Spartina Eradication Program
2005 Progress Report

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REPORT TO THE LEGISLATURE

PROGRESS OF THE 2005 *SPARTINA* ERADICATION PROGRAM

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Executive Summary

Spartina, commonly known as cordgrass, is an aggressive noxious weed that severely disrupts the ecosystems of native saltwater estuaries in Washington state. It 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 8,500 acres spread over 20,000 acres.

Since 1995, the Washington State Department of Agriculture (WSDA) has served as the lead state agency for the eradication of *Spartina*. This report details the progress of the eradication program in 2005.

2005 *Spartina* Eradication Season Accomplishments

2005 was the third consecutive year of greatly increased Spartina eradication efforts. Monitoring of the program's 2004 effort indicated that approximately 6,300 solid acres remained in Willapa Bay and 550 solid acres remained in Puget Sound at the beginning of the 2005 season. This is down from approximately 7,400 solid acres in Willapa Bay and 645 solid acres in Puget Sound at the beginning of the 2004 season. During the 2005 eradication season, an estimated 5,000 solid acres of *Spartina*, approximately 80% of the infestation, was treated in Willapa Bay. In Puget Sound, an estimated 520 solid acres of *Spartina*, approximately 95% of the infestation, was treated.

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 state grants furnished to two private landowners. Also central to this success is continued cooperation of WSDA, WDFW, DNR, other state agencies, universities, the U.S. Fish & Wildlife Service, counties, tribes, private organizations and private landowners.

Continued Funding

WSDA again allotted $1.76 million of its appropriation from the Aquatic Lands Enhancement Account (ALEA) for *Spartina* activities during the 2005-07 biennium. To continue the higher level of eradication activity, WSDA received a supplemental budget appropriation of $122,000 for fiscal year 2005 to purchase herbicide for the crucial first month of the 2005 control season.

Other agencies have significant funding committed to *Spartina* eradication. The Department of Fish & Wildlife (WDFW) and the Department of Natural Resources (DNR) budgets include a total of $1.14 million for *Spartina* eradication in the 05-07 biennium; USFWS has received about $1 million annually in federal funds.

Cooperation and Coordination Activities

Continued cooperation of local, state, federal and tribal governments, universities, interest groups and private landowners was a critical factor in the 2005 control season. Besides having the right tools to get the job done, having a committed group of individuals and organizations cooperating is absolutely essential for a program like this to be successful.

- **Willapa Bay Cooperative Efforts**

Cooperation was again important in the 2005 effort in Willapa Bay. WSDA continued to coordinate the Technical Committee meetings as well as the Advisory Committee meetings, which focused on developing an overall work plan for the 2005 season, as well as ensuring open communication and coordination throughout the treatment season.

Other notable areas of cooperation in Willapa Bay were sharing of resources to ensure treatments were conducted. WSDA provided supplemental herbicide to USFWS to assist with treatments. WSDA also worked closely with WDFW and DNR to coordinate and fund several aerial applications in North Willapa Bay, as well as conducting ground operations cooperatively in all areas of the Bay. WDFW and DNR also made herbicide and other resources available to the various cooperators for eradication activities.

WSDA, WDFW and DNR also continued to conduct small-scale cost share work along the Long Beach Peninsula and other areas of the Bay.

- **Puget Sound Cooperative Efforts**

The effort in Puget Sound continued to see excellent cooperation from all entities involved. WSDA continued to coordinate North Puget Sound Task Force meetings throughout the year. Task Force members include WSDA, WDFW, the Department of Ecology, Snohomish, Island and Skagit County Noxious Weed Control Boards, the Tulalip and Swinomish Tribes, and The Nature Conservancy (TNC). The purpose of the Task Force is to ensure a cooperative, coordinated approach to eradication of *Spartina* in North Puget Sound. This allows the effort to work across jurisdictional and ownership boundaries in an effort to eradicate *Spartina* in the most effective and efficient manner.

WSDA, WDFW and Snohomish County worked together in early July to coordinate the treatment of 180 solid acres in southeast Skagit Bay is on WDFW-managed lands in Snohomish County. Eradication activities at the site over the past several years have been carried out primarily by Snohomish County. The cooperative effort employed this season included an aerial application to the site.

The Swinomish Tribal Community continued to utilize a fully implemented integrated pest management strategy to eradicate infestations on its land. The Tribe continued to work closely with Skagit County by allowing the county to conduct all herbicide applications to tribal land. At the two or three sites that were not granted permits for herbicide application, the Tribe worked closely with Skagit County and WDFW to ensure the sites were treated mechanically or manually.

In Kitsap County, WSDA continued to work closely with the Suquamish Tribe to ensure effective treatment at the Doe-Kag-Wats site. Over the past few years, WSDA and the Suquamish Tribe have tested herbicide use on a small scale. This season the Tribe approved the use of herbicide across the entire site, increasing the likelihood of successful eradication.

Continued Efforts to Improve Control Tools, Restore Tidelands

The *Spartina* eradication program uses Integrated Pest Management (IPM), a coordinated decision-making and action process that uses the most appropriate pest control methods and strategy in an environmentally and economically sound manner to meet pest management objectives. Entities involved in *Spartina* eradication use a wide range of control tools, including ground and aerial herbicide applications, various mechanical tools, biological control using the insect *Prokelisia marginata*, and manual control involving digging seedlings in areas where an infestation has not yet taken hold.

During the 2005 season, the effort relied much more heavily on aerial applications of imazapyr, the herbicide that received federal approval for this use in 2004. Prior to 2004, aerial herbicide applications were used on a relatively small scale. During the 2004 season, approximately 2,000 solid acres were treated aerially with imazapyr. The herbicide appears effective when applied aerially, has extremely low environmental toxicity, and has a lower per acre cost for aerial applications than glyphosate, the other available herbicide.

The biggest benefit of aerial applications is the ability to treat larger areas in a relatively short amount of time. During the 2005 season, approximately 3,500 solid acres were treated aerially over the course of 12 days. This compares to the 2003 work of a cooperating agency that treated season addressed 3,500 solid acres by ground-based methods. This work took five months. The ability to treat large amounts of infestation in a short amount of time has allowed managers to control the majority of the infestations before the plants have produced seeds, thus reducing the chance for spread through seedling dispersal.

As large amounts of *Spartina* are being eradicated, the entities involved are now focusing effort on restoration. Both the standing dead stubble and the underground dead root mass have been shown to negatively effect the foraging ability of the many shorebirds and waterfowl that rely on mudflats to feed. WSDA, WDFW, WSU and USFWS have all begun to test various mechanical methods for removing the stubble, breaking down the dead root mass and restoring the tidal elevation to a more historic level.

There were several other significant activities focused on increasing efficacy and beginning restoration in 2005.

- The University of Washington-Olympic Natural Resources Center (UW-ONRC) continued to provide tide prediction maps for herbicide applications. The modeling uses LIDAR data to predict dry times of various applications at sites throughout Willapa Bay. *Spartina* must be fully exposed above the water line for several hours after a herbicide application in order to affect the plant. This modeling helps ensure the maximum efficacy for the treatment.
- Washington State University (WSU) continued its search for more effective herbicide application techniques and tested early season applications.

- WSU also continued to study the response of shorebirds and waterfowl to various restoration methods.
- UW-ONRC continued to work on improving efficacy of biological control through investigation of different biocontrol agents.

Other Noteworthy 2005 *Spartina* Eradication Program Activities

Third Year of Water Quality Testing Conducted

As required in the NPDES general permit for Aquatic Noxious Weed Control, WSDA conducted a third year of water quality monitoring at several sites throughout the statewide treatment area. Monitoring was carried out to look for concentrations of the applied herbicides directly after treatments were conducted, at the same site, and off-site as well as for concentrations post-treatment.

WSDA has completed the water quality monitoring for the 2005 season and will be developing a report detailing the results of this seasons monitoring effort shortly.

***Spartina* Identified in Whatcom County**

For the first time in program history, *Spartina anglica* was identified in Whatcom County. The infestation was found by a shoreline resident in Birch Bay at the northern boundary of Whatcom County. The resident had recently read an article in the Bellingham Herald about invasive species, including *Spartina*. The resident tentatively identified *Spartina* and called the county noxious weed board for confirmation. Upon confirmation, the weed board went to the site, confirmed the discovery and manually removed all the plant material.

WSDA's Puget Sound Field Coordinator did a follow-up visit to the site and surveyed the remainder of the Birch Bay area. One additional small plant was found and removed. Combined, the two infestations measured less than five square feet.

Suquamish Tribe Allows Herbicide Use

For the past five years the largest infestation in South/Central Puget Sound has been at Doe-Kag-Wats wetland in Kitsap County. The infestation currently measures about one to two solid acres spread over an area of approximately 20 acres. The wetland straddles two properties. A local church camp owns the west side of the wetland and the east side of the wetland is part of the Port Madison Indian Reservation.

The Suquamish Tribe currently has a no pesticide use policy for the reservation lands. WSDA has worked closely with the Tribe for the past seven years in an unsuccessful effort to eradicate *Spartina* using a non-herbicide approach. Because of the lack of success using mechanical and manual methods only, the Tribe and WSDA have spent two years conducting small-scale herbicide applications to several test plots. With favorable efficacy data and minimal impacts, the Tribe allowed the full implementation of an IPM program at the site beginning late in the 2005 season. This approach combines manual removal, mechanical control and herbicide applications to maximize efficacy and minimize potential negative impacts of the control

program. WSDA feels that this approach will now allow for *Spartina* at the site to be fully eradicated within the next four years.

Increased Efficiency With Focus On Aerial Applications

A major focus of the 2005 *Spartina* eradication strategy was to use aerial herbicide applications as much as possible. Due to a competitive and successful bid process over the past several years, the per-acre application rate for these applications has become very reasonable. In fact, for a large infestation (more than 40 acres in size), it is now less expensive to treat the infestation aerially than to treat it from the ground. Aerial applications can also be conducted much faster, making it possible to treat thousands of acres in a relatively short amount of time. Figure 22 (page 59) shows an aerial application in progress.

In 2005, 12 sites were treated aerially, ranging from a 40-acre meadow in North Willapa Bay to a 600-acre infestation in South Willapa Bay. An aerial application was also conducted in North Puget Sound on a 180-acre infestation in Snohomish County. This infestation was the largest remaining infestation in Puget Sound.

The effectiveness of imazapyr, coupled with the efficiency of aerial applications, has led the effort in Willapa Bay and in Puget Sound to move closer towards eradication.

More Grant Funding Received for *Spartina*-Specific Projects

After the successful application for Landowner Incentive Program (LIP) grant funding administered by WDFW in 2004, WSDA worked with other landowners to apply for LIP funding in 2005.

Three landowners applied for a total of $100,000 to treat several hundred acres of private tidelands in the Tokeland area of Willapa Bay and Triangle Cove in Puget Sound. Both grants were initially approved in the spring of 2005, each for $50,000, and are still awaiting final approval from the appropriate federal agency. WSDA is very optimistic that the Tokeland funding will be fully approved before the 2006 treatment season begins. Because of the presence of endangered and threatened salmonid species in Puget Sound, the Triangle Cove grant approval must go through some additional federal environmental review. Although WSDA is optimistic that this additional review will be favorable, the process could be somewhat time consuming. WSDA is working closely with WDFW and the appropriate federal agencies to try to ensure a thorough, timely review.

Summary of 2005 Statewide *Spartina* Eradication Activities

Spartina Eradication in Willapa Bay

Over the past three years, the amount of affected acres treated has continued to increase, while the overall solid acres treated in Willapa Bay has either been steady or declined. This demonstrates how the effort has been successful at reducing the overall infestation each year. In 2003, 6,500 solid acres were treated over a 10,000-acre area; in 2004, 5,700 solid acres were treated over a 12,000-acre area; and in 2005, 5,000 solid acres were treated over a 20,000-acre area.

It is estimated that a 50% overall efficacy was achieved with the 2004 treatments, leading to an overall reduction of approximately 30%. WSDA estimates that the infestation totaled approximately 6,400 solid acres at the beginning of the 2005 treatment season.

Spartina Eradication in Grays Harbor

A late season aerial survey of Grays Harbor turned up more *Spartina* than had been previously identified. Several of the newly discovered infestations were located in areas that were only easily visible from the air. The discovery of these new infestations help managers understand why the eradication work in Grays Harbor was not leading to an overall reduction, and why new small seedlings and clones continued to show up.

With the new survey information, WSDA now estimates that the Grays Harbor infestation totals approximately 5 to 10 solid acres of scattered clones and seedlings. An estimated 5 solid acres of *Spartina* were treated in Grays Harbor in 2005.

Spartina Eradication in Puget Sound and Hood Canal

An estimated 520 solid acres of *Spartina* were treated in Puget Sound and Hood Canal in 2005, approximately 95% of the overall infestation. The Puget Sound infestation, estimated at 1,000 solid acres in 1997, has been reduced by about 46%. From the spring of 2004 to the spring of 2005, an estimated 16% reduction occurred.

- **Snohomish County**

In Snohomish County, 374 solid acres of *Spartina* were treated in 2005. For the first time in program history, every infestation in Snohomish County was treated completely, including all meadows in southeast Skagit Bay, Leque Island and Mystery Island. The southeast Skagit Bay meadow, which has proven difficult to treat from the ground, was treated aerially with an imazapyr/glyphosate tank mix.

- **Island County**

In Island County, 133 solid acres of *Spartina* were treated in 2005. For the first time in program history, all known infestations in Island County received some level of treatment. Furthermore, all infestations, with the exception of Triangle Cove, were treated in their entirety.

Since 2003 the total infestation in Island County has been reduced by 57%. A total of 200 solid acres of *Spartina* have been eradicated from various sites around the county.

- **Skagit County**

In Skagit County, 10 solid acres of *Spartina* were treated in 2005. All known *Spartina* infestations were treated including the two-three acre Turners Cove infestation that was treated, mechanically. Turners Cove is now the largest infestation in Skagit County. The overall infestation in Skagit County, estimated at 100 solid acres in 1997, has been reduced by about 90% to the 10 solid acres that were treated this season.

- **San Juan, Clallam, Jefferson, Kitsap, King Counties**

WSDA crews have substantially reduced all known infestations in Clallam, Jefferson, Kitsap and King counties during the past seven years. The rate of overall reduction has began to slow, primarily because almost all of the relatively large, easily treatable sites have been substantially reduced, and crews are now faced with small scattered infestations spread widely throughout the five-county treatment area. During the 2005 season only four new infestations were found in the counties. Three were completely removed by digging. One was treated with herbicide. They were most likely a result of seed movement from the larger infestations in Northern Puget Sound.

- **Whatcom County**

For the first time in program history *Spartina* was discovered in Whatcom County in Birch Bay. The discovery can be credited to shoreline resident who saw *Spartina* and informed the County Noxious Weed Control Board. Subsequent surveys turned up one more plant in Birch Bay. The Whatcom County Noxious Weed Control Board and WSDA removed all plant material.

Table 1 illustrates the total solid acres and estimated solid acres treated by county from 1997 through 2005.

Table 1. Acres of *Spartina* Treated in Washington State – 1997 through 2005

County	*Spartina* Present at Start of 2005	*Spartina* Treated, 1997 - 2005	2005 Treatment Methods
Pacific (Willapa Bay)	~ 6,300 solid acres spread over > 20,000 acres	'97 - approx. 742 solid acres '01 – approx. 900 solid acres '98 - approx. 450 solid acres '02 – approx. 1,804 solid acres '99 - approx. 600 solid acres '03 – approx. 6,000 solid acres '00 - approx. 800 solid acres '04 – approx. 5,700 solid acres **'05 – approx. 5,000 solid acres**	Mow/herbicide, herbicide, seedling removal, various mechanical controls
Snohomish	Approx. 374 solid acres spread over > 4,500 acres	'97 - approx. 89 solid acres '01 – approx. 75 solid acres '98 - approx. 126 solid acres '02 – approx. 238 solid acres '99 - approx. 90 solid acres '03 – approx. 343 solid acres '00 - approx. 158 solid acres '04 – approx. 350 solid acres **'05 approx. 374 acres**	Mow/herbicide, herbicide, seedling removal, dig, mechanically crush, mow
Island	Approx.150 solid acres spread over >1,000 acres	'97 - approx. 250 solid acres '01 – approx. 72 solid acres '98 - approx. 160 solid acres '02 – approx. 300 solid acres '99 - approx. 155 solid acres '03 – approx. 325 solid acres '00 - approx. 130 solid acres '04 – approx. 164 solid acres **'05 – approx. 134 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 '01 – approx. 33 solid acres '98 - approx. 57 solid acres '02 – approx. 37 solid acres '99 - all treated '03 – approx. 26 solid acres '00 - approx. 60 solid acres '04 – approx. 13.5 solid acres **'05 – approx. 10 solid acres**	Mow/herbicide, herbicide, seedling removal, dig, mow
Grays Harbor	Scattered clones and seedlings 10 acres in size	'97 - all treated '01 – all treated '98 - all treated '02 – all treated '99 - all treated '03 – all treated '00 - all treated '04 – all treated **'05 – approx. 5 solid acres**	Herbicide, seedling removal, mow
Kitsap	8 infestations - approx. 1 solid acre total	'97 - all but 2 tribal sites '01 – all treated '98 - all treated '02 – all treated twice '99 - all treated twice '03 – all treated twice '00 - all treated '04 – all treated twice **'05 – all treated twice**	Mow, herbicide, dig, seedling removal
Jefferson	14 infestations – approx. 0.01 solid acres total	'97 - all treated '01 – all treated three times '98 - all treated twice '02 – all treated three times '99 - all treated twice '03 – all treated twice '00 - all treated three times '04 – all treated twice **'05 – all treated twice**	Mow, mow/herbicide, dig, seedling removal
Clallam	1 infestation < 0.006 acres in size	'97 - treated twice '01 – treated four times '98 - treated three times '02 – treated four times '99 - treated twice '03 – treated three times '00 - treated four times '04 – all treated twice **'05 – all treated twice**	Dig
King	2 infestations – single clones and a few seedlings	'97 - monitored '01 – all treated twice '98 - all treated '02 – all treated twice '99 - all treated '03 – all treated twice '00 - all treated twice '04 – all treated twice **'05 – all treated twice**	Dig
San Juan	6 infestations – approx 0.5 solid acres total.	'97 - all treated '01 – all treated '98 - all treated '02 – all treated '99 - monitored '03 – all treated '00 - all treated '04 – all treated **'05 – all treated once**	Survey, dig, herbicide
Whatcom	2 infestations ~ 0.0001 solid acres	**Initial discovery in Whatcom County in 2005 All removed**	Dig

Recommendations for the Future

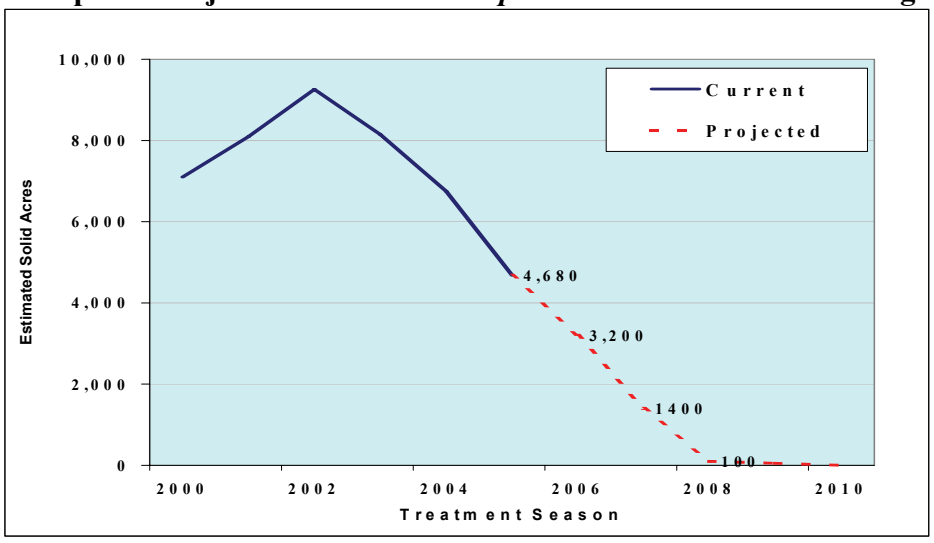
An unprecedented amount of control work was carried out in 2003, resulting in the first overall decline in the size of the *Spartina* infestation in Washington. The 2004 control season built on that achievement by treating as much acreage as possible in both Willapa Bay and Puget Sound and by using a new, more effective herbicide. In 2005, the statewide effort continued to build on the past two years of success.

In Willapa Bay, an estimated 80% of the overall infestation was treated. Eradication program partners and the participants are currently working on plans for complete treatment of the entire infestation during the 2006 season. In Puget Sound, the effort continues to steadily decrease the overall size of the infestation.

With the large-scale reduction of the seed-producing meadows in both Willapa Bay and Puget Sound, the opportunity for fast-paced aerial and ground broadcast applications to the meadows is reduced. The effort will start increasing the focus on second and third year re-treatment of scattered infestations. This type of control work is likely to be as costly, if not more costly, than the large-scale aerial and ground operations. The effort will start to rely more on large numbers of small crews that cover vast areas of once heavily infested habitat, searching out the small, scattered re-growth that may be present. Graph 1 illustrates the current projection of *Spartina* eradication on a five-year time frame. The projection assumes that:

- The 2005 treatments result in 50% reduction of *Spartina* on treated acres.
- WSDA, WDFW and DNR funding continues at current levels.
- USFWS continues to receive $1,000,000 per year in federal funding for *Spartina* control.
- The effort eradicates 2,000 solid acres per year in 2006 and 2007.
- The *Spartina* infestation has a growth rate of 17%.

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



Continued funding and cooperation is more important than ever as the statewide effort achieves historic reductions that make eradication possible within five years.

In Grays Harbor, an extensive aerial survey conducted in 2005 turned up much more infestation than previously known. To eradicate the infestations, a dedicated two-person crew for the five-month summer treatment season is recommended. The funding for this level of effort would be approximately $50,000 per year. Diverting funding from the Willapa Bay effort is not recommended. WSDA and its partner agencies are looking for alternative sources of funding.

Experience in central and southern Puget Sound shows that continuous control and monitoring of infestations, coupled with the elimination of nearby seed-producing meadows, can eradicate infestations and limit re-infestation. Substantial use of the new herbicide imazapyr may result in higher efficacy and faster declines in the overall infestation in Puget Sound. Continued funding and support is needed to keep up this successful effort in Puget Sound.

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. It destroys migratory shorebird and waterfowl habitat in Willapa Bay, one of the most important estuaries on the West Coast migratory route. It 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 over 5,000 solid acres currently infesting the Bay. *Spartina alterniflora* is also known to occur in Skagit County within Padilla Bay, Clallam County within Sequim Bay, Jefferson County within Thorndyke Bay and at several sites within Grays Harbor. Figure 12 *(see pg. 54)* shows *Spartina alterniflora* invading a mudflat in Willapa Bay.

Spartina patens is known to occur at only one location, Dosewallips State Park in Jefferson County. This infestation is controlled with yearly surveys, digging and herbicide applications as needed. Figure 13 *(see pg. 54)* 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 14 (*see pg. 55*) shows a *Spartina anglica* clone in Puget Sound. It currently infests approximately 520 acres in Puget Sound and Hood Canal.

Spartina densiflora is a South American species that was discovered in 2001 in the northwest portion of Grays Harbor and within Race Lagoon in Island County. Figure 15 (*see pg. 55*) shows *Spartina densiflora* in northwest Grays Harbor.

How was *Spartina* introduced into Washington state?

Spartina alterniflora was unintentionally introduced to Willapa Bay as packing material for east coast oysters that were dumped into the bay during the late 1800's. In Puget Sound, various landowners intentionally introduced *Spartina alterniflora*, planting it to stabilize shorelines. *Spartina anglica* was also intentionally introduced. It was planted at a farm located in Port Susan in the early 1960's to serve as bank stabilization and potential feed for cattle. The modes of introduction for both *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. *Spartina* infestations range from one infestation in Clallam County measuring only a few square feet to

more than 6,000 solid acres (if contiguous) spread throughout Willapa Bay in Pacific County. All totaled, *Spartina* infests over 6,500 solid acres spread over more than 30,000 total acres.

How do we eradicate *Spartina*?

Spartina spreads quickly and is extremely 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 2005, the WSDA *Spartina* Eradication Program worked collaboratively with partner agencies to continue *Spartina* eradication. In doing so, 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, TNC and the aquaculture industry on infestations in Willapa Bay.

WSDA continued to work cooperatively with the Department of Ecology to administer its coverage under the NPDES general permit for aquatic noxious weed control, facilitating access for numerous federal, state and local governmental agencies and private entities to conduct appropriate herbicide applications to both marine and freshwater environments.

WSDA provided funding and services through interagency agreements, personal services contracts and direct cost-share to state and local government agencies and private landowners. WSDA also provided more than $300,000 in equipment and materials to WDFW, DNR, USFWS, Skagit, Island and Snohomish counties and the Willapa Bay/Grays Harbor Oyster Growers Association for work in Willapa Bay and Puget Sound. WSDA organized and facilitated the exchange of *Spartina* eradication information through regional planning and informational meetings; and continued to explore with partner agencies more efficient and cost-effective ways to eradicate *Spartina.*

During the 2005 season, WSDA also began working with WDFW, WSU and USFWS to explore the potential for restoration of once-infested tidelands back to functioning shorebird and waterfowl habitat.

Spartina 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. WSDA also received an additional $122,000 in ALEA funds for *Spartina* eradication efforts in Willapa Bay and Grays Harbor in the FY 05 supplemental budget. This funding was used to purchase herbicide and conduct early season aerial applications in June 2005. Table 2 illustrates how WSDA has budgeted its 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, Snohomish and Skagit counties.
3. Purchased Services: WSDA has written 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 amount of funding provided by the USFWS for eradication activities. USFWS reports it received $1,400,000 for the 2005 control season.

County Activities

In 2005, WSDA continued to allocate funding for resources and *Spartina* work crews in those counties with the majority of the infestations. WSDA allocated these resources by way of interagency agreements with the Skagit, Island and Snohomish County Noxious Weed Control Boards and WDFW in Pacific County. WSDA also provided $10,000 per year 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 directed by RCW 17.26.007, WSDA offered financial assistance to private landowners for *Spartina* control and eradication in 2005. WSDA was able to provide cost share assistance in the form of herbicide purchases for appropriately licensed private applicators as well as providing control for private landowners through county and state crews.

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

For the third year in a row, WSDA contracted with a commercial pesticide applicator in Pacific County to assist in coordinating the Oyster Growers Association eradication operations in Willapa Bay. WSDA also provided additional cost share assistance in the form of herbicide and necessary logistical support.

Management Plans

In fulfillment of a requirement of the NPDES general permit, WSDA developed a Statewide IPM Plan for the 2005 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 2005 statewide management plan as well as the 2005 regional plans are available by contacting the WSDA Statewide *Spartina* Eradication Program Coordinator. WSDA will update all IPM work plans prior to the 2006 control season.

2005 Noteworthy Activities and Developments

In 2005, WSDA, state and federal partner agencies, local governments, tribal entities, and private landowners treated approximately 5,600 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 2005. Several are discussed below.

LIP Grant Awarded to Tokeland Landowner and Triangle Cove Landowner

After the successful application for Landowner Incentive Program (LIP) grant funding from WDFW in 2004, WSDA and the WDFW *Spartina* Program worked with three more landowners to pursue more LIP funding.

In Willapa Bay, WSDA worked closely with two landowners in the Tokeland area to apply for a $50,000 grant to treat several hundred acres of private tidelands on either side of the Tokeland Peninsula. This grant was initially approved in spring 2005 and is awaiting final approval from the appropriate federal agency. WSDA is very optimistic that this funding will be fully approved and available for the eradication effort before the 2006 treatment season begins.

In Puget Sound, WSDA worked with a private landowner who owns the majority of the tidelands in Triangle Cove, a site of one of the heaviest remaining infestations in Puget Sound. This grant application was also for $50,000 and also received initial approval from WDFW in the spring of 2005. The grant must now be approved by the appropriate federal agency, however, due to different review requirements, this grant is likely to take longer to receive final approval.

WSDA continues to work closely with the landowners, WDFW and USFWS to expedite the approval process and ensure that *Spartina* eradication activities take place in a timely and effective manner.

Drift Card Study Reveals Potential Seed Dispersal of *Spartina*

Beginning in September 2004, Portland State University began the *Spartina* dispersal study to track the potential distribution of *Spartina* seeds and plant parts from areas of heavy infestation. The study was conducted by releasing 4" x 6" biodegradable wooden cards from the mouths of Willapa Bay and Humboldt Bay and San Francisco Bay in California. Two hundred cards were released on outgoing tides each month from locations near the bay mouths. As they came ashore, beachcombers, property owners, tourists and children reported their discoveries to Portland State University's Spartina Watch Program. The Washington State Department of Fish and Wildlife, Oregon Department of Agriculture and the San Francisco Estuary Institute funded the study.

Willapa Bay Results

The release location for Willapa Bay was just off shore of Tokeland. These releases were done with the assistance of WDFW. Recovery patterns exhibited seasonal trends, which may be a function of seasonal shifts in ocean currents as well as short-term wind conditions at or shortly after the release There were a total of 521 respondents, reporting a total of 971 drift card

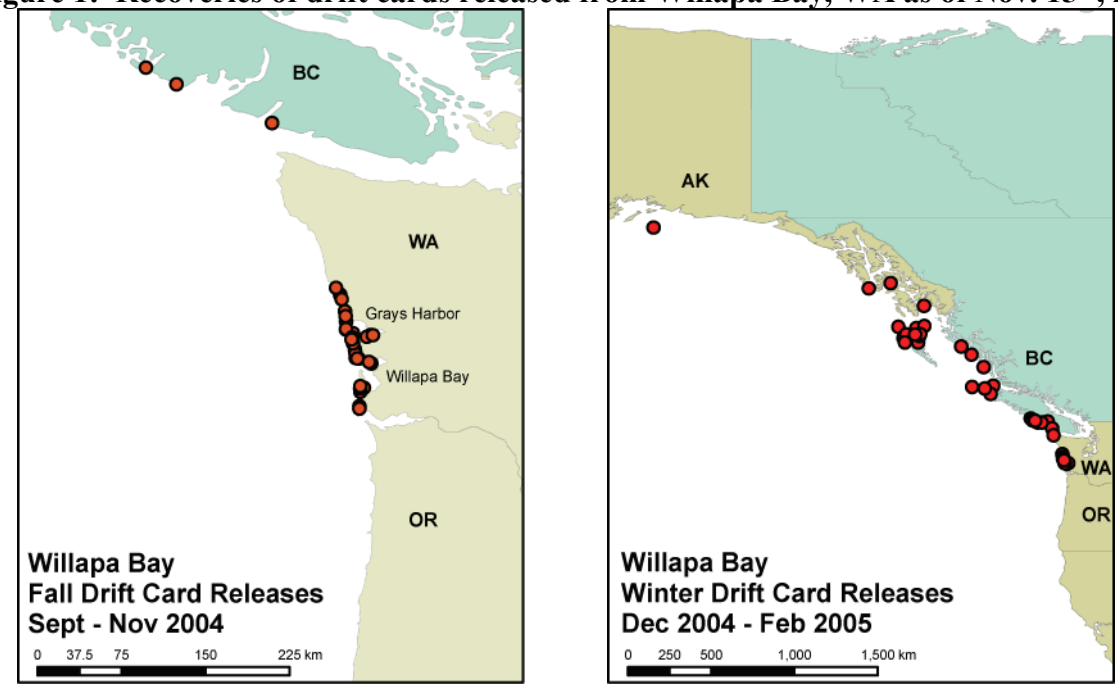
recoveries. On average, 40% of the cards were recovered from each month's release. Most (91.6%) were recovered within 60 miles of the release location. The closest recoveries occurred repeatedly both north and south of the bay mouth – from North Cove to Moclips and from the Long Beach Peninsula to Seaside, Oregon (Figure 1). At least one card released during the fall, spring and summer was recovered within Grays Harbor (eight, two and one cards respectively).

Of the cards carried greater distances, repeated findings occurred around the Queen Charlotte Islands (61-169 days after release) and along the western edge of Vancouver Island, British Columbia, especially along the Pacific Rim National Park Reserve of Canada (6-167 days after release) and the Cape Scott area (41 - 143 days after release). One recovery was made more than 1,200 miles from Willapa Bay at Middleton Island, Alaska approximately four months after release.

Other Results of Interest

Other recoveries of interest include those originating from the Humboldt Bay releases in California. Cards released between December 2004 and March 2005 were recovered along the Oregon, Washington and British Columbia coastlines. Of particular note was the December 2004 release in which over 30 cards were found between Cape Disappointment and Pacific Beach, Washington an average of 36 days after release. These results indicate the southern coastline of Washington may frequently receive *S. densiflora* seeds or plant parts originating from Humboldt Bay.

Figure 1: Recoveries of drift cards released from Willapa Bay, WA as of Nov. 15th, 2005.



Whatcom County *Spartina* Discovery

For the first time in program history *Spartina anglica* was identified in Whatcom County in 2005. The infestation was found by a shoreline resident in Birch Bay at the northern boundary of Whatcom County.

The resident had learned of the impact of *Spartina* from a recent article in the Bellingham Herald newspaper. The resident discovered the *Spartina* and notified the county noxious weed board for confirmation. Upon confirmation, the weed board went to the site and manually removed all the plant material.

After the discovery and removal by the county noxious weed control board, the WSDA Puget Sound Field Coordinator visited the site and surveyed the remainder of the Birch Bay area. One additional small plant was found and removed. Combined, the two infestations measured less than 5 square feet.

Birch Bay is located at the very northern boundary of Whatcom County, directly south of Boundary Bay, British Columbia. Boundary Bay is the site of a small scattered infestation of *Spartina anglica* that was discovered by a Canadian ecologist two years ago. Canadian officials have been working diligently to remove this infestation and have been coordinating closely with Washington.

Due to the location and the very small size of the infestations, it is highly likely that they are a result of seeds or plant parts being transported south in the currents from Boundary Bay. Washington scientists are currently collaborating with Canadian scientist to possibly conduct a drift card study to determine the likely spread of *Spartina* infestations on both sides of the Washington-Canada border.

2005 Biological Control Program

The biological control program for *Spartina*, using the insect agent *Prokelisia marginata*, has made substantial progress in the past year. Improved ability to select suitable release sites and the importation of East Coast ecotypes have led to increased establishment and growth of the insect population. The insects may also be adapting to local conditions.

2005 was the first year that *P. marginata* was not reared in the greenhouse. The field populations are now sufficiently established to allow collection and redistribution to new areas. The insects are also naturally dispersing. Currently, there are four regions of Willapa Bay where *P. marginata* populations are well established and expanding. These include Leadbetter Marsh, North Cove, Tarlatt Slough, and Tokeland. Within each of these areas, there have been multiple points of release in past years (Table 4).

Population increases at the North Cove and two South Tokeland sites are especially noteworthy. At North Cove, *P. marginata* is present on least 75% of the stems throughout the west 20 acres. Densities are patchy throughout the meadow, with the highest densities (up to 29,000 per m^2) occurring near release points and near channels. In an area of approximately 2 acres, the insects caused browning of the plants in advance of normal fall senescence. In Tokeland, browning of plants was more localized to the immediate release points. However, the insects could be found as far as ¼ mile from the release points. These areas are being monitored for changes in stem densities and seed viability.

Only one new release was made in 2005. Approximately 5,000 insects from the North Cove population were collected and released onto a privately owned tideland midway up the Long Beach Peninsula in July.

Twenty of the releases made in 2004 are being monitored to determine which geographic source of *P. marginata* will be most effective against *Spartina* in Washington. Results of this experiment suggest that ecotypes from both Rhode Island and California perform well in the Washington coastal environment. Those from Virginia and Georgia are able to establish but these populations have not grown as rapidly. Future redistribution efforts should therefore concentrate on insects from Rhode Island and California.

In Puget Sound, *P. marginata* populations are established at West Pass Dike and in two locations within Turners Cove. The insects were recovered at densities of 57 per stem (Turners Cove) and 49 per stem (West Pass) by the WDFW field crew. These represent substantial increases in density over previous years (Table 5).

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 on track toward making a substantial contribution to the control of *Spartina* in both Willapa Bay and Puget Sound in the near future. Figure 23 (page 59) shows visible signs of biocontrol damage to plants in Willapa Bay.

Table 4. Current Status of Releases, Willapa Bay

Site	Release Date	Source	Number released	Oct. 2005 *Prokelisia* abundance (per m^2)**
Mid Long Beach Peninsula	7/25/2005	North Cove	5,000	unknown
Grassy Island	4/15/2004	CA	5,000	372
	"	GA	5,000	644
	"	RI	5,000	393
	"	VA	5,000	185
Leadbetter(1)	4/8/2004	CA	5,000	1,395
	"	GA	5,000	9
	"	RI	5,000	4,158
	"	VA	5,000	950
Leadbetter(2)	4/27/2004	CA	3,000	20
	"	GA	3,000	621
	"	RI	3,000	9
	"	VA	3,000	6
North Cove	4/14/2004	CA	5,000	11,038
	"	GA	5,000	2,044
	"	RI	5,000	28,710
	"	VA	5,000	1,692
Tokeland North	4/23/2004	CA	5,000	19,751
	"	GA	5,000	511
	"	RI	5,000	7,058
	"	VA	5,000	1,859
Niawiakum Bridge	5/6/2004	mix	6,000	sparse
Tokeland S-curve	5/11/2004	mix	7,000	medium
Tokeland Tide gate	5/11/2004	mix	4,000	medium
South Leadbetter (2)	5/19/2004	mix	9,000	sparse
Jenson Spit*	5/20/2004	mix	14,700	unknown
Tokeland Golf Course	5/20/2004	mix	9,000	abundant
Upper Palix 2*	6/2/2004	mix	10,000	sparse
South Leadbetter (1)	6/8/2004	mix	21,000	sparse
Tokeland South (1)	5/25, 8/10/2004	mix	26,500	abundant
Tokeland South (2)	6/9/2004	mix	10,000	abundant
Leadbetter Extra South	6/15/2004	mix	15,000	Not recovered
Lower Palix tidal gut*	6/17/2004	mix	7,000	Not recovered
Terramar	7/8/2004	mix	12,500	unknown
Tarlatt South (2)	4/21- 7/28/2004	mix	31,500	medium
North Cove West End	2002	CA	10,000	abundant
Leadbetter (high marsh clone)	2002	CA	10,000	medium
Tarlatt South (1)	2002	CA	10,000	abundant

* Site treated with herbicide in 2005

** abundant = more than 5,000 insects per m^2; medium = 200 to 5,000 insects per m^2; sparse = less than 200 per m^2

Table 5. Current Status of Releases, Puget Sound

Site	Date released	Source	Number released	Oct. 2005 abundance	*P. marginata* per stem
Turners Cove (1 and 2)	8/4/03 & 4/21/04	CA, mix	14,000+14,000	High	57.1 ± 10.2
Turners Cove Channel	5/3/04	mix	13,000	High	na
West Pass Dike	4/21/04	mix	30,000	High	49.0 ± 10.3

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

The estimated extent of *Spartina* remaining in Willapa Bay at the beginning of the 2005 season was acquired through the use of 2005 treatment data, aerial infrared photos taken in 2003, and on-the-ground GPS work.

The acreage information collected while conducting herbicide applications during the 2005 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 had 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. These methods result in accounts of the total solid acres treated.

For sites that were not treated during the 2005 season, managers work from the acreage data provided by 2003 infrared aerial photos. The two-year-old data is modified by a factor reflecting an estimated 17% per year growth rate to obtain current year acreage estimates. This data is then ground truthed in selected areas to ensure the accuracy of the aerial photo acreage calculations.

Adding the acreage information obtained from treatment data to the acreage information obtained from the aerial photos of the untreated sites provides a reasonably accurate total solid acres estimates for the beginning of the 2005 treatment season.

Based on this method, WSDA estimates that, at the beginning of the 2005 season, a total of 6,300 solid acres were infested in Willapa Bay.

Roles of Participating State and Federal Agencies in 2005

In 2005, the participating agencies pursued the use of various herbicide application systems and mechanical control tools to combat the spread of *Spartina*. The following list outlines the role each agency assumed in Willapa Bay during the 2005 control 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 the Oyster Growers Association. Worked cooperatively with WDFW to control North Willapa Bay meadow. Conducted cost share control activities with WDFW and DNR on private land on the Long Beach Peninsula and the northeast side of

Willapa Bay. Conducted all aerial applications in north Willapa Bay in cooperation with WDFW. Conducted mechanical restoration activities in Bay Center area in cooperation with WDFW and DNR.

- **DNR** – Conducted control work in Pot Shot, Stanley Point and Naselle River as well as Natural Area Preserves. Assisted WDFW with treatment of Rose Ranch and South Willapa River. Conducted pre-treatment site preparation of Tarlatt slough for USFWS. Implemented a *Spartina* control-monitoring program in cooperation with WSU. Provided staff time and airboat assistance for UW-ONRC biocontrol program. Assisted WSDA with cost share on the Long Beach Peninsula.

- **WDFW** – Conducted control operations in cooperation with WSDA in North Bay priority area, conducted control work with WSDA on private property in Northeast Willapa. Collected data for control monitoring program. Cooperated with WSDA on aerial broadcast applications in North Bay.

- **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.

- **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. Began researching the potential of various mechanical tools for restoration at successfully eradicated sites.

Highlights of the 2005 Season in Willapa Bay

In 2005, the cooperative *Spartina* eradication effort resulted in treatment of approximately 5,000 solid acres spread throughout nearly 20,500 affected acres of Willapa Bay. The acreage treated encompassed about 80% of the overall solid infestation. Of particular note is the increase in overall affected acres treated and decrease in solid acres treated. 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. 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.

Table 6 identifies the areas of the Bay treated, who conducted treatment, and what kind of treatment was done. Table 7 compares the treatment data from several sites over the past three years. Figure 2 is an overview of all treatments in the entire Bay. Figures 3 and 4 are maps of North Willapa Bay and South Willapa Bay treatment areas, respectively.

Efficacy date collected during the early 2005 treatment season and follow-up treatment data from the 2005 season indicated that an overall reduction of around 50% was achieved as a result of the 2004 treatments. During the 2005 treatment season, almost 90% of all treatments conducted were

second and third year follow-up treatments (meaning that the sites had been treated entirely for one or two years prior to 2005). Research data collected by WSU on the Puget Sound eradication program indicate that as control becomes more consistent, the rate of the reduction increases. If this holds true, the results of the 2005 treatment season will be even greater than the 50% achieved from the 2004 effort. This would mean that the hard work carried out in 2005 will likely lead to the biggest declines in *Spartina* yet.

During the fall of 2004 and winter of 2005, WSDA worked cooperatively with WDFW, DNR, USFWS, TNC, WSU, UW and the Willapa Bay/ Grays Harbor Oyster Growers Association (Oyster Growers) to develop a 2005 work plan that focused primarily on re-treatment of the previous years' treatment sites, with much less focus on moving into new treatment areas. This was necessary to ensure that all previous treatment sites received full and thorough re-treatments. The plan recognized that it would be most efficient to use aerial broadcast applications to re-treat the large sites that still contained extensive infestations.

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. DNR provided assistance with treatments at the Rose Ranch site and along the banks of the Willapa River east to South Bend. Over 900 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 third year re-treatments. Many of these sites are beginning to show large decreases in *Spartina*, such as Rose Ranch and the west end of the North Willapa Meadow. Table 7 includes several sites in the North Bay area and demonstrates how the acreage has declined over the past several years. Figures 16 & 17 (page 56) are before and after photos of the western portion of the North Willapa meadow. The only sites in this area that were treated for the first time were the small meadows and clone fields at the mouth of the Cedar River. WSDA and WDFW feel that this focus on thorough re-treatments in the North Bay area will result in far less regrowth present in 2006 and allow for initial treatments to the rest of the infestations in the North Bay areas of Tokeland and Kindred Island.

DNR: In 2005, 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 first thorough treatments to the entire Niawiakum NAP and the second year re-treatment of the Bone River NAP. DNR also assisted to WDFW in treating the Rose Ranch and Willapa River banks, and assisted WSDA with the Peninsula Cost Share applications. *Spartina* in many of the areas that DNR has been responsible for over the past several years 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 two to three 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 1.6 solid acres in Pot Shot, 13 solid acres at Stanley Point and 7 acres at Chetlo Harbor. That equates to declines of 98%, 88% and 93% of overall *Spartin,a* respectively. Figures 18 & 19 (page 57) are before and after pictures of Chetlo Harbor.

USFWS: The USFWS area of responsibility was increased during the 2005 season from Seal Slough/South Nemah north to include all the infestations in the Palix and Bay Center Areas. USFWS continued to treat from the north tip of Long Island south to the Tarlatt Slough infestation. It also treated the remaining untreated infestations on Long Island. The treatment of the Porters Point infestation at the southern end of Willapa Bay was conducted on a cooperative basis with WSDA and USFWS. WSDA provided approximately 500 gallons of herbicide for the aerial treatment of the site, and USFWS contracted for the aerial application, as well as providing the logistical support for the aerial application contractor. One of the areas treated by the USFWS, Bay Center, was initially treated during the 2004 season by WSDA through an aerial application. USFWS was able to re-treat the site during the 2005 season with ground-based precision application equipment. Figures 20 and 21 (page 58) are before and after photos of the Bay Center treatment site. WSDA, WDFW, DNR and WSU will now use this site to test the restoration potential of mechanical crushing on previously treated infestations.

Over the past three years, the combined effort in Willapa Bay has become more effective, due to the use of the herbicide (imazapyr), and more efficient, due to a heavy reliance on aerial applications. Cooperation between the various agencies and entities involved has continued to improve. During the 2005 season, approximately 80% of the overall infestations in Willapa Bay were treated. The 2006 plan, if successful, will result in the treatment of all remaining infestations in Willapa Bay. The effort will conduct the initial treatment to the entire Long Beach Peninsula, Tokeland and Kindred Island areas. The effort will also continue to focus a large amount of the resources on re-treatment of the previously treated infestations to ensure that previous reductions are not lost.

Going into the fourth year of the stepped up eradication effort in 2006, WSDA feels confident that reductions will continue and eradication will become more of a reality in Willapa Bay.

Figure 2. Approximate Location of 2005 Interagency Willapa Bay Treatment Sites

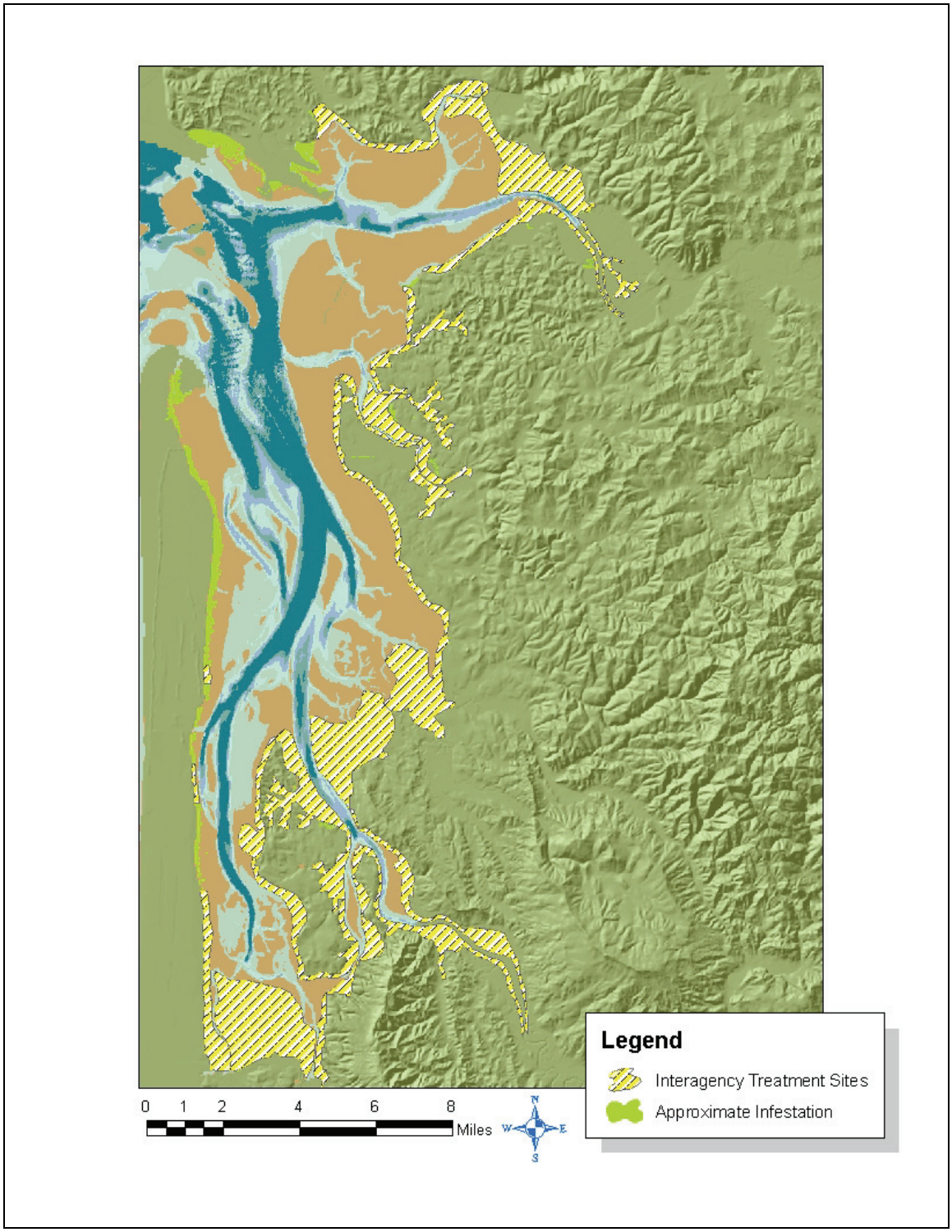


Table 5. Summary of 2005 Willapa Bay *Spartina* Eradication Effort

Site	Estimated Solid Acreage Treated	Approximate Affected Acres Treated	Entity Conducting Treatment	Treatment Method Used
North Willapa Area				
North Willapa Meadow/ Smith Creek	620	2,074	WDFW, WSDA	Herbicide
North Shore	147	719	WDFW, WSDA	Herbicide
Cedar River	95	225	WDFW, WSDA	Herbicide, Crush
Bruceport / Rose Ranch	54	319	WDFW, WSDA, DNR	Herbicide
S. Willapa River/ Rose Ranch	52	392	WDFW, DNR	Herbicide, Crush
Mailboat Slough	12.5	200	WDFW, DNR	Herbicide
Niawiakum NAP	27	334	DNR	Herbicide
Bone River NAP	4.75	257	DNR	Herbicide
South Stoney Point	67.5	141	WDFW, WSDA	Herbicide, Crush
Wilson Point	90	155	WDFW, WSDA	Herbicide
Bay Center	387	1,425	WSDA, WBOGA, DNR, USFWS	Herbicide, Crush
Nemah Beach	33.33	735	USFWS	Herbicide
North Nemah	474.25	1,686	USFWS	Herbicide
South Willapa Area				
North Pot Shot	48	121	USFWS	Herbicide
O'Meara Pt. – Bear R.	1.25	240	USFWS	Herbicide
O'Meara Cove	11	132	USFWS	Herbicide
Pot Shot	1.6	281	DNR	Herbicide
South Long Island	4	36	USFWS	Herbicide
Sunshine Point	7	19	DNR	Herbicide
East Long Island	123	730	USFWS	Herbicide
Naselle	49	1741	DNR, TNC	Herbicide,
Porters Point/Tarlatt Slough	787	3,457	USFWS, WSDA	Crush, Herbicide
Stanley Point	13	119	DNR	Herbicide
Kaffee Lewis Slough	680	1,223	USFWS	Herbicide
South Nemah/Seal Slough	1,100	2,182	WBOGA, USFWS	Herbicide
West Long Island	83	986	USFWS	Herbicide
Long Beach Cost Share	46	403	WSDA, DNR, WDFW	Herbicide
Total	**5,018.08**	**20,332**		

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

Table 6. Reduction in Acres Treated By Major Site, 2003-2005

Site	Solid Acres Treated			% Reduction in 2003 to 2005
	2003	2004	2005	
North Willapa Meadow / Smith Creek	925	815.7	620	33%
South Willapa River / Rose Ranch	177.88	196.2	52	73%*
Bay Center / Palix	None	573**	387.33	32%
North Nemah	None	860	474.25	44%
Pot Shot	137	26	1.58	98%
Naselle	200.06	193	48.45	75%
Stanley Point	114	87.5	13	88%
North Pot Shot	83.3	50.6	42	49%
O'Meara Cove	75	56	11	85%
East Long Island	175	244.5	122.71	50%*
Porters Point/ Tarlatt Slough	2,425.30	844	786.9	73%

*Percent reduction calculated from 2004 because entire site not treated in 2003.
**2004 treatment did not include infestations upriver from Highway 101 Palix River Bridge.

Figure 3. 2005 North Willapa Bay Interagency Treatment Sites

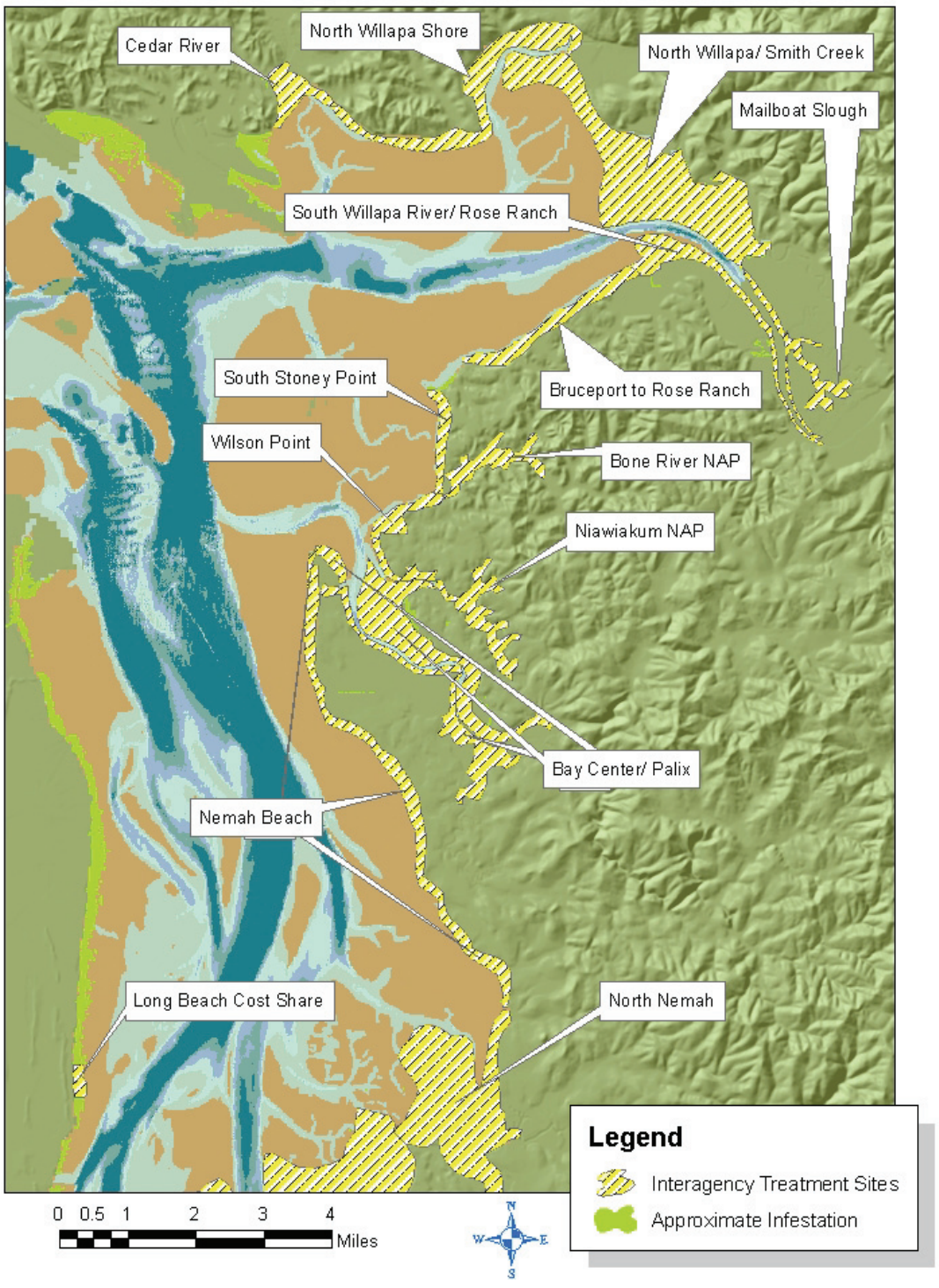
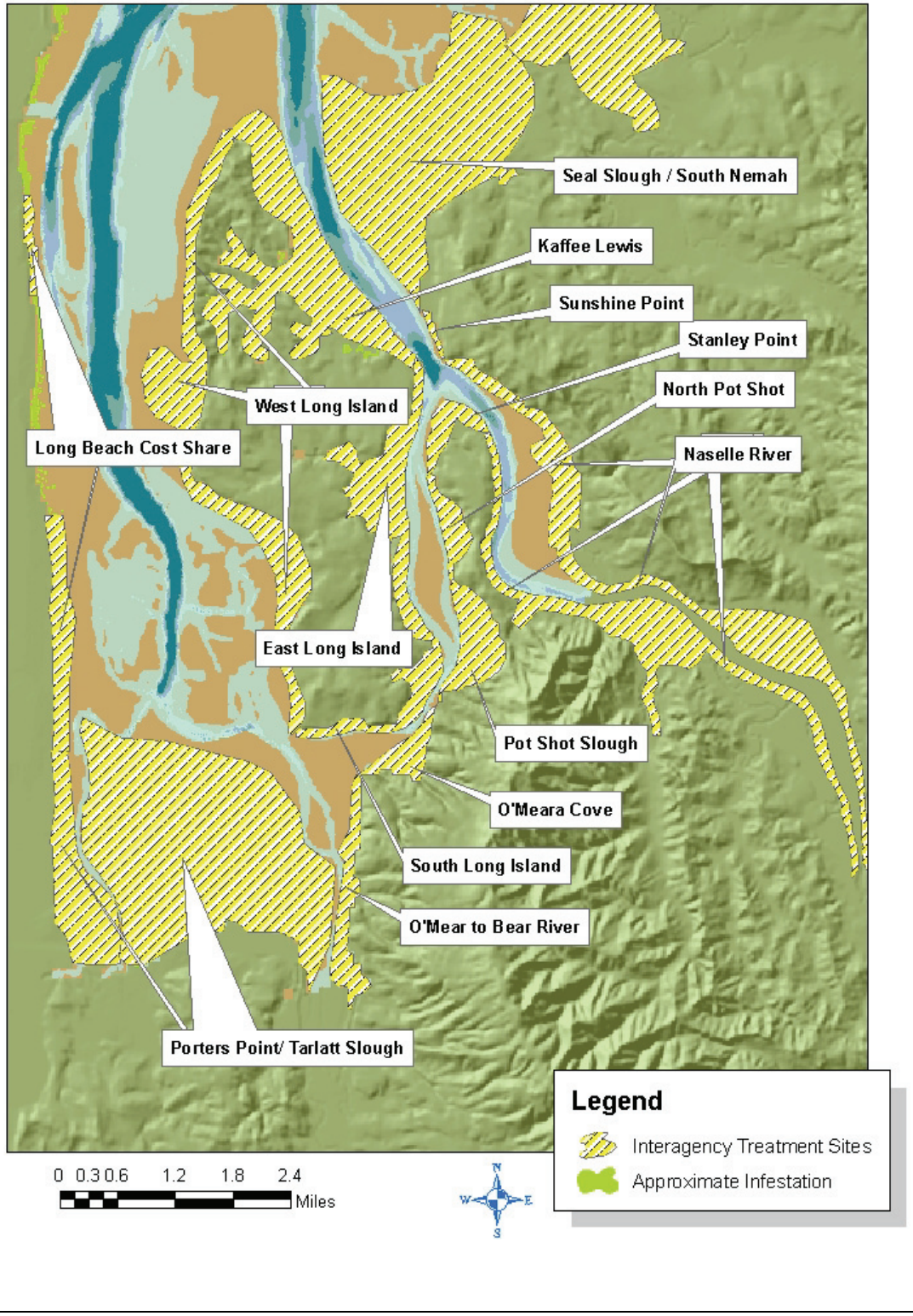


Figure 4. 2005 South Willapa Bay Interagency Treatment Sites



2005 *Spartina* Eradication Monitoring Program, Willapa Bay

The Willapa Bay *Spartina* monitoring program continued this year, building on the 2004 efforts. The monitoring program allows managers to understand the effectiveness of treatment methods at different sites and then use that information, along with acres treated, to determine how much *Spartina* was killed each year. It also provides information about how effective the overall control approach is, as well as effectiveness of individual treatments. Data generated from the program are used for adaptive management purposes, to improve and make future adjustments to the control strategy.

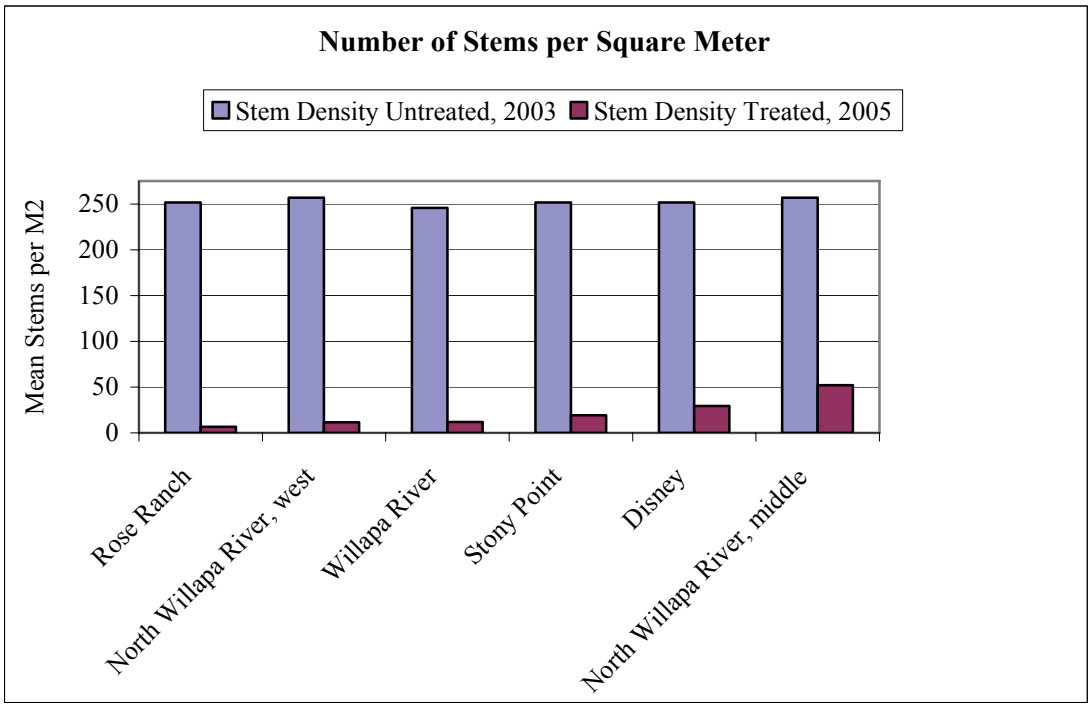
Monitoring sites were selected in areas where chemical and mechanical controls have been previously used. The treated sites vary in substrate type and method and timing of treatments. Untreated sites serve as a reference for comparison to the sites where control has taken place. The sites included in the monitoring program (see below) changed slightly from the year before. Three sites were dropped from the monitoring program in 2005: the Stanley Point and Chetlo Harbor sites were close enough to eradicated to not require efficacy data, and the Oysterville site was not treated in 2004 as treatment priority shifted from the Long Beach Peninsula to the rest of the Bay. The six sites monitored this year are listed below:

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

Stem Density

The results of the monitoring work show significant decreases in stem density at all sites (Graph 2). Following two years of treatment at these sites, reduction rates range from 97 percent (Rose Ranch) to 80 percent (North Willapa River, middle). The largest reductions in stem density, those with at least a 90 percent change, were measured at sites sprayed with either glyphosate or imazapyr. Some of these sites had been crushed in years before being sprayed, but one site, Willapa River aerial spray, had been aerially sprayed in 2003 and 2004 with no prior crushing. The site with the lowest percent change in stem density was the North Willapa River site, which had been crushed in 2003 and 2004 with no follow-up spraying. Control was still extremely effective at this site, yielding an 80 percent reduction in stem density, which illustrates the value of mechanical control work at certain sites. Crushing in Chetlo Harbor (see monitoring reports from 2003 and 2004 Legislative Reports) also showed the effectiveness of crushing at sites with softer sediments. These results attest to the strength of implementing IPM, when different control techniques are applied where they work best and the overall success of the program is maximized.

Graph 2. 2005 *Spartina* Monitoring Data - Stem Density



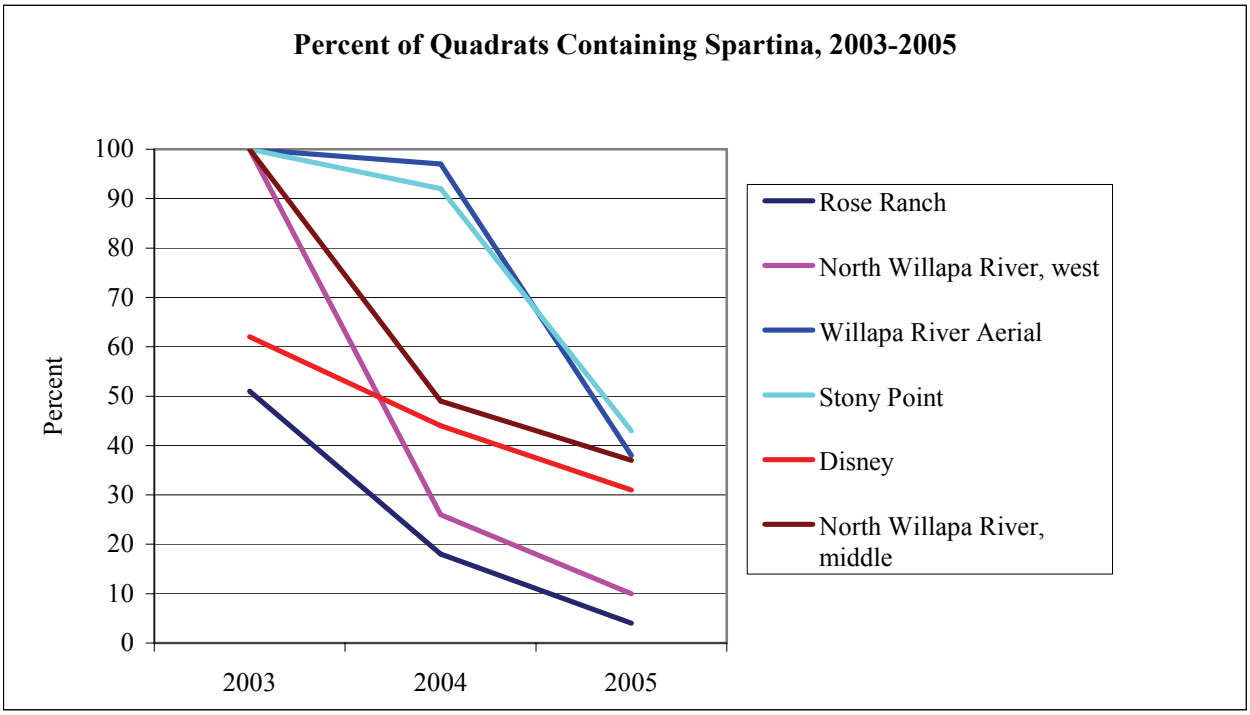
***Spartina* Presence**

To get a more complete view of the distribution of *Spartina*, the monitoring program measured the number of quadrats containing one or more stems of *Spartina*, or conversely, no *Spartina* at all (Graph 3). This measurement provides information about how the *Spartina* is spread out over the tide flats, whether stems are bunched together in sporadic clumps or spread more evenly across the landscape. It gives information about how frequent *Spartina* is occurring in the sampling units. By offering both sets of data, we are able to better understand the distribution of *Spartina* at a given site, as well as the overall quantity of live stems.

Graph 3 shows a downward trend of *Spartina* presence at all sites over time. In 2003, four of the sites contained *Spartina* in every quadrat sampled (100 percent frequency) either because the site had not been treated or treatment had not been particularly effective. These data have shown that crushing in firmer sediment sites results in reduced densities of *Spartina* stems but not much in the way of reduced frequencies. The sites that were crushed first and then sprayed for one or more seasons (e.g., Rose Ranch, Stony Point, Willapa River-west) showed very effective control both in terms of reduced stem density and high percentage of sample quadrats containing no *Spartina*. While the data show differences in how a site has changed over time in regards to presence or absence of *Spartina*, we can also see, most importantly, that the percentage of quadrats containing any *Spartina* stems is dramatically declining at all of the sites monitored.

Monitoring at all sites will continue in 2006 to assess the amount of *Spartina* growing back after herbicide applications and additional mechanical control. The expectation in 2006 is to see *Spartina* nearly eradicated from several of the monitored sites.

Graph 3. 2005 *Spartina* Monitoring Data – *Spartina* Presence



Recommendations for the Future

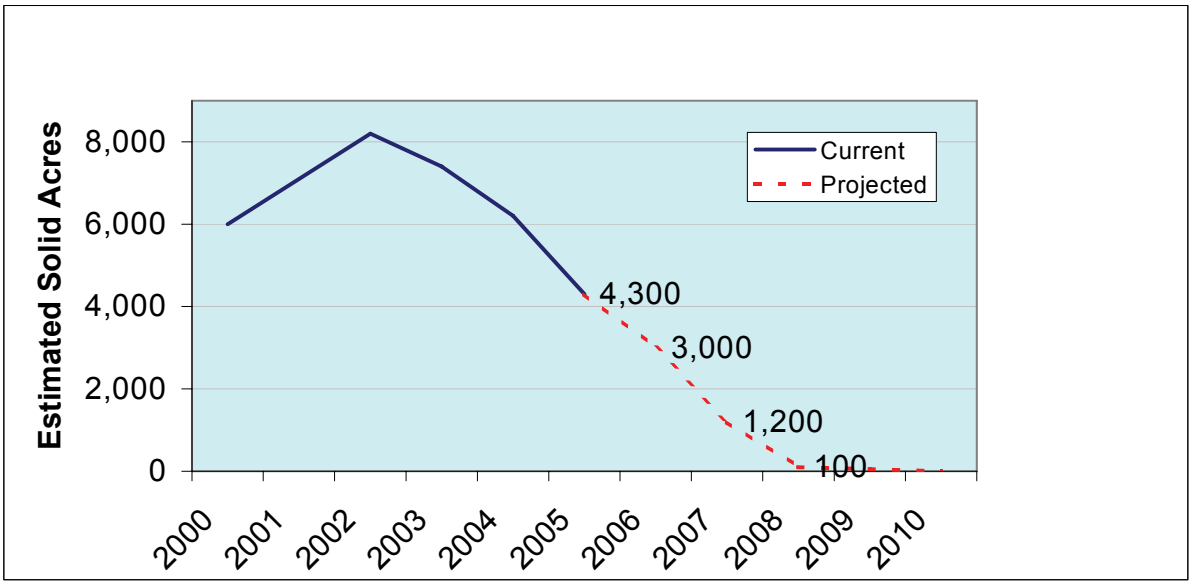
Over the past three seasons, the cooperating entities in Willapa Bay have treated an unprecedented amount of *Spartina* and large reductions are becoming very evident. The focus of control work over the past three years has been on reducing the many large meadows in the Bay. This work was conducted primarily with the use of fast-paced aerial applications, capable of covering large areas of infestation in relatively short amounts of time. These types of applications only required the on-site work of a small handful of personnel.

Because of the successes of the past three years, and the sizable reductions of the large meadows in Willapa Bay, the effort is beginning to transition from the large-scale aerial operations to re-treatment operations that require a large number of field personnel to cover the same area. It is anticipated that the cost for re-treating these sites will not differ very much from the cost of conducting initial applications. The amount of herbicide needed to treat these large areas will decline, bringing the herbicide costs down, however, the number of personnel needed to re-treat these same areas will greatly increase. The effort will go from utilizing one aerial applicator and two to three support personnel to treat a large area, to needing a dozen or more applicators and several airboats for transport to, from and within the site.

With the successful reduction of several thousand acres of infestation from Willapa Bay in the past several years, it is extremely important that focus and funding continues to be placed on the *Spartina* problem in Willapa Bay. Graph 4 illustrates the current projection that *Spartina* can essentially be eradicated from Willapa Bay in four more seasons. The projection assumes that:

- The 2005 treatments result in a 50% efficacy of treated acres.
- WSDA WDFW and DNR funding continues at current levels.
- USFWS continues to receive $1,000,000 per year in federal funding for *Spartina* control.
- The effort will eradicate 2,000 solid acres per year in 2006 and 2007.
- The *Spartina* infestation has a growth rate of 17%.

Graph 4. 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 2005 season.

Extent of the Infestation in Grays Harbor

Due to the magnitude of the problem in neighboring Willapa Bay, property managers and landowners in Grays Harbor have long been concerned about the potential for invasion of *Spartina*. This threat was validated in 1992 with the discovery of one large *Spartina* clone in Grays Harbor by DNR staff. This was the only known infestation in Grays Harbor at the time, and the DNR crew mowed it repeatedly throughout the growing season.

In 1995, WDFW began conducting yearly surveys and control work in Grays Harbor. At the beginning of the 1995 season there were approximately 2 solid acres of known *Spartina* within the Grays Harbor management area. Between 1995 and 2002, WDFW and the Grays Harbor County Noxious Weed Control Board conducted regular surveys of the harbor. WDFW conducted yearly control work on any infestations found during the surveys.

For the past five years WSDA has provided funding for WDFW to conduct survey and control work in both Willapa Bay and Grays Harbor. Because of the magnitude of the infestation in Willapa Bay, a majority of the WDFW effort has been focused on Willapa Bay. The funding allowed for only two to three weeks of work in Grays Harbor.

In September 2005, WSDA, WDFW and DNR conducted an extensive aerial survey of Grays Harbor. This aerial survey turned up much more infestation than had previously been known. The aerial survey was followed by a more focused ground survey of the area. Based on both surveys, it was estimated that the overall infestation is about 10 acres. Figure 5 identifies the locations of all infestations in Grays Harbor.

WDFW attempted to control all newly discovered infestations and re-treat previously treated infestations, however, with the current funding, WDFW was only able to treat approximately 50% of the infestations.

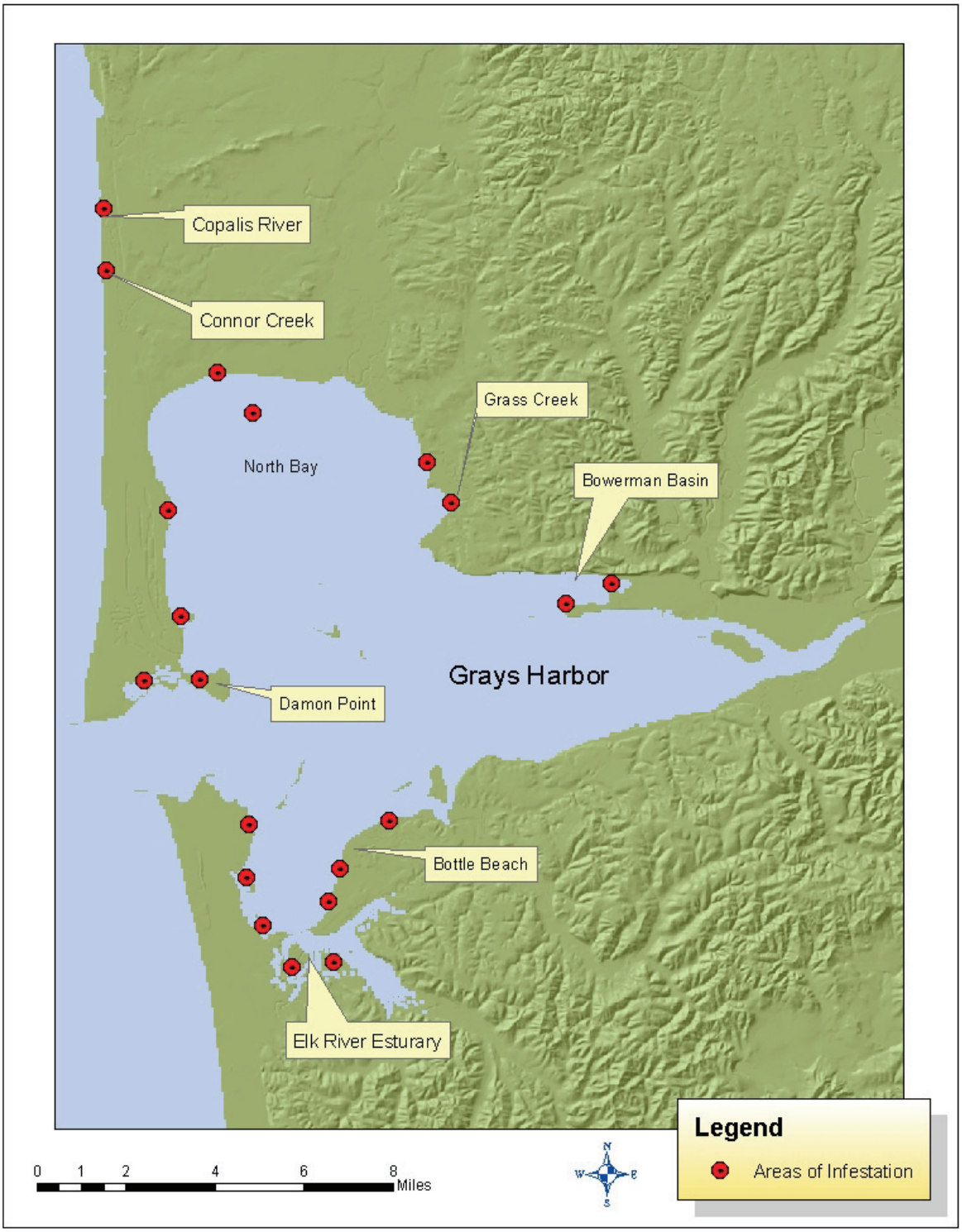
Recommendations for the Future

With the 2005 survey resulting in much more *Spartina* being discovered in Grays Harbor, WSDA and WDFW have concluded that the level of control possible with the funding made available to WDFW from WSDA is not sufficient to reduce or eradicate the infestation. WSDA and WDFW also agree that shifting funding from the Willapa Bay effort to the Grays Harbor effort is unwise at this point with the gains that are being made in Willapa Bay.

Both WDFW and WSDA feel that a dedicated two-person crew to focus on the survey and eradication of *Spartina* in Grays Harbor is necessary. The ideal funding level would allow for this two-man crew for the five-month summer treatment season. Managers have estimated that

this level of effort would cost approximately $50,000 per year. WDFW and WSDA have begun to pursue alternative sources of funding to ensure that Grays Harbor can be successfully eradicated.

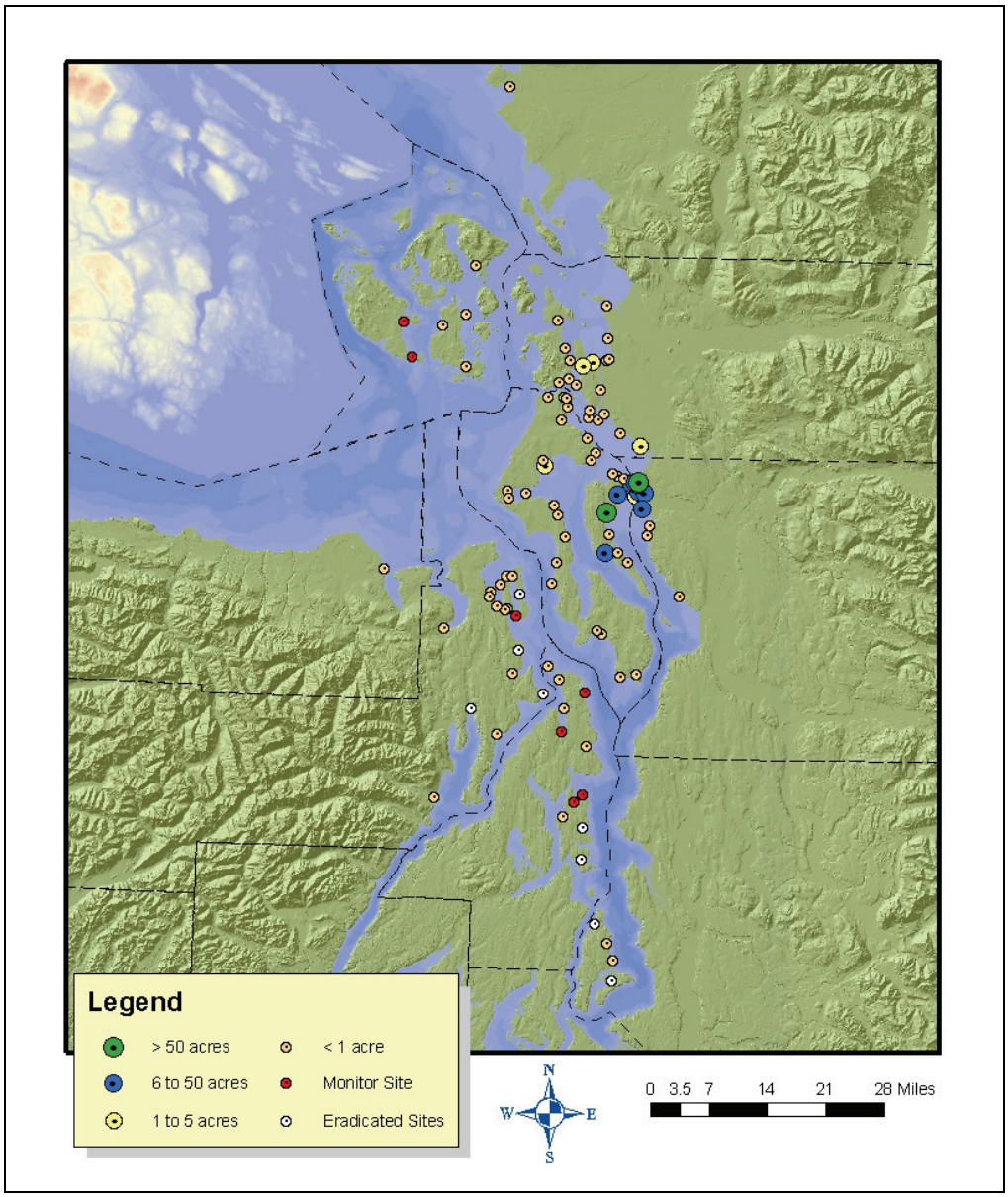
Figure 5. Approximate Locations of Grays Harbor Infestation and Treatment Sites, 2005



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 6 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. During the 2005 season, an estimated 520 solid acres were treated.

Figure 6. Locations and Sizes of Known Puget Sound and Hood Canal *Spartina* Infestations



Extent of the Infestation in Puget Sound and Hood Canal

After another successful treatment season in Puget Sound, monitoring and survey data have been coupled with treatment figures for the 2005 season to estimate the total solid acreage of the Puget Sound and Hood Canal infestation at the beginning of the 2005 treatment season. The effort now estimates that a total of 540 solid acres infests all of Puget Sound and Hood Canal.

Snohomish County

WSDA provided $50,000 to the Snohomish County Noxious Weed Control Board for *Spartina* eradication activities in 2005. In addition to this funding, WSDA provided a supplemental allocation of herbicide to the county, but unlike the past two years, WSDA was not able to provide all herbicide used by the county. WSDA also assisted in funding an aerial application to southeast Skagit Bay. WDFW also conducted a substantial amount of control work in Snohomish County during the 2005 season. This work focused mainly on WDFW-managed lands on Leque Island. WSDA also provided a supplemental allocation of herbicide to WDFW for these treatments.

In total, 374 solid acres of *Spartina* were treated in Snohomish County in 2005. Table 8 shows the solid acres treated, who did the treatment, and the treatment methods used on every site in Snohomish County. Figure 6 identifies the approximate location of the infestations.

All meadows in southeast Skagit Bay, Leque Island and Mystery Island were treated entirely. This is the third season that all meadows in this area have been treated. The herbicide imazapyr was applied for the first time to southeast Skagit Bay. This treatment was the first time in more than six years that an aerial application was conducted in Puget Sound.

An aerial application of imazapyr to the southeast Skagit Bay infestations was chosen because the previous control work conducted at the site was not resulting in substantial reductions. Also, recent experience with aerial applications in Willapa Bay indicate that aerial applications are the most cost effective method of treating large meadow infestations. Results of this application will not be known until next spring, however, based on similar treatments to Leque Island and Mystery Island, the application to southeast Skagit Bay should result in 50% to70% overall reduction. Figure 24 (page 60) shows the southeast Skagit Bay site several months after the treatment.

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 2005 control season, only 70.5 solid acres remained. This is a 65% decline since the beginning of 2003.

The Nature Conservancy (TNC) was again a major on-the-ground contributor during the 2005 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.

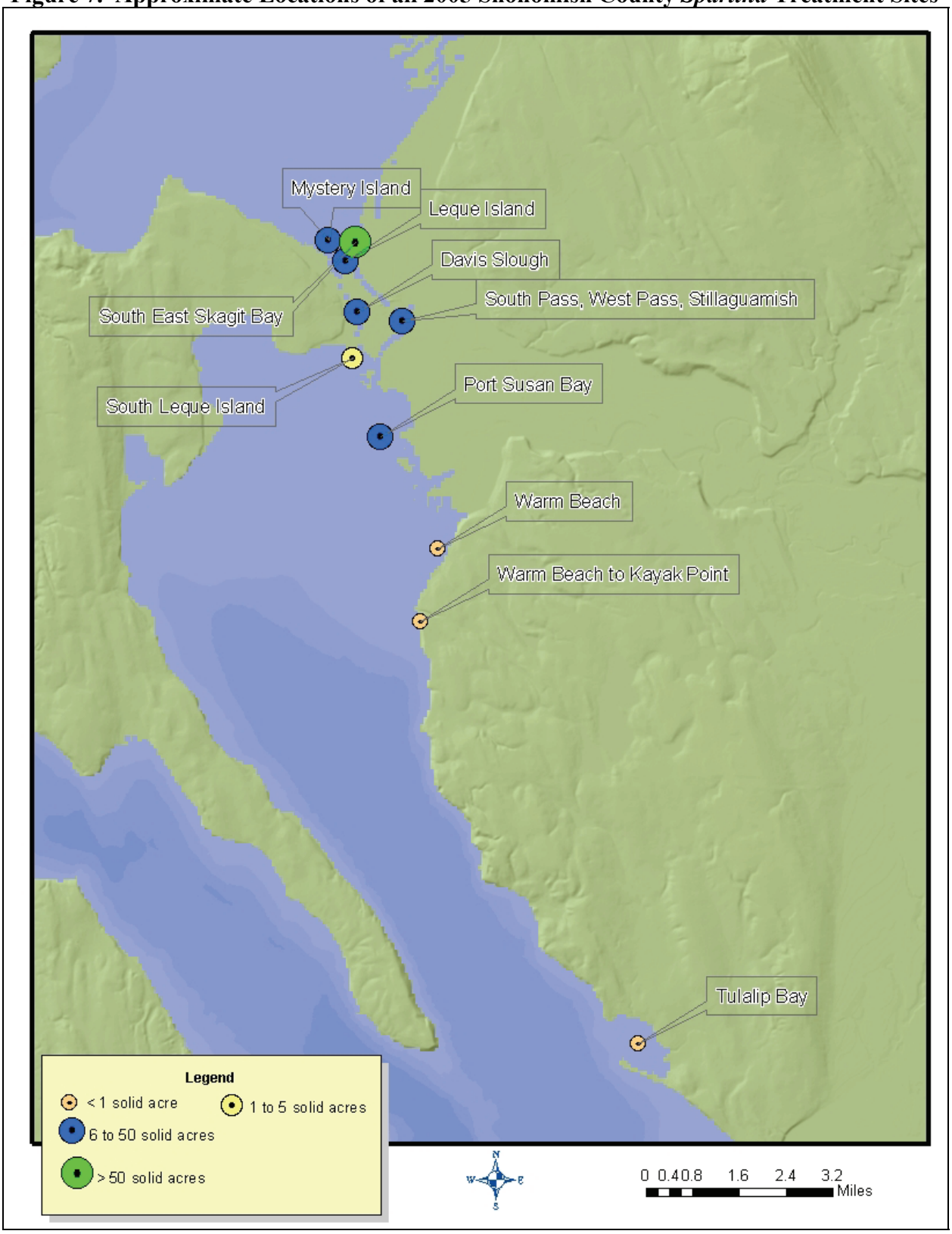
Table 8. Summary of 2005 *Spartina* Eradication Effort in Snohomish County

Site	Estimated Solid Acreage treated	Entity Conducting Treatment	Treatment Method used
Port Susan	10*	TNC	Herbicide, Dig
Southeast Skagit Bay	226.5*	SC, WDFW	Herbicide, Crush
Davis Slough	8.29*	WDFW	Herbicide
Mystery Island	15*	WDFW	Herbicide
Leque Island	55.5*	WDFW	Herbicide, Crush
South Leque	3*	WDFW, WM	Herbicide
Warm Beach	0.002*	SC	Herbicide
South Pass, West Pass, Stillaguamish River Channels	54.87	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	**373.41**		

*Denotes entire site treated

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

Figure 7. Approximate Locations of all 2005 Snohomish County *Spartina* Treatment Sites



Island County

WSDA provided $50,000 to the Island County Noxious Weed Control Board for *Spartina* eradication activities in 2005. 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 2005 season. WSDA also provided approximately $20,000 worth of herbicide to WDFW for use in the North Puget Sound region.

In total, 134 solid acres of *Spartina* were treated in Island County in 2005. Table 10 shows the solid acres treated, who did the treatment, and the treatment methods used. Figure 8 shows the approximate locations of the treatment sites.

In 2005, the effort in Island County continued to focus on reducing the few remaining large infestations in the county, as well as ensuring that all small outlier infestations were treated. All known infestations in Island County received complete treatment during 2005 with the exception of a small portion of the Triangle Cove infestation. The 2004 treatments resulted in an overall decrease in solid acres of only about 20%, however, this is mostly due to the lack of reduction at one site: Triangle Cove. Looking at several of the infestations on a site-by-site basis, you get a better idea of how the infestation in Island County has been reduced over the past three years. Table 9 illustrates this by comparing the solid acreage at several sites during the past three years.

The largest sites remaining in Island County continue to be the Emerick's/Price site and Triangle Cove. Both sites had received only mechanical control for the past two years, with the work being conducted primarily by WDFW and DNR. The mechanical control worked well, with Triangle Cove being reduced from approximately 170 solid acres to 75 solid acres, and Emrick's/Price being reduced from 120 solid acres to 32 solid acres. The remaining acreage at each site is not easily controlled by mechanical means and require herbicide application. WDFW was able to conduct herbicide applications to the Emerick's/Price infestation. However, due to budget constraints, only about 10 of the 75 solid acres remaining at Triangle Cove were treated with herbicide.

Triangle Cove continues to prove difficult to eradicate. This difficulty is not due to a lack of effective eradication options, but rather funding difficulties. During the fall of 2004 and winter of 2005, WSDA, WDFW and the major landowner in Triangle Cove applied for an LIP grant to provide substantial funding for eradication. The grant was approved, but the funding comes from USFWS through WDFW, thus requiring a federal Section 7 endangered species consultation. This process can take several years to complete. WSDA and WDFW are working closely with USFWS staff in hope that the project will receive approval for the 2006 season. If the project does not receive federal approval by 2006, WSDA and WDFW will fund eradication work at this site differently.

Wildlands Management (WM) continues to conduct extensive eradication work throughout Island County. During the 2004 season, WM crews extensively surveyed the entire shoreline of east Whidbey Island and several high-risk sites on west Whidbey Island. Through this extensive survey work, WM discovered several new, small infestations and treated all infestations on

Whidbey Island. During the 2005 season, WM returned to all of the sites and conducted re-treatments as necessary. Several sites had no regrowth as a result of the 2004 treatments.

People for Puget Sound (PFPS) continued to be active in the *Spartina* eradication effort during the 2005 season. To date, it has set up four community-based survey and monitoring groups in Island County. The community groups are focused on infestation 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 application at the sites until infestations are small enough that community members can easily 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 five 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, 2003-2005

Site	Solid Acreage Present			% Reduction 2003 - 2005
	2003	2004	2005	
Emerick's/Price	121.5	60	50	58%
Livingston Bay	34.5	4.45	10.32	70%
Triangle Cove	127.5	75	75	41%
English Boom	15	7.5	0.75	95%
Cultus Bay	1.75	1.5	0.5	71%
Deer Lagoon	1.5	1.325	0.175	88%
Total	**301.75**	**149.77**	**137.50**	**54%**

Table 10. Summary of 2005 *Spartina* Eradication Effort in Island County

Site	Estimated Solid Acreage Treated	Entity Conducting Treatment	Treatment Method
Hope Harbor	0.03*	WM	Herbicide
Ala Spit	0.03*	WM	Herbicide
Cornet Bay	0.01*	WM	Herbicide
Dugwalla Bay	0.19*	WM	Herbicide
Race Lagoon	0.15*	WM	Herbicide
Arrowhead Beach	0.25*	WM	Herbicide
Utsalady Bay	0	WM	*Monitor*
Livingston Bay	10.32*	WM, WDFW	Herbicide
Emrick's/Price	32.5*	WDFW	Crush, Herbicide
Deer Lagoon	0.175*	WM	Herbicide
Cultus Bay	0.5*	WM	Herbicide
Scatchet Head	0.01*	WM	Herbicide
English Boom	0.75*	WM	Herbicide
Mt. View Lagoon	0.0025*	WDFW	Herbicide
Elger Bay	6.75*	WDFW, WM	Herbicide
County Club	0.0025*	WDFW	Herbicide
Sunny Shores	1.25*	WDFW	Herbicide
Eagle Tree	0.031*	PFPS	Dig
Sunlight Beach	0.125*	WM	Herbicide
Juniper Beach	2.55*	WM, WDFW	Herbicide, Dig
Triangle Cove	75	WDFW	Crush, Herbicide
Penn Cove/Twin Lagoons, Kennedy Lagoon	0.08*	WM	Herbicide
Blowers Bluff	0	WM	*Monitor*
El Capitan Lagoon	0.025*	WM	Herbicide
Fawn Bluff	0.03*	WM	Herbicide
Harrington's Lagoon	0.075*	WM	Herbicide
Glenwood Lagoon	0.175*	WM	Herbicide
Holmes Harbor	0	WM	*Monitor*
Mariner's Cove	0.125*	WM	Herbicide
Lagoon Point	0.01*	WM	Herbicide
Strawberry Point	0.025*	WM	Herbicide
Oak Harbor	0.035*	IC, PFPS	Dig
Maylor Marsh	2*	WM, WDFW	Herbicide
Hancock Lake	0.5*	WM, WDFW	Herbicide
Total Solid Acres Treated	**133.081**		

*Denotes entire site treated
WM = Wildlands Management, WDFW = Department of Fish and Wildlife, IC = Island County
WSDA = Department of Agriculture, PFPS = People For Puget Sound.

Figure 8. Approximate Locations of all 2005 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 2005 control season. The Swinomish Tribe, WDFW and the Department of Ecology also allocated resources towards *Spartina* eradication activities in Skagit County.

In total, 10 solid acres of *Spartina* were treated in Skagit County in 2005 including the largest infestation in the county, Turners Cove, which until this season had not received any substantial level of control. The 10 acres treated in Skagit County represent all known *Spartina* infestations in the county. Table 11 shows the solid acres treated, who did the treatment, and the treatment methods used on every site in Skagit County. Figure 9 shows the approximate locations of all Skagit County 2005 treatment sites.

For the fourth 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, all tribal sites are treated by Skagit County using an IPM approach that includes herbicide application. The only site on the reservation where herbicide applications are not allowed, due to an ongoing environmental health study, is Turners Cove. However, the entire infestation was treated mechanically by WDFW at the beginning of the season.

One new infestation was found in Skagit County during the 2005 season. During a shoreline survey being conducted by People For Puget Sound, a small 4-square-foot clone was identified on Guemes Island. This is the first infestation found on the island, which will be surveyed extensively in the future.

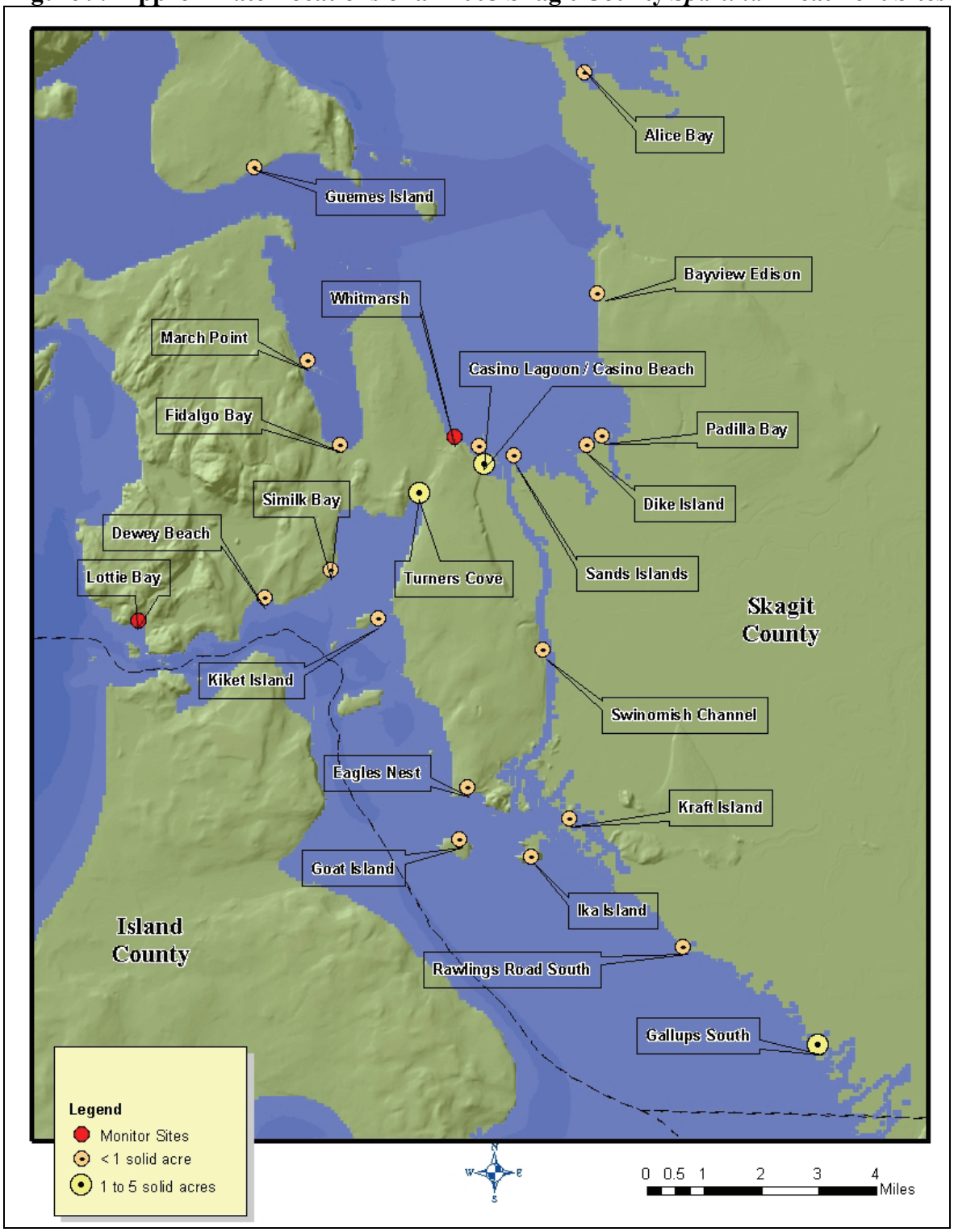
The overall effort in Skagit County continues to be extremely successful. The overall infestation in the county, estimated at 100 solid acres in 1997, has been reduced by about 90% to 10 solid acres in 2005. With the continued use of an IPM approach for controlling infestations on Swinomish Tribal property, the effort in Skagit County will continue its progress towards eradication. Managers estimate that less than 5 solid acres will remain at the beginning of the 2006 treatment season.

Table 11. Summary of 2005 *Spartina* Eradication Effort in Skagit County

Site	Estimated Solid Acreage Treated	Entity Conducting Treatment	Treatment Method
Gallups South	1.124*	SK	Dig, Herbicide
Rawlings Rd. South	0.9*	SK	Mow, Herbicide
Kiket Island	0.09*	SK	Herbicide
Sands Island	0.1*	SK	Herbicide
Kraft Island	0.64*	SK	Herbicide
Ika Island	0.01*	SK	Dig
Dike Island	0.04*	WM, WDFW	Herbicide
Padilla Bay	0.003*	DOE	Dig
Similk Bay	0.001*	SK	Dig
Bayview Edison	0.0002*	DOE	Dig
Eagle's Nest	0.6*	SW, PFPS	Dig
Alice Bay (Samish Island)	0.5	WDFW, DOE	Herbicide, Dig
Turners Cove	5	WDFW, SW	Crush, Dig
Lottie Bay	0	SK	*Monitor*
Goat Island	0.001*	SK	Herbicide
Dewey Beach	0.005*	SK	Dig
Fidalgo Bay	0.03*	SK	Dig
March Point	0.011*	SK	Dig, Herbicide
Guemes Island	0.0001	PFPS	Dig
Whitmarsh	0	SK	*Monitor*
Casino Lagoon/ Casino Beach	1.86*	WDFW, WSDA, SW, PFPS	Mow, Dig, Herbicide
Swinomish Channel	0.33*	SK, SW, PFPS, WSDA,WDFW	Dig, Herbicide
Total Solid Acres Treated	**10.00**		

*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, PFPS = People for Puget Sound

Figure 9. Approximate Locations of all 2005 Skagit County *Spartina* Treatment Sites



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

In 2005, 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, Suquamish Tribe, and North Olympic Salmon Coalition to conduct control work in San Juan, Whatcom, Clallam, Jefferson, Kitsap, and King counties. Table 12 shows the solid acres treated, who performed the treatment, and the treatment methods used at every site in San Juan, Whatcom, Clallam, Jefferson, Kitsap and King counties.

WSDA crews conducted fairly extensive shoreline surveys of San Juan County. During this survey new infestations were discovered at Spencer Spit and Mud Bay. The Spencer Spit infestation was treated entirely with herbicide in cooperation with State Parks, and the Mud Bay infestation was completely dug out by the San Juan County Noxious Weed Control Board. Figure 10 shows where surveys and control work took place in San Juan County.

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.

Of special note in Kitsap County in 2005 was the continued partnership between WSDA and the Suquamish Tribe. During the course of this partnership, WSDA and the Tribe have worked closely to find eradication techniques that are agreeable to the Tribe. After many years of mechanical and manual control techniques, the infestation does not appear to be getting any smaller, and is still producing seed that can potentially spread to other areas of Puget Sound. Because of this, the Tribe and WSDA began several small-scale tests of the new herbicide imazapyr on infested land directly adjacent to the Tribal land during the 2004 season. After post-treatment monitoring found its efficacy in controlling the *Spartina* was acceptable and the 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. This is by far the largest site left in the Central/South Puget Sound area and the use of herbicide should allow for reductions to finally begin at this site.

WSDA crews have substantially reduced all known infestations in Clallam, Jefferson, Kitsap and King counties during the past five years. It is important to note that all sites were treated entirely at least twice in 2005. WSDA continues to survey extensively in this area and find new, small infestations before they become a problem.

For the first time, a small infestation was found in Whatcom County. The infestation was found in Birch Bay very near the Washington/Canadian border. Canadian officials have been aggressively treating a scattered infestation in Boundary Bay, just around the corner from Birch Bay, for the past two years. It is highly likely that the infestation found in Birch Bay resulted from a seedling or plant fragment being transported south from the infestation in Canada. Managers will continue to keep a close eye on the shorelines along the Washington/Canadian border. Figure 10 shows the location of the Whatcom County infestation.

Recommendations for the Future

The results of continuous control and monitoring of these sites, coupled with the elimination of major nearby seed-producing meadows, is reflected 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 second consecutive year at the three largest infestations in Puget Sound. Great progress was made this season and these infestations are much closer towards eradication. Continued funding and support is needed to keep up this successful effort in Puget Sound.

Figure 10. Approximate Locations of 2005 San Juan and Whatcom County *Spartina* Treatment/Survey Sites

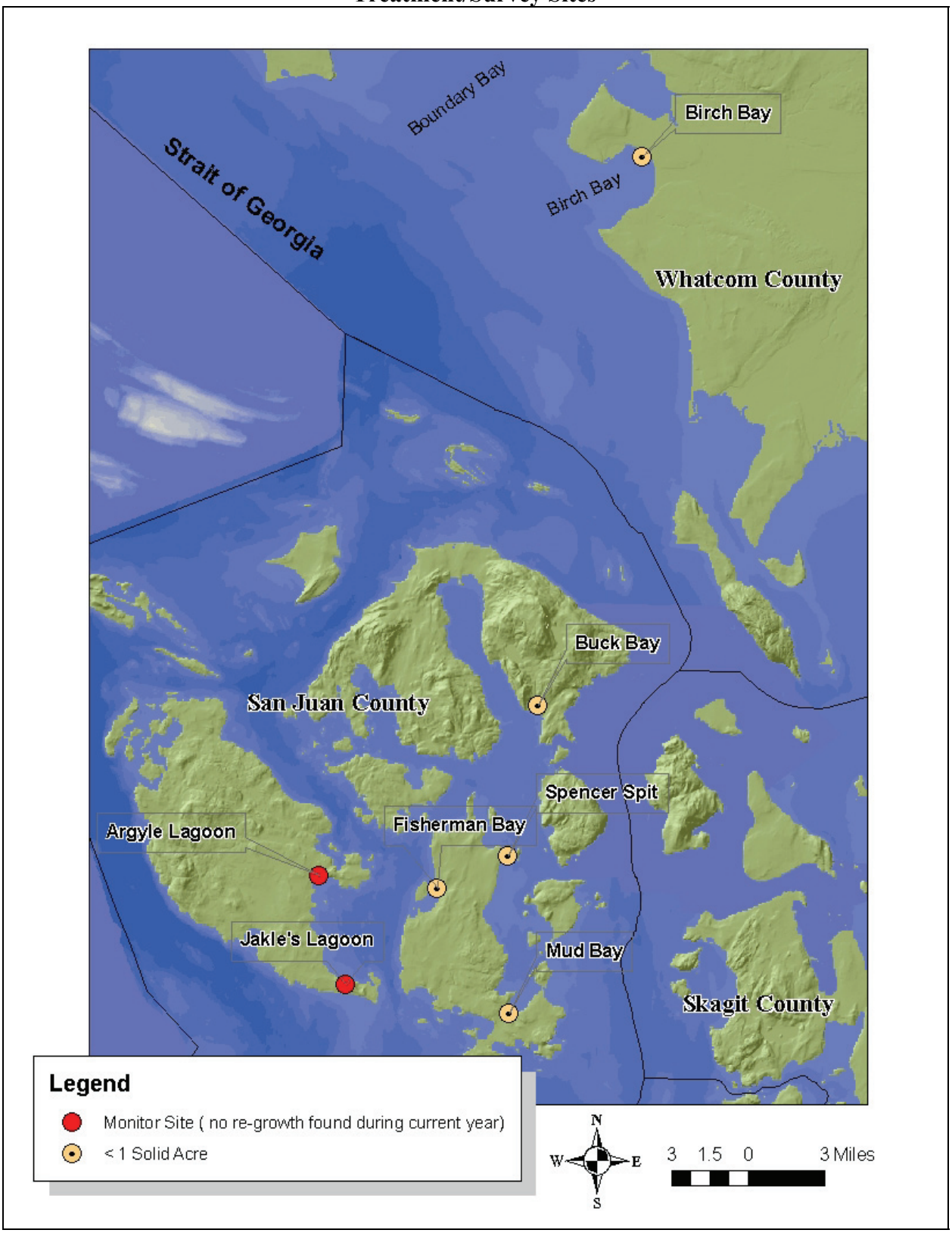


Figure 11. Approximate Locations of all 2005 Clallam, Jefferson, Kitsap and King county *Spartina* infestations

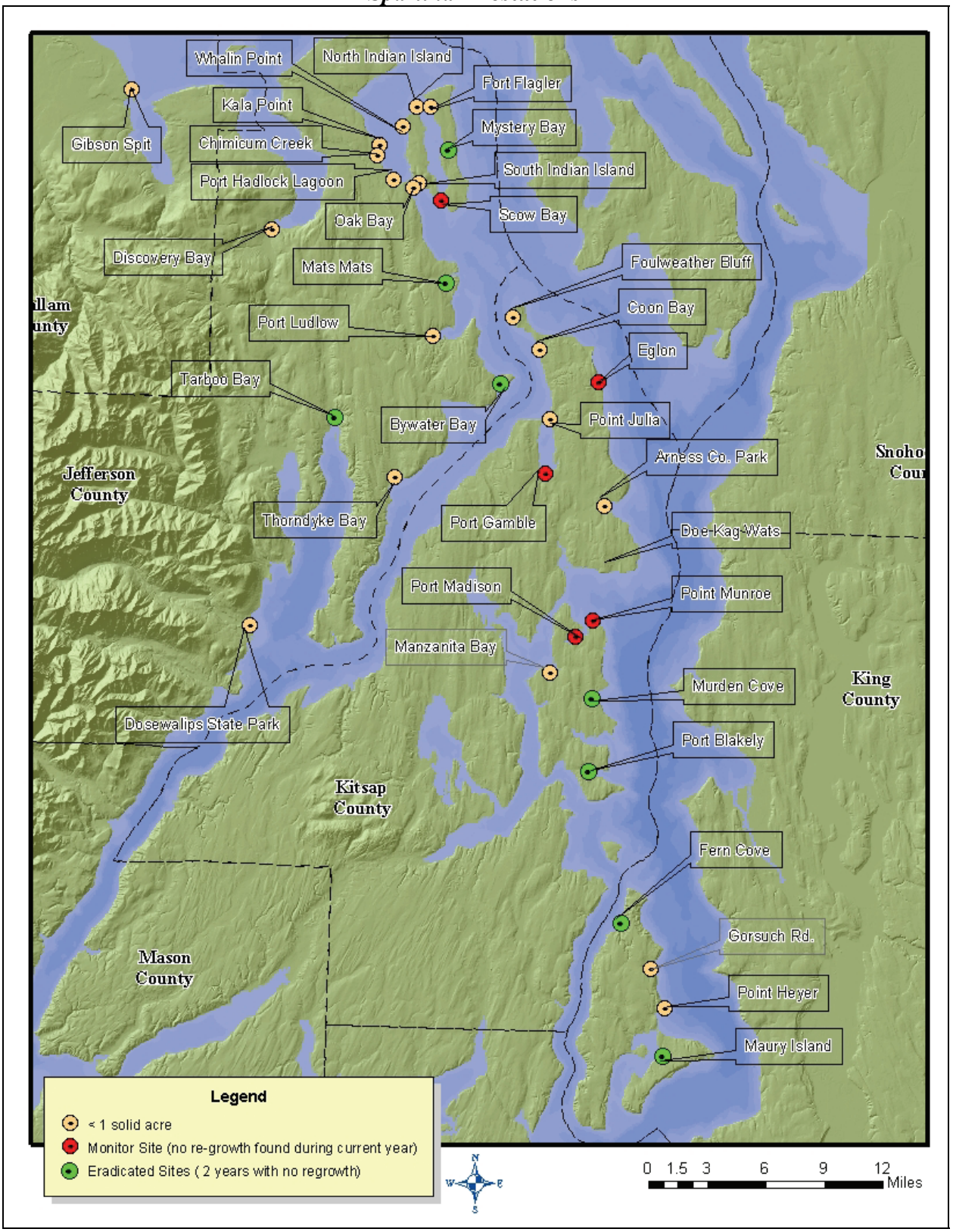


Table 12. Summary of 2005 *Spartina* Eradication Effort Central and South Puget Sound

Site	Estimated Solid Acreage Treated	Entity Conducting Treatment	Treatment Method
➢ **San Juan County**			
Buck Bay	0.0005*	SJC/UW	Dig
Argyle & Jackle's Lagoon's	0	SJC/WSDA	*Monitor*
Fisherman Bay & Mud Bay#	0.001*	SJC/WSDA	Dig
Spencer Spit#	0.005*	WSDA	Herbicide
➢ **Whatcom County**			
Birch Bay	0.00001*	WC/WSDA	Dig
➢ **Clallam County**			
Gibson Spit	0.0006*	WSDA	Dig
➢ **Jefferson County**			
Dosewallips State Park	0.005*	WSDA	Herbicide
Thorndyke Bay	0.0003*	WSDA	Dig
Tarboo Bay	0	WSDA	***Eradicated***
Oak Bay	0.0005*	WSDA	Dig
Port Hadlock Lagoon	0.0006*	WSDA	Dig
Mats Mats	0	WSDA	***Eradicated***
Scow Bay	0	WSDA	*Monitor*
Whalin Point	0.0006*	WSDA/Navy	Dig
Kala Point	0.0004*	WSDA	Dig
Bywater Bay & Mystery Bay	0	WSDA	***Eradicated***
Chimicum Creek	0.0001*	WSDA/NOSC	Dig
Discovery Bay	0.0003*	WSDA	Dig
South Indian Island	0.0001*	WSDA	Dig
North Indian Island	0.0008*	WSDA/Navy	Dig
Fort Flagler	0.00005*	WSDA	Dig
Port Ludlow	0.0001*	WSDA	Dig
➢ **Kitsap County**			
Murden Cove & Port Blakely	0	WSDA	***Eradicated***
Point Monroe & Port Madison	0	WSDA	Dig
Foulweather Bluff	0.001*	WSDA	Dig
Point Julia	0.0009*	WSDA	Dig
Coon Bay	0.0001*	WSDA	Dig
Kingston Ferry	0.0001*	WSDA	Dig
Doe-Kag-Wats	1.25*	WSDA	Mow, Herbicide
Eglon	0	WSDA	*Monitor*
Arness Park	0	WSDA	*Monitor*
Port Gamble	0	WSDA	*Monitor*
Manzanita Bay#	0.00006*	WSDA	Dig
➢ **King County**			
Fern Cove	0	WSDA	***Eradicated***
Rabb's Lagoon (Maury Island)	0	WSDA	***Eradicated***
Gorsuch Road#	0.0001*	WSDA	Dig
Point Heyer	0.0001*	WSDA	Dig
Total Solid Acres Treated	**1.0317***		

*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, NOSC = North Olympic Salmon Council, WC = Whatcom County Noxious Weed Control Board

Figure 12. ***Spartina alterniflora*** **in Willapa Bay, Pacific County, Washington. (2003)**

Figure 13. ***Spartina patens*** **at Dosewallips State Park, Jefferson County, Washington. (2000)**

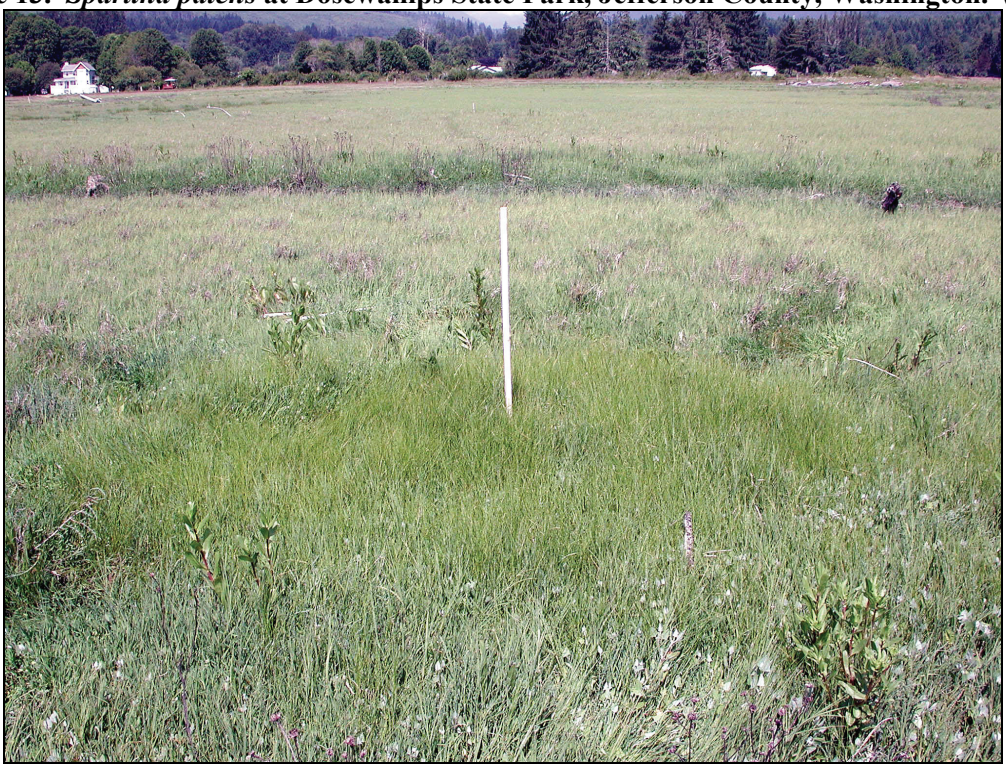


Figure 14. *Spartina anglica* invading mudflat in Livingston Bay, Island County. (1999)

Figure 15. *Spartina densiflora* located in Grays Harbor near Damon Point. (2002)

Figure 16. West North Willapa meadow before any eradication work. (Spring 2002)

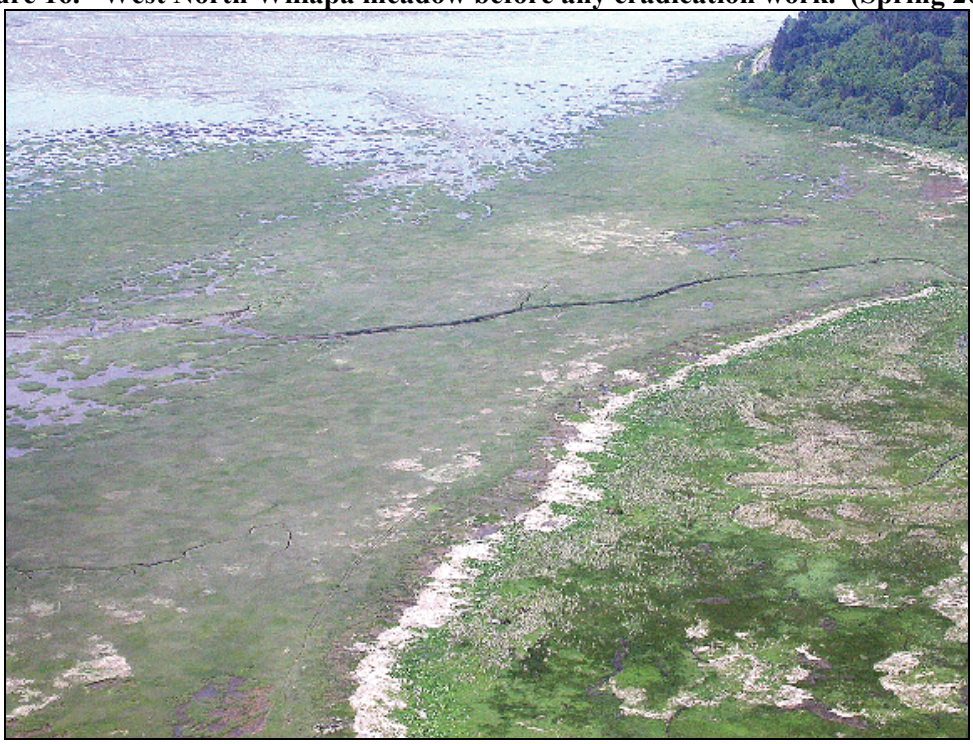


Figure 17. West North Willapa Meadow after several years of eradication work. (Summer 2005)

Figure 18. Chetlo Harbor, Willapa Bay at the end of the first season the site was treated with herbicide. (Summer 2003)

Figure 19. Chetlo Harbor, Willapa Bay after 3 years of eradication work. (Summer 2005)

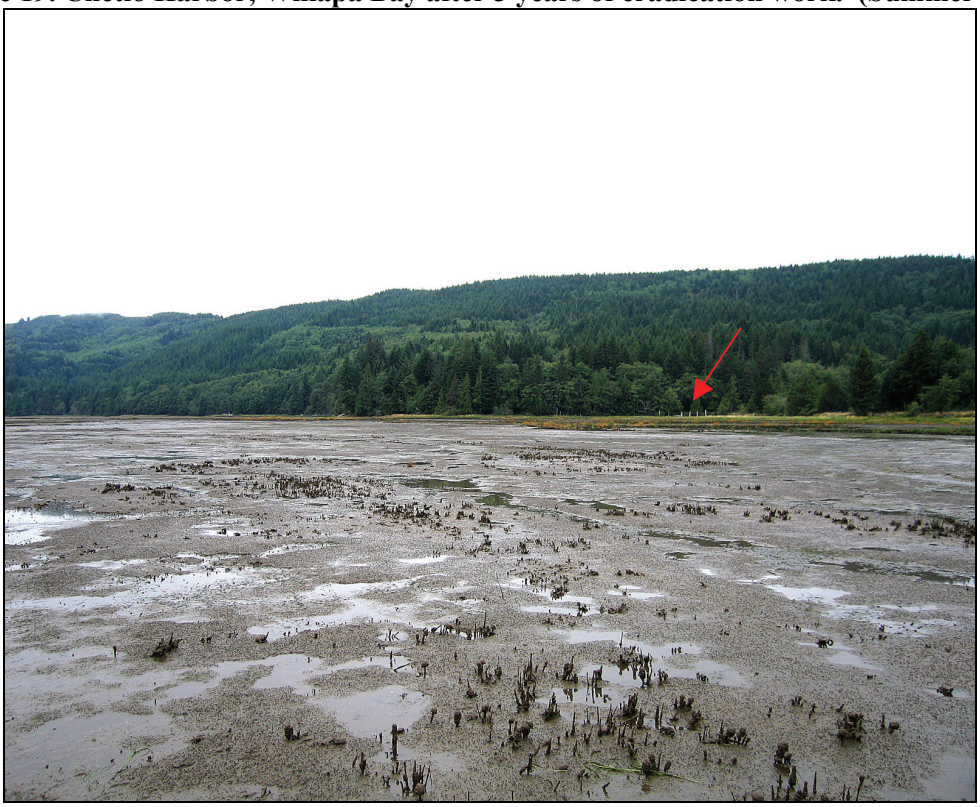


Figure 20. Bay Center treatment area before eradication work, looking south. (Summer 2004)

Figure 21. Bay Center treatment area after two years eradication work, looking north. (Summer 2005)

Figure 22. Aerial application taking place in Willapa Bay. (Summer 2003)

Figure 23. Visible biocontrol damage to plants in Willapa Bay. (Summer 2005)

Figure 24. Southeast Skagit Bay after aerial herbicide application. (October 2005)

Figure 25. Triangle Cove after three years of control. (Summer 2005)