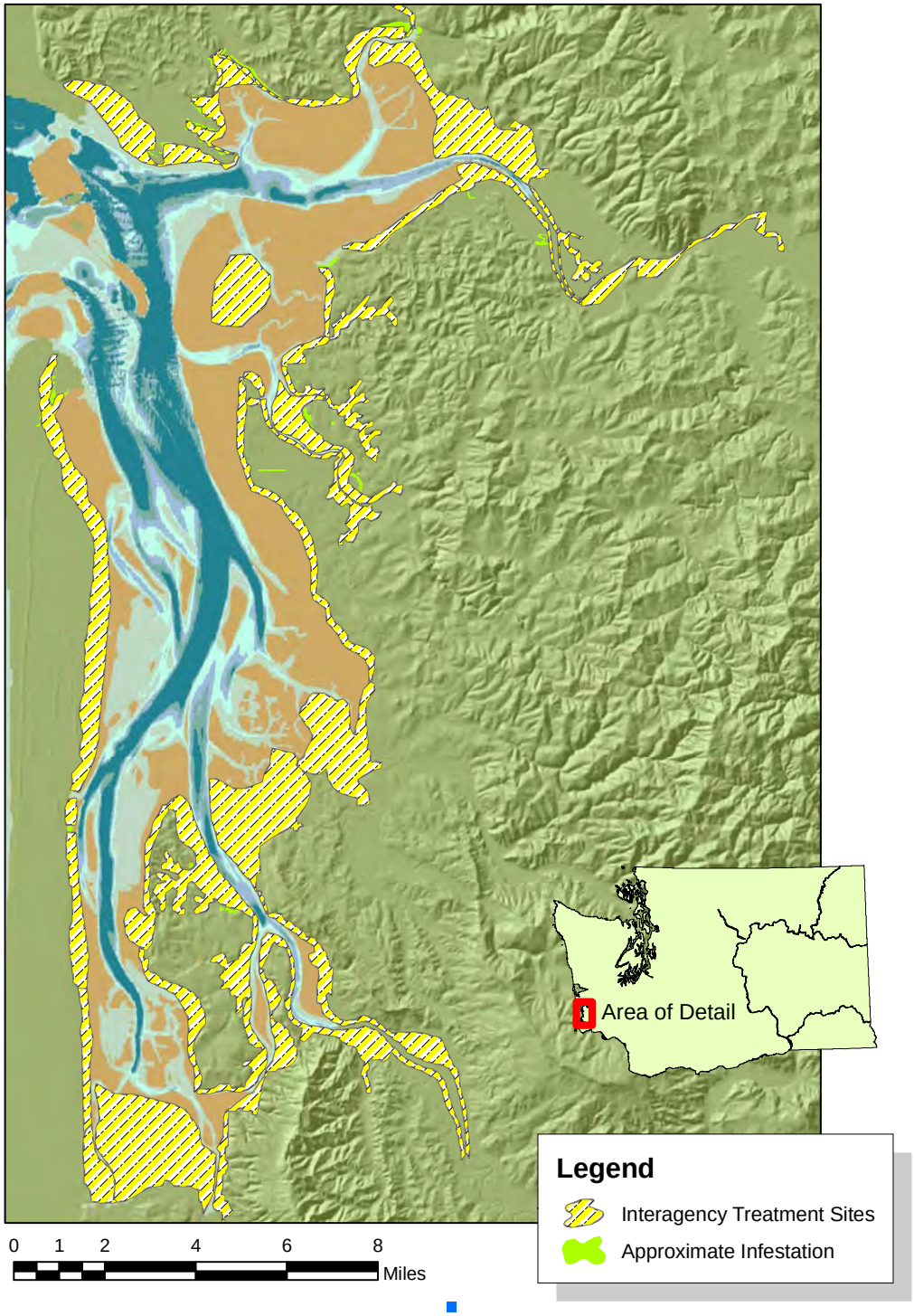


Table 5. Summary of 2006 Willapa Bay *Spartina* Eradication Effort

Site	Estimated Solid Acreage Treated	Approximate Affected Acres Treated	Entity Conducting Treatment	Treatment Method Used
North Willapa Area				
North Willapa Meadow/ Smith Creek	285	2,074	WDFW, WSDA	Herbicide
North Shore/Cedar River	75.1	876	WDFW, WSDA	Crush/Herbicide
Tokeland	402.8	720	WDFW, USFWS, WSDA, ST, DNR	Herbicide
Bruceport / Rose Ranch	16.8	319	WDFW, WSDA, DNR	Herbicide
S. Willapa River/ Rose Ranch	48.8	392	WDFW, DNR	Crush
South Bend/Raymond	6.5	628	WDFW	Herbicide
Mailboat Slough	4	271	WDFW, DNR	Herbicide
Niawiakum NAP	23.7	334	DNR	Herbicide
Bone River NAP	1.2	257	DNR	Herbicide
South Stoney Point	17.3	141	WDFW, WSDA	Herbicide, Crush
Wilson Point	12.6	155	WDFW, WSDA	Herbicide
Ellan Sands	20	1,000	WSDA	Herbicide
Bay Center/Palix	234.2	1,516	WSDA, WBOGA, DNR, USFWS	Herbicide, Crush
Nemah Beach	26.1	735	USFWS	Herbicide
North Nemah	227.9	1,686	USFWS	Herbicide
South Willapa Area				
North Pot Shot	31	121	USFWS	Herbicide
O'Meara Pt. – Bear R.	2.3	240	USFWS	Herbicide
O'Meara Cove	6	132	USFWS	Herbicide
Pot Shot	1.5	281	DNR	Herbicide
East Long Island	103.1	740	USFWS	Herbicide
South Long Island	1.4	36	USFWS	Herbicide
Sunshine Point	7	19	DNR	Herbicide
Naselle	31.5	1,741	DNR, TNC	Herbicide,
Porters Point/Tarlatt Slough	325.9	3,384	USFWS, WSDA	Herbicide
Stanley Point	11.8	119	DNR	Herbicide
Kaffee Lewis Slough	211.6	1,223	USFWS	Herbicide
South Nemah/Seal Slough	80.9	2,182	WBOGA, USFWS	Herbicide
West Long Island	54.5	986	USFWS	Herbicide
Long Beach Peninsula	872.5	3,127	WSDA, DNR, USFWS, WBOGA	Herbicide
Total	**3,143**	**25,438**		

WSDA = Department of Agriculture, WDFW = Department of Fish and Wildlife, DNR = Department of Natural Resources, WBOGA = Willapa Bay Oyster Growers Association, USFWS = U.S. Fish and Wildlife Service, TNC = The Nature Conservancy, ST = Shoalwater Tribe

Table 6. Reduction in Acres Treated By Major Site, 2006

Site	Solid AcresTreated				Base year for calculation	% Reduction as of 2006
	2003	2004	2005	2006		
North Willapa Meadow / Smith Creek	925	815.7	620	285	2003	69%
South Willapa River / Rose Ranch	177.88	196.2	52	48.8	2004	75%
North Shore/Cedar River	None	150.00	242.0	75.1	2005	69%
South Stoney Point	25	25	67.5	17.3	2005	74%
Bruceport to Rose Ranch	None	57	54	16.8	2004	70%
Wilson Point	None	64	90	12.6	2005	86%
Bay Center / Palix	None	573*	387.33	234.2	2004	59%
North Nemah	None	860	474.25	227.9	2004	73%
Pot Shot	137	26	1.58	1.5	2003	99%
Naselle	200.06	193	48.45	31.5	2003	84%
Stanley Point	114	87.5	13	11.8	2003	90%
North Pot Shot	83.3	50.6	42	31	2003	63%
O'Meara Cove	75	56	11	6	2003	92%
East Long Island	175	244.5	122.71	103.1	2004	58%
Porters Point/ Tarlatt Slough	2,425.30	844	786.9	325.9	2003	87%

*2004 treatment did not include infestations upriver from Highway 101 Palix River Bridge.

Figure 3. 2006 North Willapa Bay Interagency Treatment Sites

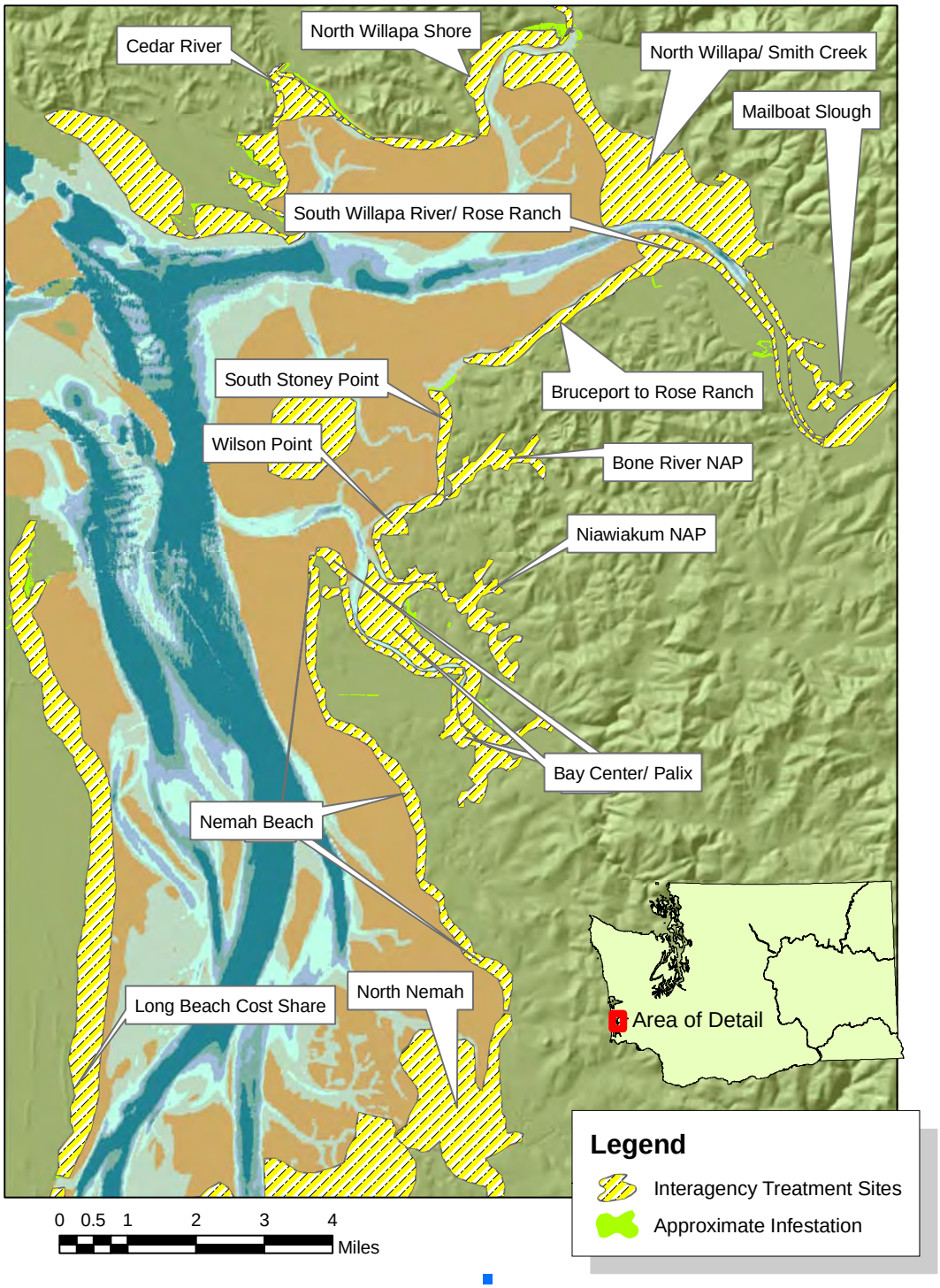
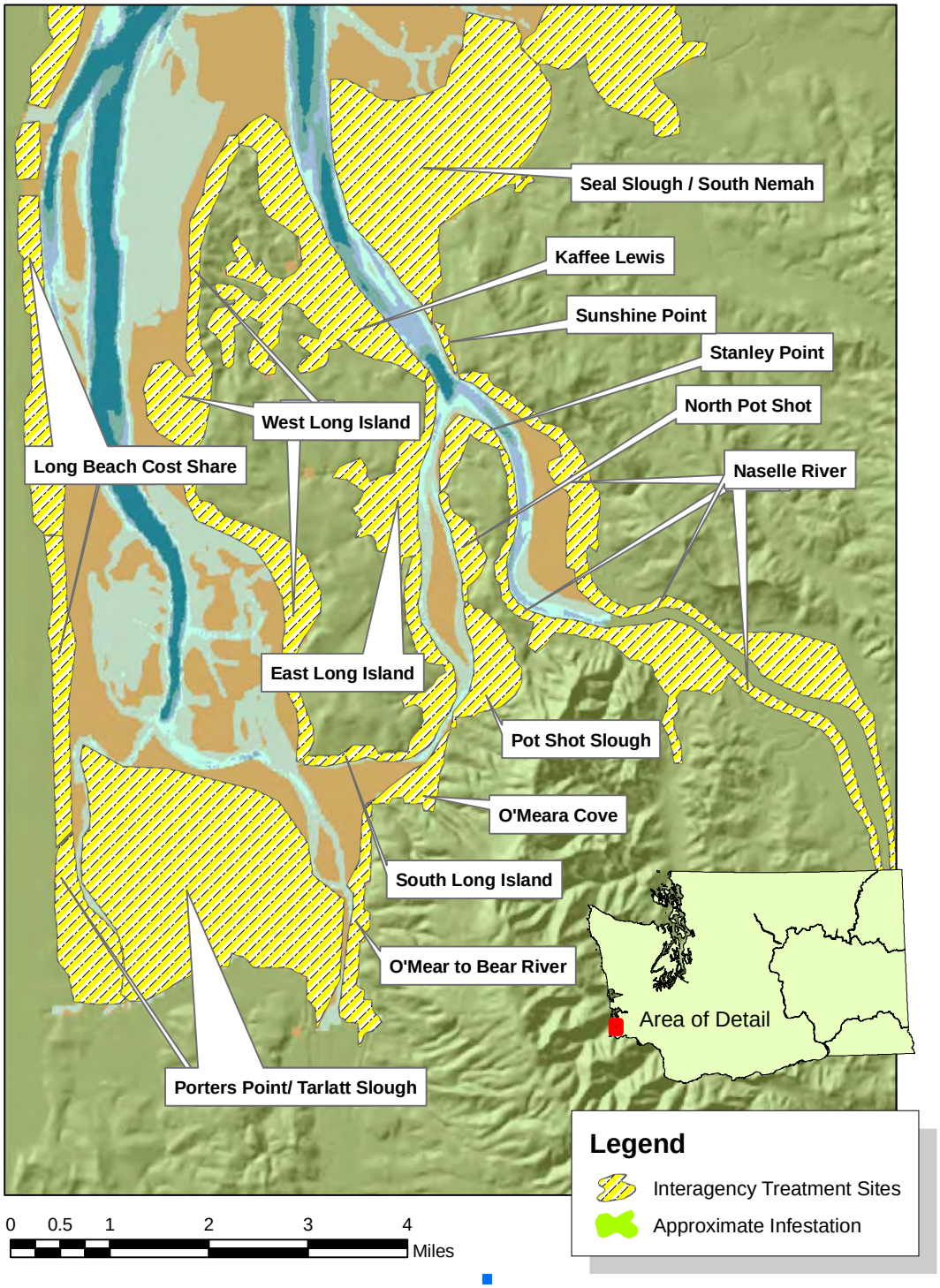


Figure 4. 2006 South Willapa Bay Interagency Treatment Sites



2006 *Spartina* Eradication Monitoring Program, Willapa Bay

The Willapa Bay *Spartina* monitoring program allows managers to understand the effectiveness of treatment methods at different sites and evaluate the overall control approach, as well as theeffectiveness of individual treatments. Data generated from the program are used for adaptive management purposes to improve planning and make future adjustments to the control strategy.

Monitoring sites were selected in areas where chemical and mechanical controls have been previously used. The treated sites vary in substrate, method and timing of treatments. Each site was measured before any treatment occurred as well as after each year of control work. Two new sites were added this year: Cedar River east and west, which were sampled following their first year of chemical treatment. Table 8 identifies the sites monitored this year.

Table 8. Monitor Sites in Willapa Bay

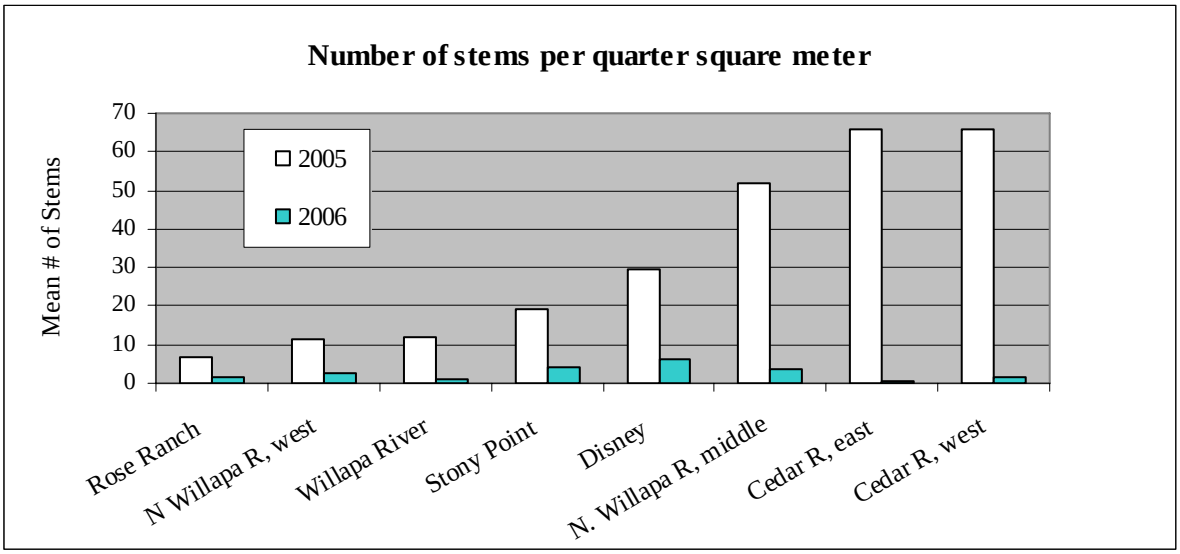
Site	Treatment History
Rose Ranch	Crushed winter 2002-spring 2004, sprayed with imazapyr 2004 and 2005.
Stony Point	Crushed fall 2002, sprayed 2003-2005.
Disney Property	Crushed fall 2002 and 2003, sprayed with imazapyr 2004 and 2005.
Willapa River, aerial spray	Aerial spray with glyphosate 2003, aerial spray with imazapyr 2004, spray 2005.
N. Willapa River, west	Crushed winter 2003-spring 2004, spray with glyphosate 2004, spray with imazapyr 2005.
N. Willapa River, middle	Crushed winter 2003, crushed winter 2004, aerial spray 2005.
Cedar River, east	Crushed winter 2004, aerial spray with imazapyr 2005.
Cedar River, west	Spray with imazapyr 2005.

Stem Density

The results of the monitoring work show significant decreases in stem density at all sites (Figure 5). Following treatment in 2005, reduction rates ranged from 99 percent (Cedar River, east) to 76 percent (North Willapa River, west). All of the sites had been chemically treated with imazapyr, either by air or ground. The slight differences in efficacy may be attributable to differences in dry time (amount of time the majority of the *Spartina* plant is above the tide following spray application), month of application (June and July are best for chemical treatment), or, simply, differences in individual application methods.

The site of the most dramatic reduction in stem density -- Cedar River, east -- had been crushed in the winter of 2004-2005 and then sprayed for the first time in 2005. No other control work had been done at this site prior to that time. We believe that the crushing reduced some of the stem biomass, while also stimulating earlier-than-usual regrowth of the stems. The stems were then tall enough and healthy enough to fully absorb and translocate the herbicide when it was applied aerially in the summer. These results attest to the strength of implementing IPM, where different control techniques are applied where they work best and the overall success of the program is maximized.

Figure 5. 2006 *Spartina* Monitoring Data - Stem Density



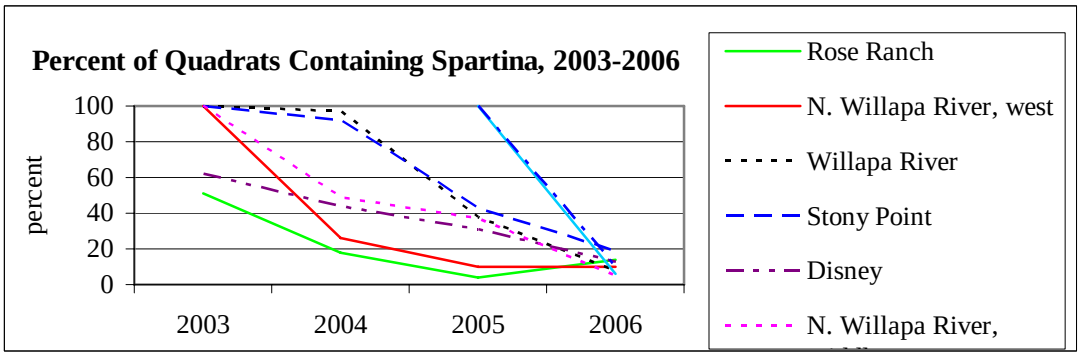
***Spartina* Presence**

Crew members count the number of quadrats containing one or more stems of *Spartina*, or conversely, no *Spartina*, to show how frequently *Spartina* is occurring in the sampling units. This measurement provides information about how *Spartina* is spread out over the tide flats, whether stems are bunched together in clumps or spread more evenly across the landscape.

Figure 6 shows a downward trend of *Spartina* presence over time. The decline in *Spartina* in our sampling quadrats between 2005 and 2006 is dramatic at all but two sites. For example, the percentage of quadrats containing live *Spartina* stems at Cedar River east in 2005 was 100 percent and in 2006 was 6 percent. At Cedar River west, the percentage in 2005 was 100 percent and in 2006 was 10 percent. At the two sites where *Spartina* frequency did not decrease from 2005 to 2006 -- Rose Ranch and North Willapa River west – large decreases in stem density (Figure 5) were measured this year. So, while *Spartina* stems may be showing up more often in the sampling quadrats (meaning they are more spread out over the landscape), the overall amount of *Spartina* at these sites has been reduced.

Monitoring at all sites will continue in 2007, reductions of both stem density and percentage of quadrats containing live stems are expected.

Figure 6. 2006 *Spartina* Monitoring Data – *Spartina* Presence

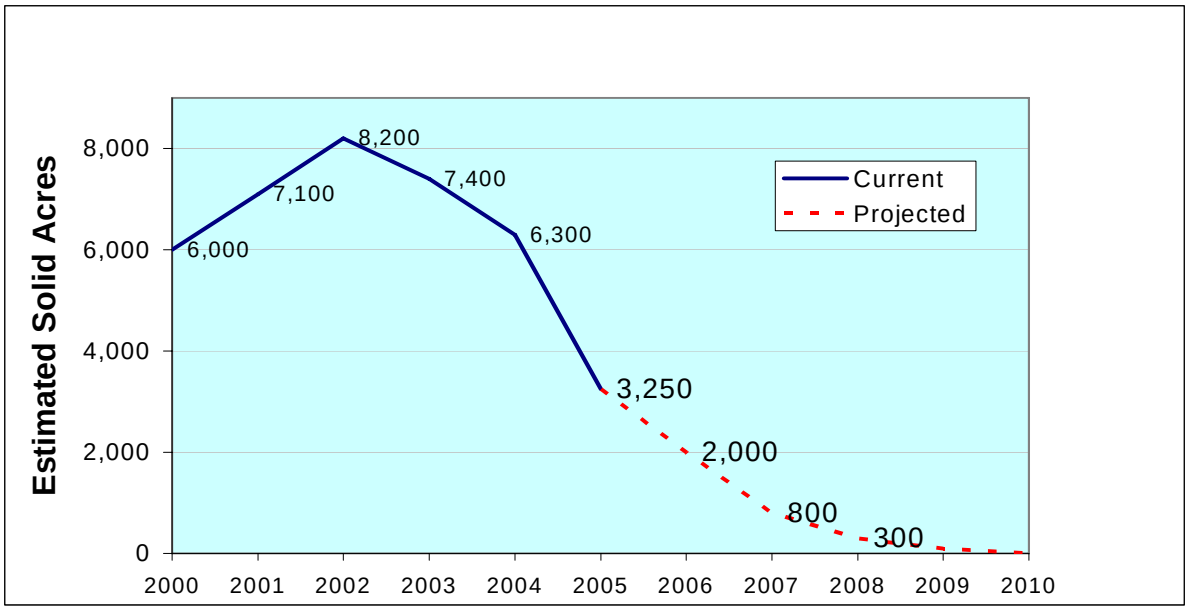


Recommendations for the Future

Due to the successes of the past four years, and the sizable reductions of the *Spartina* meadows in Willapa Bay, the eradication effort must transition from large-scale ground and aerial operations to smaller re-treatment operations that require a greater number of field personnel to cover the same areas. The eradication effort will also transition to surveying and treating the remaining scattered infestations that will be found throughout the Bay. Areas that helicopters or large machines were previously able to cover in a relatively short amount of time will require more time to treat a much smaller number of solid acres. Through the amount of herbicide needed will decline, bringing costs down, the number of personnel needed will increase. It is anticipated that the overall cost for re-treating sites will not significantly differ from the overall cost of conducting the initial large-scale applications.

With the successful eradication of several thousand acres of *Spartina* in Willapa Bay over the past four years, it is critical that program focus and funding continue. Figure 7 illustrates the current projection that *Spartina* can be largely eradicated from Willapa Bay in four more seasons.

Figure 7. Projected solid acres of *Spartina* in Willapa Bay with sustained funding



Spartina Eradication Effort in Grays Harbor

This water body includes the mouth of Grays Harbor, Grays Harbor, and all the rivers, creeks and streams that run into Grays Harbor and the Copalis River drainage. Figure 5 shows the sites of infestations and treatment sites in Grays Harbor during the 2006 season.

Extent of the Infestation in Grays Harbor

During an aerial survey of Grays Harbor in the late summer of 2005, several acres of previously unknown *Spartina* were identified. This brought the total known infestation in Grays Harbor to approximately 10 solid acres. After discovery of the infestations, WDFW sent ground crews into Grays Harbor to treat the infestations despite the limited time remaining in the 2005 treatment season. With limited funds, WDFW was able to treat approximately half (6.5 acres) of the new discovery.

In the fall of 2005, WSDA formed the Grays Harbor *Spartina* Task Force to start working on a plan and pursuing resources for a dedicated Grays Harbor *Spartina* effort. The Task Force is made up of representatives from WSDA, WDFW, DNR, USFWS, State Parks, TNC, Audubon Society, Grays Harbor County, Friends of Grays Harbor and the Grays Harbor aquaculture industry. The members worked effectively and formulated several contingency plans for varying funding levels.

During this time, WSDA, WDFW and USFWS began working on several grant applications in an attempt to secure adequate funding to hire a ground crew that would focus on Grays Harbor *Spartina* infestations. In the spring of 2006, the partners learned that the effort to pursue federal grant funding had been successful and, after a permitting process, $40,000 in federal funding was in place for conducting treatments. In addition, the Washington State legislature appropriated $50,000 in funding for Grays Harbor treatments during the 2006 fiscal year. Approximately $50,000 of the $90,000 obtained for work in Grays Harbor will be available for continued work in 2007.

WDFW was responsible for control work in Grays Harbor, and began work in mid-June. Survey and treatment activities took place throughout the season and all known infestations were treated.

In 2006, herbicide treatments within Grays Harbor totaled approximately 3.5 acres. There were three primary areas of infestation: the Elk River, North Bay, and Grass Creek. The most challenging area is the Elk River estuary which contains approximately half the *Spartina* in Grays Harbor. The difficult terrain required the crews to resort to backpack sprayers and traverse very uneven and hazardous substrate. The North Bay is dominated by clones of all sizes that are also difficult to reach using airboats. Grass Creek is another large infestation (about 1 acre) but, for the most part, is easily accessible with airboats. Figure 8 is a map showing the approximate locations of infestations in Grays Harbor.

Recommendations for the Future

The results of the 2005 aerial survey revealed approximately 10 acres of previously unknown *Spartina* infestations. WDFW was able to immediately treat 6.5 acres of the newly discovered *Spartina*. The remaining 3.5 acres were treated during the 2006 season. In addition, previously treated sites were resurveyed and treated. In 2007, Grays Harbor should be entirely re-surveyed and any new infestations that are found should be treated.

The additional state and federal funds made achieving the 2006 control objectives possible. Based on what was learned during the 2006 treatment season, the rest of these funds will be used in 2007 to treat any remaining infestations. The agencies will:

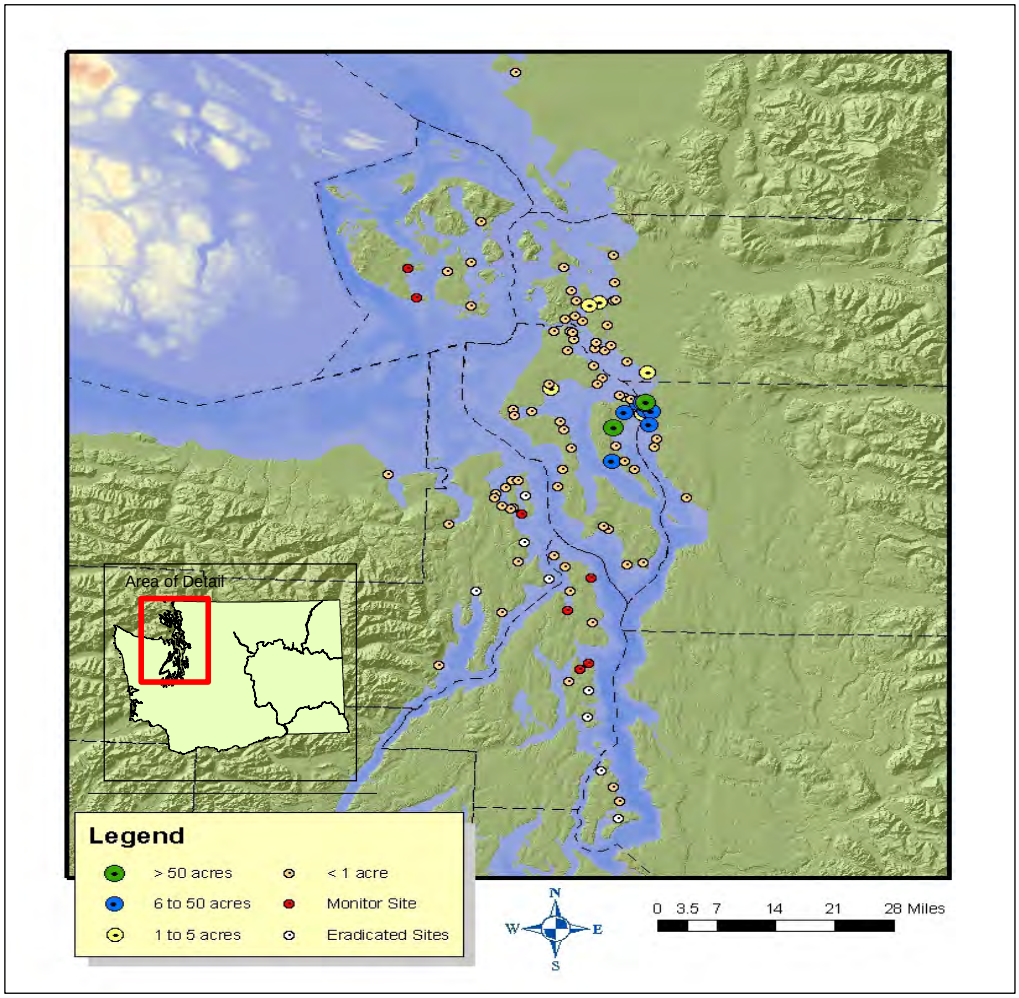
1. Hire a crew for Grays Harbor by April.
2. Train crew members in preparation for spray season. Crews must be familiar with the geography of the Harbor, licensed for herbicide application, and trained on equipment operation and safety before they are qualified to operate in Grays Harbor independently.
3. Purchase herbicide for the control season.
4. Invest in equipment that will improve or expedite control in Grays Harbor.
5. Survey coastal sites that may harbor unknown *Spartina* infestations.

Figure 8. Approximate Locations of Grays Harbor Infestation and Treatment Sites, 2006

Spartina Eradication Effort in Puget Sound and Hood Canal

For purposes of the WSDA *Spartina* Program, Puget Sound and Hood Canal refers to Whatcom, San Juan, Skagit, Island, Snohomish, Clallam, Jefferson, Kitsap and King counties. Figure 9 shows approximate locations and sizes of all known *Spartina* infestations in Puget Sound and Hood Canal. Figure 6 also shows locations of monitor sites, which are defined as sites of previous infestation at which no re-growth was found during the current season, and eradicated sites, at which no re-growth was found for at least the past two years.

Figure 9. Locations of Known Puget Sound and Hood Canal *Spartina* Infestations



Extent of the Infestation in Puget Sound and Hood Canal

Using monitoring and survey data coupled with 2006 treatment figures, WSDA estimates the total solid acreage of the Puget Sound and Hood Canal infestation at the beginning of the 2006 treatment season was 350 solid acres. During the 2006 season, an estimated 325 solid acres were treated, including an estimated 215 solid acres in Snohomish County and 99 solid acres in Island County.

Snohomish County

WSDA provided $50,000 to the Snohomish County Noxious Weed Control Board for *Spartina* eradication activities in 2006. In addition to this funding, WSDA provided a supplemental allocation of herbicide to the county. WDFW also conducted a substantial amount of control work in Snohomish County during the 2006 season. This work focused mainly on WDFW-managed lands on Leque Island. WDFW treated the entire infestations at Leque Island and Mystery Island. The combined size of these infestations before substantial control efforts began was approximately 200 solid acres. At the start of the 2006 control season, only 25 solid acres remained. This is an 87% decline since the beginning of 2003. WSDA also provided a supplemental allocation of herbicide to WDFW for these treatments.

All meadows in southeast Skagit Bay, Leque Island and Mystery Island were treated. One small infestation in the extreme southeast portion of the bay was discovered late in the 2006 season and is on the treatment schedule for 2007. This is the fourth season that all meadows in this area have been treated. The herbicide imazapyr was applied for the first time to southeast Skagit Bay in 2005. The success of that treatment allowed the county to focus its efforts on the smaller surrounding infestations.

The Nature Conservancy (TNC) was again a major on-the-ground contributor during the 2006 season. With grant funding through the NOAA Fish America Foundation and a private donor, TNC again hired an Americorps field crew to conduct extensive surveys and control work in Port Susan. TNC was able to treat every known *Spartina* plant in Port Susan with either imazapyr or a combination of imazapyr and glyphosate. With continued surveys and control work by TNC, and continued reduction and seed suppression to the nearby large infestations, this site will quickly near eradication.

In total, 215 solid acres of *Spartina* were treated in Snohomish County in 2006. Table 8 shows the solid acres treated, who did the treatment, and the treatment methods used on every site in Snohomish County. Figure 10 identifies the approximate location of the infestations.

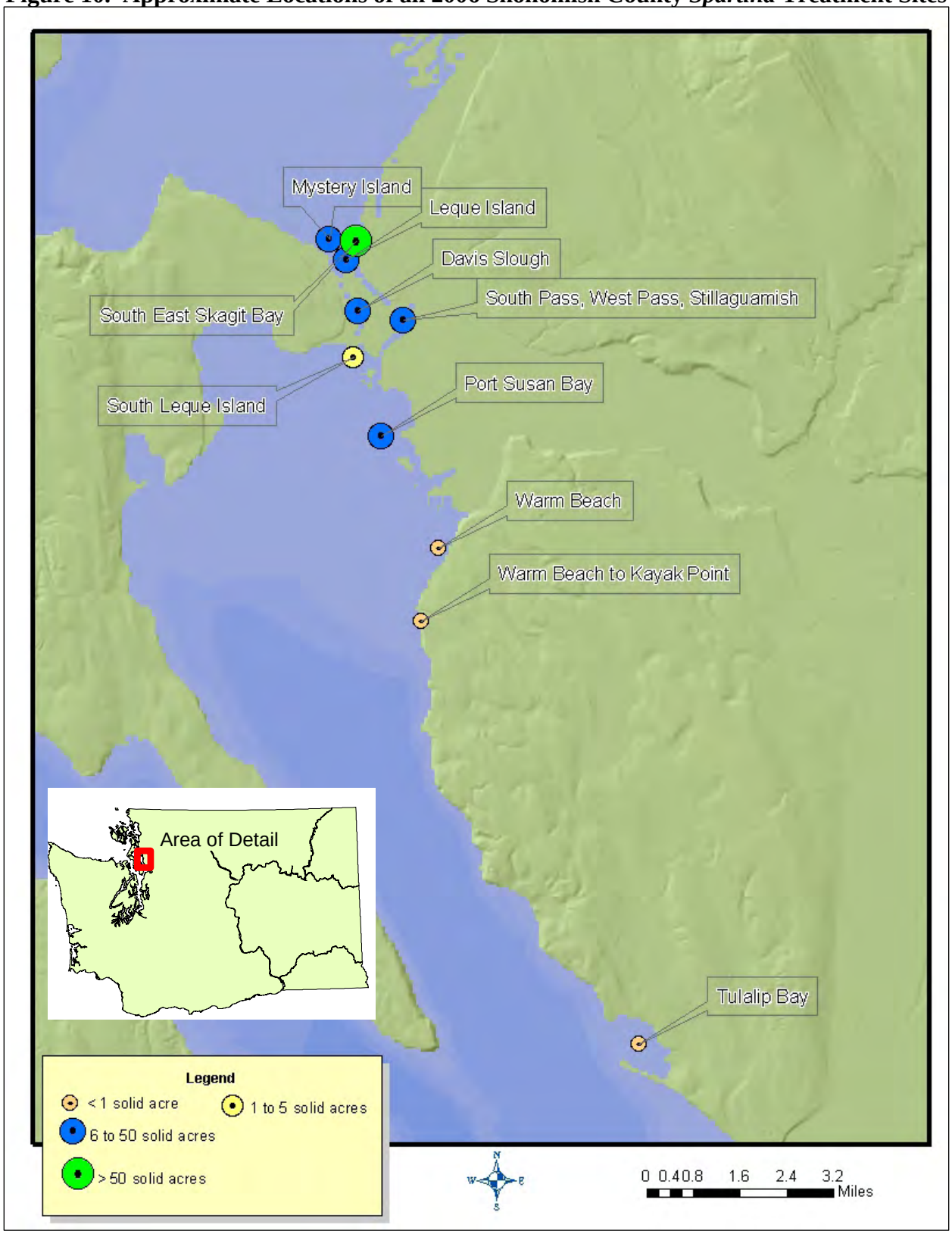
Table 8. Summary of 2006 *Spartina* Eradication Effort in Snohomish County

Site	Estimated Solid Acreage treated	Entity Conducting Treatment	Treatment Method used
Port Susan	0.1*	TNC	Herbicide, Dig
Southeast Skagit Bay	134.86	SC,WDFW	Herbicide
Davis Slough	6.01*	WDFW	Herbicide
Mystery Island	3.5*	WDFW	Herbicide
Leque Island	20.5*	WDFW	Herbicide, Crush
South Leque	1*	WDFW, WM	Herbicide
Warm Beach	0.002*	SC	Herbicide,
South Pass, West Pass, Stillaguamish River Channels	48.76*	SC, WDFW	Herbicide
Kayak Point to Warm Beach	0.0001*	TNC	Mow, Dig
Tulalip Bay	0.25*	WSDA, SC, TT	Mow, Dig
Total Solid Acres Treated	**214.98**		

*Denotes entire site treated

SC = Snohomish County, WDFW = Department of Fish and Wildlife, WM = Wildlands Management, TT = Tulalip Tribe, TNC = The Nature Conservancy

Figure 10. Approximate Locations of all 2006 Snohomish County *Spartina* Treatment Sites



Island County

WSDA provided $50,000 to the Island County Noxious Weed Control Board for *Spartina* eradication activities in 2006. Island County sub-contracted the majority of its *Spartina* eradication work to a private company, Wildlands Management (WM). In addition, WDFW conducted a large amount of control work in the county during the 2006 season.

In total, 99 solid acres of *Spartina* were treated in Island County in 2006. Table 10 shows the solid acres treated, who did the treatment, and the treatment methods used. Figure 11 shows the approximate locations of the treatment sites.

In 2006, WDFW and Wildlands Management treated 64 acres of the 67-acre Triangle Cove site – the largest single site in Island County. This effort will reduce the number of smaller infestations that result from seed production at this site. The success at Triangle Cove is in part due to the $50,000 LIP grant which WSDA, WDFW and the major landowner in Triangle Cove were able to secure for use in the 2006 through 2011 treatment seasons.

People for Puget Sound (PFPS) continued to be active in the *Spartina* eradication effort during the 2006 season. To date, it has set up four community-based survey and monitoring groups in Island County. The community groups focus on sites that are either owned by community members or are on the shorelines surrounding the communities. Groups have been set up at the Juniper Beach, Eagle Tree Estates, Oak Bay, and Harrington Lagoon sites. Most of the groups have decided to apply herbicide at the sites until infestations are small enough that community members can remove them manually. The community groups work closely with PFPS and the Island County Noxious Weed Control Board to ensure that treatments are conducted and that sufficient assistance is given during community dig events.

The overall infestation in Island County has been reduced by more than 60% in the past four years. With current funding and efforts continuing, WSDA feels it is possible to eradicate all infestations in Island County in the next four years. With the large seed-producing meadows now being substantially reduced, most of the small outlier infestations should start to be eradicated over the next two years; the large meadows will require several more years.

Table 9. Reduction in Infestation, Major Sites, 2003-2006

Site	Solid Acreage Present				% Reduction 2003-2006
	2003	2004	2005	2006	
Emerick's/Price	121.5	60	50	50	58%
Livingston Bay	34.5	4.45	10.32	1.06	99%
Triangle Cove	127.5	75	75	67	48%
English Boom	15	7.5	0.75	0.175	99%
Cultus Bay	1.75	1.5	0.5	0.05	97%
Deer Lagoon	1.5	1.325	0.175	0.05	97%
Total	**301.75**	**149.77**	**137.50**	**118.34**	**61%**

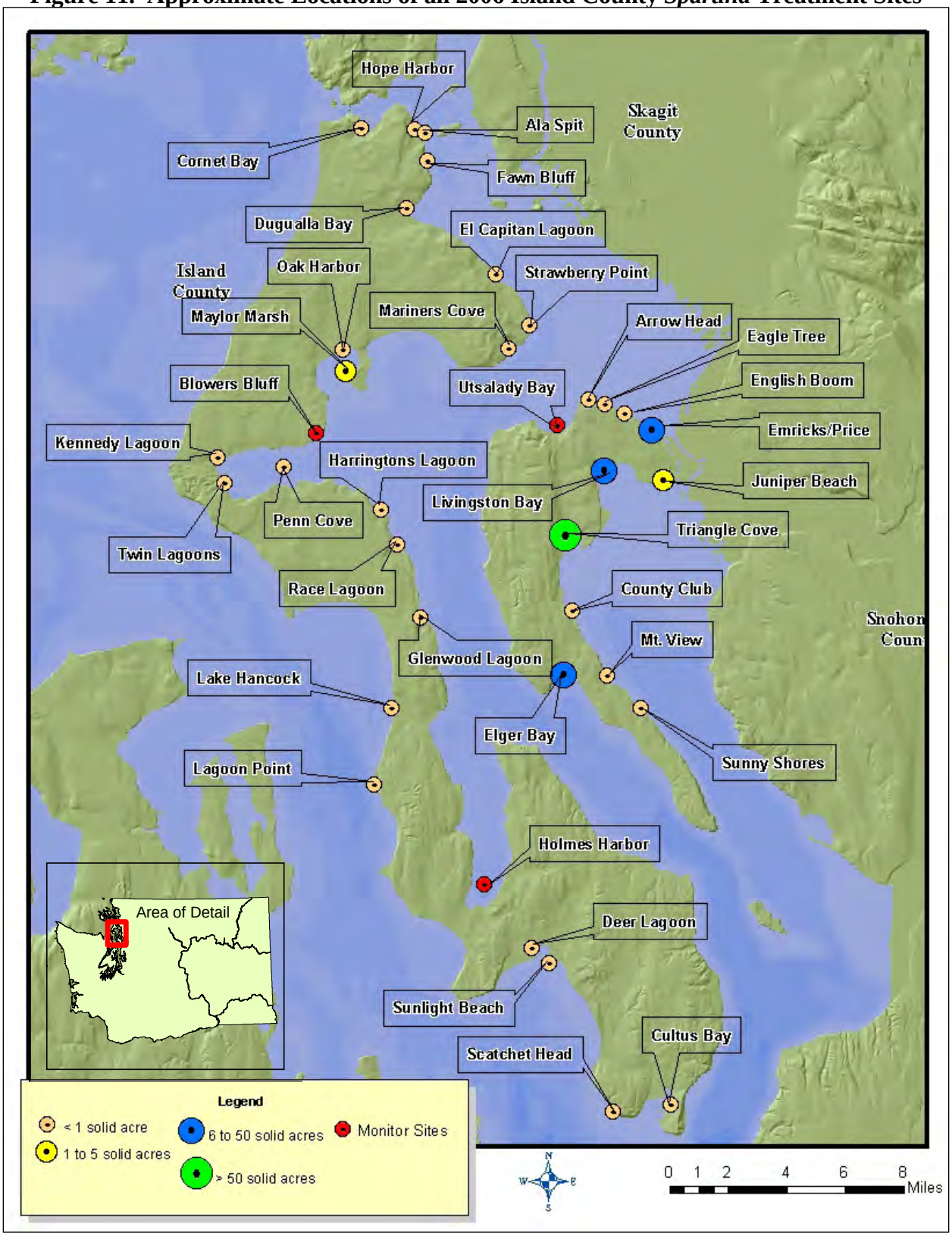
Table 10. Summary of 2006 *Spartina* Eradication Effort in Island County

Site	Estimated Solid Acreage Treated	Entity Conducting Treatment	Treatment Method
Hope Harbor	0.007*	WM	Herbicide
Ala Spit	0.008*	WM	Herbicide
Cornet Bay-	0.005*	WM	Herbicide
Dugualla Bay	0.03*	WM	Herbicide
Race Lagoon	0.02*	WM	Herbicide
Arrowhead Beach	0.125*	WM	Herbicide
Utsalady Bay	0	WM	*Monitor*
Livingston Bay	1.06*	WM, WDFW	Herbicide
Emrick's/Price	30	WM, WDFW	Herbicide, Disc
Deer Lagoon	0.05*	WM	Herbicide
Cultus Bay	0.05	WM	Herbicide
Scatchet Head	0.01*	WM	Herbicide
English Boom	0.175*	WM	Herbicide
Mt. View Lagoon	0.0025*	WDFW	Herbicide
Elger Bay	0.475*	WDFW, WM	Herbicide
County Club	0.0025*	WDFW	Herbicide
Sunny Shores	0.25*	WDFW	Herbicide
Eagle Tree	0	IC	*Monitor*
Sunlight Beach	0.03*	WM	Herbicide
Juniper Beach	1.7*	WM, WDFW	Herbicide, Dig
Triangle Cove	64.25	WM,WDFW	Herbicide
Penn Cove/Twin Lagoons, Kennedy Lagoon	0.0675*	WM	Herbicide
Blowers Bluff	0	WM	*Monitor*
El Capitan Lagoon	0.01*	WM	Herbicide
Fawn Bluff	0.01*	WM	Herbicide
Harrington's Lagoon	0.0125*	WM	Herbicide
Glenwood Lagoon	0.025*	WM	Herbicide
Holmes Harbor	0	WM	*Monitor*
Mariner's Cove	0.015*	WM	Herbicide
Lagoon Point	0	WM	*Monitor*
Strawberry Point	0	WM	*Monitor*
Oak Harbor	0.275	IC	Herbicide
Maylor's Point /Polnell Point	0.06	IC	Herbicide
Hancock Lake	0		*Not visited*
Total Solid Acres Treated	**98.75**		

*Denotes entire site treated

WM = Wildlands Management, WDFW = Department of Fish and Wildlife, IC = Island County WSDA = Department of Agriculture.

Figure 11. Approximate Locations of all 2006 Island County *Spartina* Treatment Sites



Skagit County

WSDA provided $40,000 to the Skagit County Noxious Weed Control Board and $10,000 to the Swinomish Tribal Community during the 2006 control season. The Swinomish Tribe, WDFW and the Department of Ecology also allocated resources towards *Spartina* eradication activities in Skagit County.

In total, 10.3 solid acres of *Spartina* were treated in Skagit County in 2006. This acreage treated roughly equals the amount treated in 2005. Many sites showed reduced infestation size, but three sites (Gallups South, Rawlings Rd. South, and Kraft Island) showed an increase in the size of the infestation. These sites were difficult to access and additional resources may be needed to treat these sites in the future. A National Fish and Wildlife Foundation grant was awarded to WDFW in 2006 and will help address these sites next year. Table 11 shows the solid acres treated, who did the treatment, and the treatment methods used on every site in Skagit County. Figure 12 shows the approximate locations of all Skagit County 2006 treatment sites.

For the fifth year in a row the Swinomish Tribal Community worked cooperatively with WSDA, Skagit County and others to conduct *Spartina* eradication activities using an integrated pest management (IPM) approach. Through an agreement between WSDA, the Swinomish Tribal Community and Skagit County, most tribal sites are treated by Skagit County. The only site on the reservation where herbicide application is not allowed, due to an ongoing environmental health study, is Turners Cove. In addition to mechanical treatment, the Swinomish Tribal Community introduced fabric covering at Turners Cove. A portion of the infestation was covered with 2,250 square feet of geo-textile fabric in an effort to eradicate the *Spartina*. The Swinomish Tribe plans to continue geo-textile fabric covering efforts at Turner's Cove in 2007.

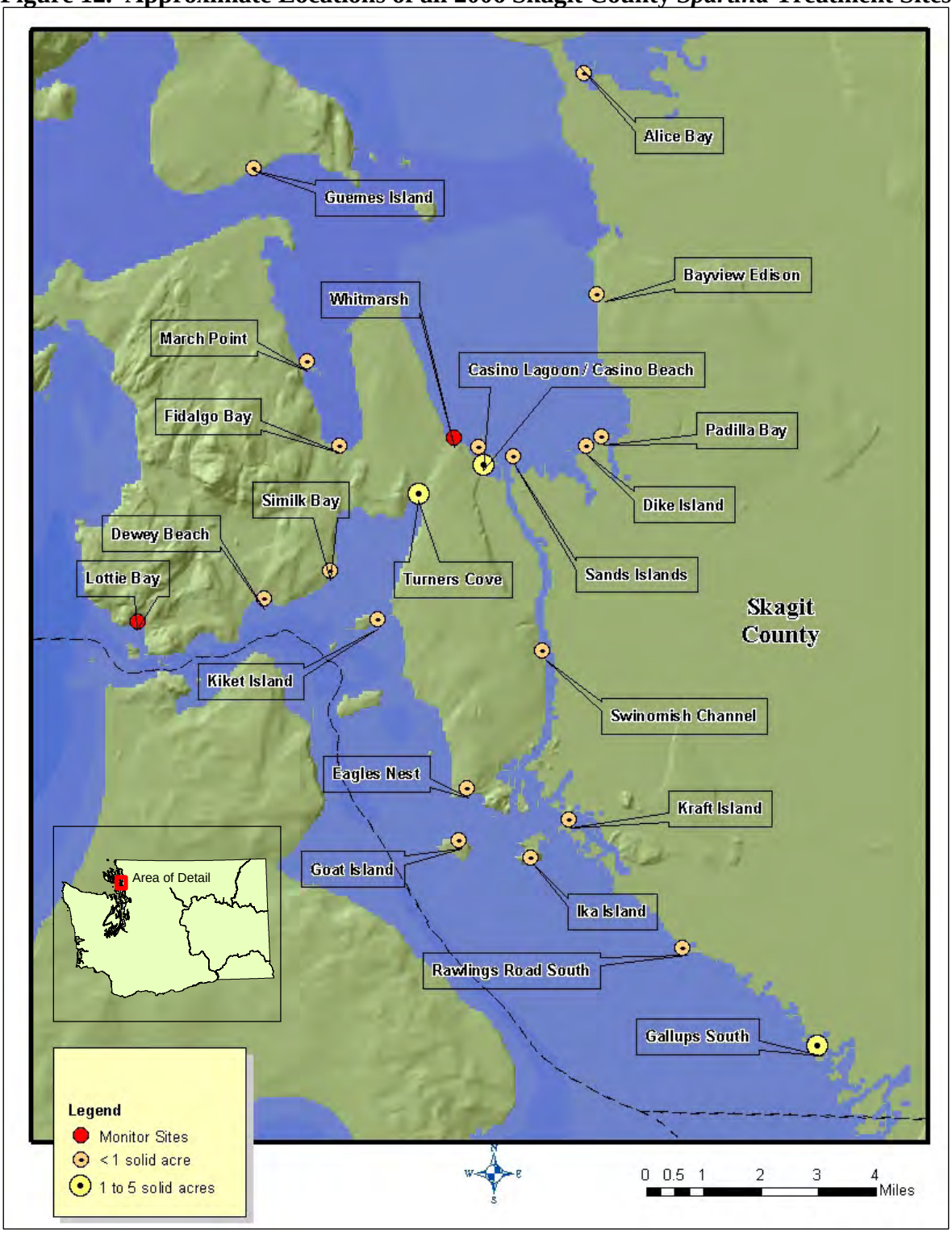
The effort in Skagit County continues to be successful. The infestation in the county, estimated at 100 solid acres in 1997, has been reduced by about 90% to 10 solid acres in 2006. A dedicated, cooperative effort in 2007 is necessary to realize further reductions at all sites in Skagit County.

Table 11. Summary of 2006 *Spartina* Eradication Effort in Skagit County

Site	Estimated Solid Acreage Treated	Entity Conducting Treatment	Treatment Method
Gallups South	2.05*	SK	Dig, Herbicide
Rawlings Rd. South	1.85*	SK	Mow, Herbicide
Kiket Island	0	SK	*Monitor*
Sands Island	0.1*	SK	Herbicide
Kraft Island	3.81*	SK	Herbicide
Ika Island	0	SK	*Monitor*
Dike Island	0	WM, WDFW	*Monitor*
Padilla Bay	0.0003*	DOE	Dig
Similk Bay	0.002*	SK	Herbicide
Bayview Edison	0.0002*	DOE	Dig
Eagle's Nest	0.01*	SW	Dig
Alice Bay (Samish Island)	0.15*	WDFW, DOE	Herbicide, Dig
Turners Cove	2.5*	WDFW, SW	Crush, Dig, Covering
Deception Pass/Lottie Bay	0.002*	SK	Herbicide
Goat Island	0	SK	*Monitor*
Dewey Beach	0	SK	*Monitor*
Fidalgo Bay	0.07*	SK	Dig
March Point	0	SK	*Monitor*
Guemes Island	0	PFPS	*Monitor*
Whitmarsh	0	SK	*Monitor*
Casino Lagoon/ Casino Beach	0	WDFW, WSDA, SW, SK	*Monitor*
Swinomish Channel	0.04*	SK	Herbicide/Dig
Total Solid Acres Treated	**10.31**		

*Denotes entire site treated
SK = Skagit County, WM = Wildlands Management, DOE = Department of Ecology,
WSDA = Department of Agriculture, WDFW = Department of Fish and Wildlife,
SW = Swinomish Tribal Community

Figure 12. Approximate Locations of all 2006 Skagit County *Spartina* Treatment Sites



San Juan, Whatcom, Clallam, Jefferson, Kitsap, and King Counties

In 2006, WSDA continued to work with the Noxious Weed Control Boards in San Juan, Kitsap and Whatcom counties as well as the U.S. Navy, State Parks, Vashon/Maury Island Land Trust, and the Suquamish Tribe to conduct survey and control work in San Juan, Whatcom, Clallam, Jefferson, Kitsap, and King counties. Figures 13 and 14 show the approximate locations of infestations in the Puget Sound and San Juan Islands. WDFW assisted the Whatcom County Noxious Weed Control Board in performing a *Spartina* survey of the Nooksack estuary. No *Spartina* was found.

The U.S. Navy assisted the WSDA crew with control work and surveys on Indian Island in Jefferson County by providing access to sites on naval property and logistical support. WSDA also worked with State Parks to conduct control work at Dosewallips State Park in Jefferson County.

In Kitsap County, WSDA and the Suquamish Tribe continued to work cooperatively to find eradication techniques that are agreeable to the Tribe. After many years of mechanical and manual control techniques, the infestation did not appear to be getting any smaller, and was producing seed that could potentially spread to other areas of Puget Sound. The Tribe and WSDA began several small-scale tests of imazapyr on infested land directly adjacent to Tribal land during the 2004 season. After post-treatment monitoring found that efficacy in controlled *Spartina* was acceptable and that impact to the native vegetation was minimal and short term, the Suquamish Tribal Council approved the use of herbicide at the Doe-Kag-Wats site. At the beginning of 2006, a 60% reduction had been achieved. The remaining infestation was treated in 2006 as this site is becoming more manageable.

WSDA crews have substantially reduced all known infestations in Clallam, Jefferson, Kitsap and King counties during the past six years. All sites were treated entirely at least twice in 2006. As part of this successful effort, a number of the smaller Puget Sound sites have been declared eradicated in the last few years. WSDA continues to survey extensively in these counties in an effort to find new infestations before they become large problems. Table 12 summarizes the status of the effort in Central and South Puget Sound.

Recommendations for the Future

The results of continuous control, coupled with the elimination of major nearby seed-producing meadows, has resulted in the small size and the low re-infestation rate of central and southern Puget Sound infestations. With continued funding for all agencies involved, this same success will be achieved in the rest of Puget Sound. Substantial control took place for the third consecutive year at the three largest infestations in Puget Sound. These infestations are much closer to eradication. Continued funding and support is needed to keep up this successful effort in Puget Sound.

Figure 13. Approximate Locations of 2006 San Juan and Whatcom County *Spartina* Treatment/Survey Sites

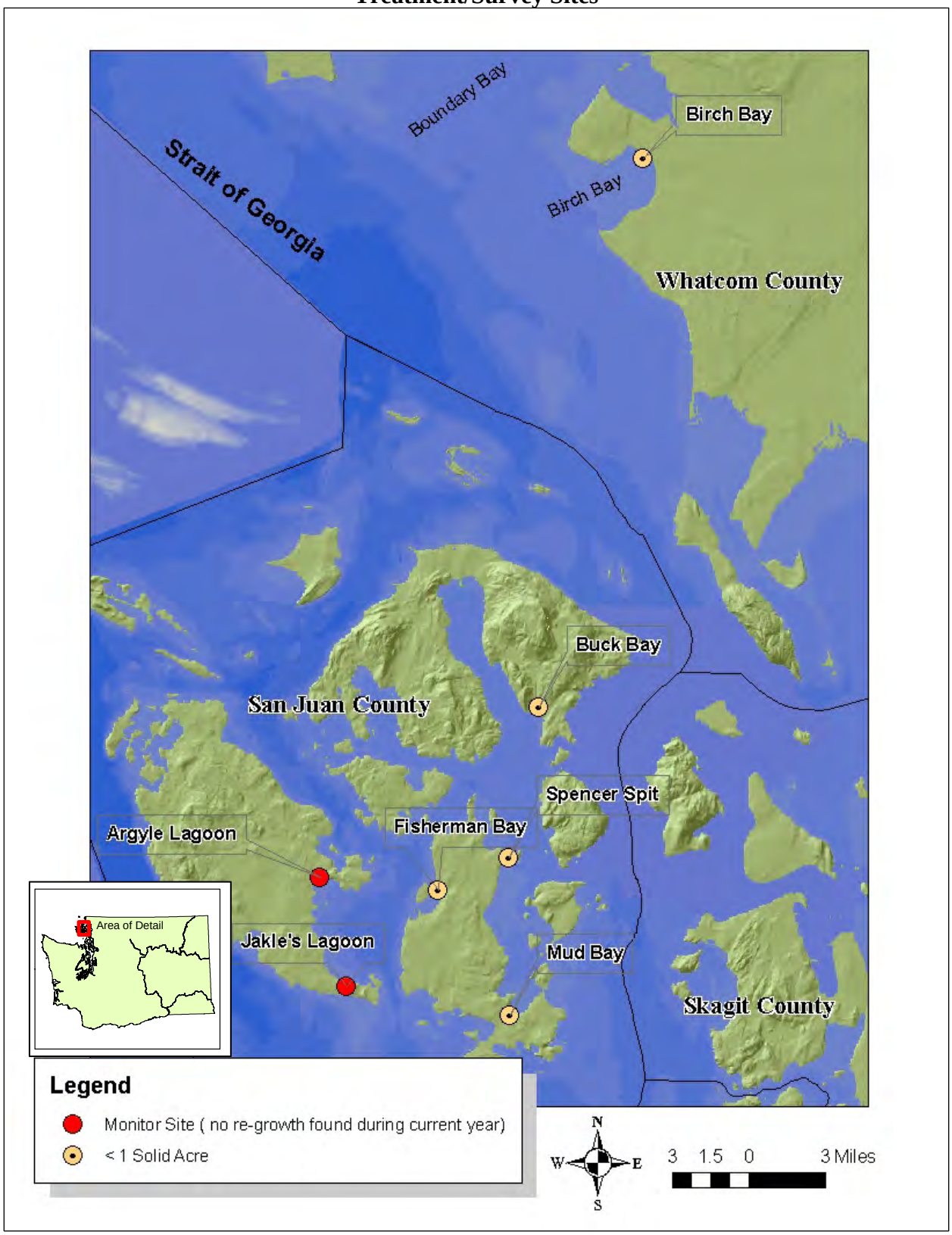


Figure 14. Approximate Locations of all 2006 Clallam, Jefferson, Kitsap and King county *Spartina* infestations

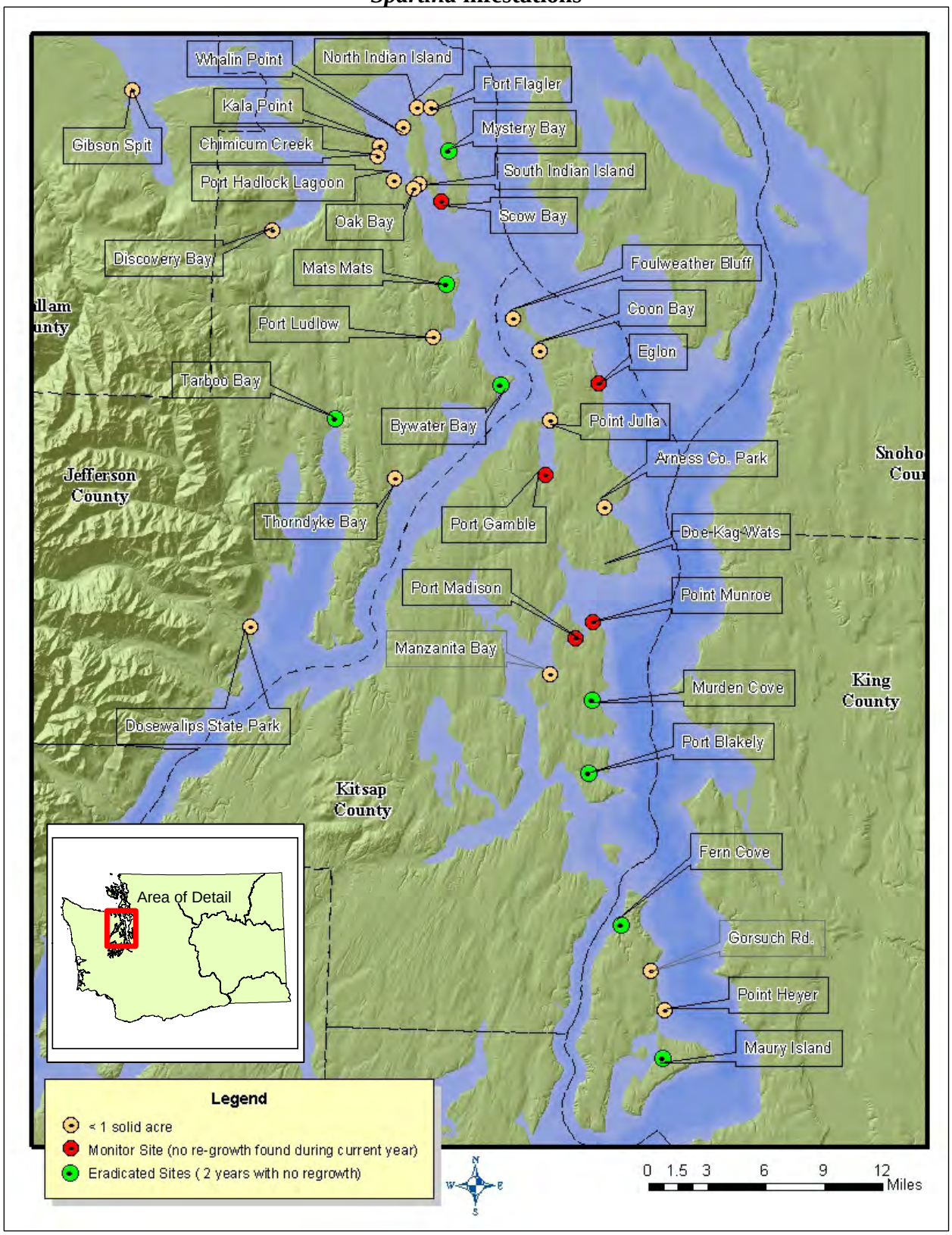


Table 12. Summary of 2006 *Spartina* Eradication Effort Central and South Puget Sound

Site	Estimated Solid Acreage Treated	Entity Conducting Treatment	Treatment Method
➢ **San Juan County**			
Buck Bay	0.00005*	SJC/WSDA	Dig
Argyle & Jackle's Lagoon's	0	SJC/WSDA	*Monitor*
Fisherman Bay & Mud Bay	0.001*	SJC/WSDA	Dig
Spencer Spit	0.0005*	SJCWSDA	Dig
Mulno Cove#	0.00005*	SJC	Dig
➢ **Whatcom County**			
Birch Bay	0	WC	*Monitor*
➢ **Clallam County**			
Gibson Spit	0.0001*	WSDA	Dig
➢ **Jefferson County**			
Dosewallips State Park	0.0005*	WSDA	Herbicide
Thorndyke Bay	0	WSDA	*Monitor*
Tarboo Bay	0	WSDA	***Eradicated***
Oak Bay	0.00005*	WSDA	Dig
Port Hadlock Lagoon	0.00005*	WSDA	Dig
Mats Mats	0	WSDA	***Eradicated***
Scow Bay	0.0003*	WSDA	*Dig*
Whalin Point	0.0001*	WSDA/Navy	Dig
Kala Point	0.0003*	WSDA	Dig
Bywater Bay & Mystery Bay	0	WSDA	***Eradicated***
Chimicum Creek	0.00005*	WSDA	Dig
Discovery Bay	0.003*	WSDA	Dig
South Indian Island	0.0001*	WSDA	Dig
North Indian Island	0.0005*	WSDA/Navy	Dig
Fort Flagler	0.00005*	WSDA	Dig
Port Ludlow	0	WSDA	*Monitor*
➢ **Kitsap County**			
Murden Cove & Port Blakely	0	WSDA	***Eradicated***
Point Monroe & Port Madison	0	WSDA	*Monitor*
Foulweather Bluff	0.002*	WSDA	Dig
Point Julia	0.0006*	WSDA	Dig
Coon Bay	0.00005*	WSDA	Dig
Kingston Ferry	0	WSDA	*Monitor*
Doe-Kag-Wats	0.5*	WSDA	Herbicide
Eglon	0	WSDA	*Monitor*
Arness Park	0.00005*	WSDA	*Dig*
Port Gamble	0	WSDA	***Eradicated***
Manzanita Bay	0	WSDA	*Monitor*
➢ **King County**			
Fern Cove	0	WSDA	***Eradicated***
Rabb's Lagoon	0	WSDA	***Eradicated***
Gorsuch Road	0	WSDA	*Monitor*
Point Heyer	0.00005*	WSDA	Dig
Total Solid Acres Treated	**0.516***		

*Denotes entire site treated # Denotes a newly discovered site

WSDA = Department of Agriculture, SJC = San Juan County Noxious Weed Control Board, Navy = U. S. Navy, WC = Whatcom County Noxious Weed Control Board

Figure 15. ***Spartina alterniflora*** **in Willapa Bay, Pacific County, Washington (2003)**

Figure 16. ***Spartina patens*** **at Dosewallips State Park, Jefferson County, Washington (2000)**

Figure 17. *Spartina anglica* invading mudflat in Livingston Bay, Island County (1999)

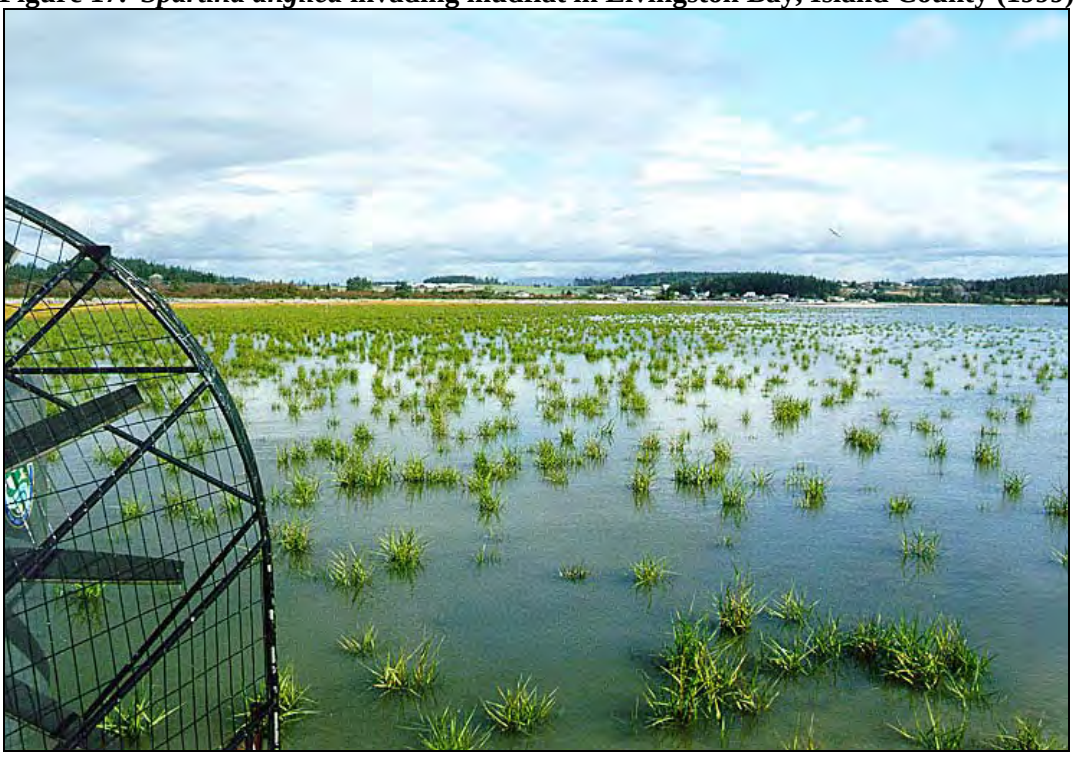


Figure 18. *Spartina densiflora* in Grays Harbor near Damon Point (2002)