

REPORT TO THE LEGISLATURE
PROGRESS OF THE *SPARTINA* ERADICATION
AND CONTROL PROGRAMS

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EXECUTIVE SUMMARY

Chapter 255, Laws of 1995 designated the Washington State Department of Agriculture (WSDA) as the lead state agency for the eradication of invasive *Spartina* species. The 2001 Legislature appropriated \$2,166,260 from the Aquatic Lands Enhancement Account (ALEA) to WSDA for these activities in the 2001-03 biennium. Since 1995, WSDA has reported to the Legislature at least annually on the progress of these programs. This report details progress of the programs in 2001.

***Spartina* Eradication Program**

New Developments and Challenges

The 2001 *Spartina* program was marked by two very significant changes. The first change was a tripling of the budget for the WSDA *Spartina* Control Program to more aggressively and effectively achieve the program's goal to eradicate *Spartina* in Washington. The second change was the decision not to use herbicide as a control tool during the 2001 control season due to a federal court ruling. Other new developments included the advancement of mechanical control tools and the continued progress in the registration process for a new herbicide for control.

Enhanced Budget

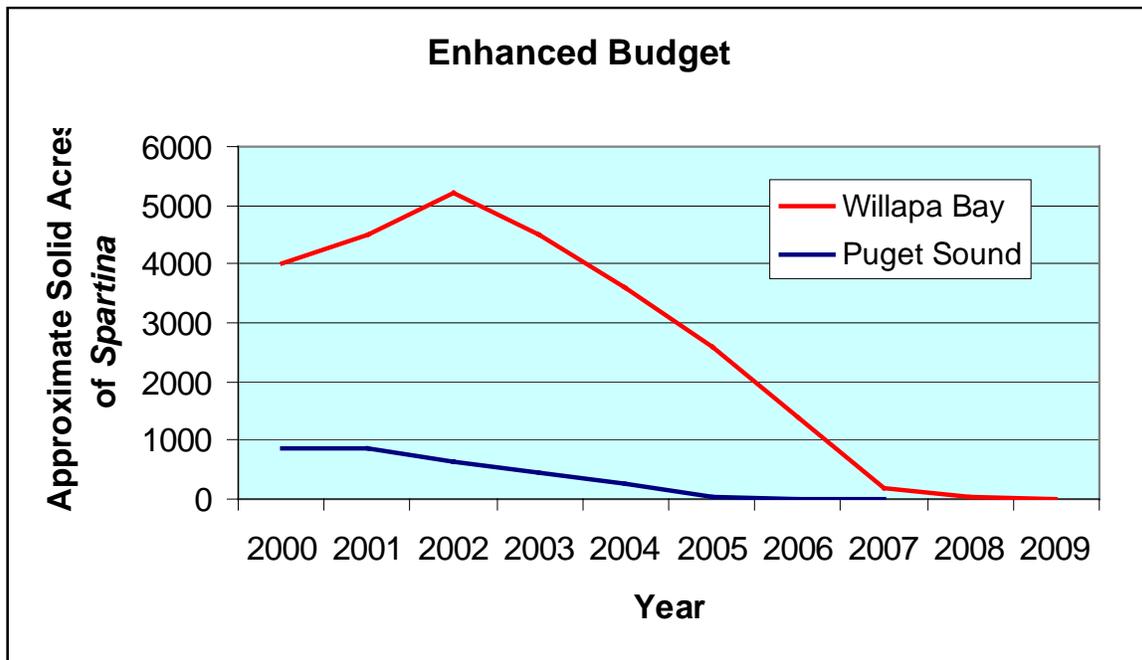
The 2001 legislature appropriated \$2,166,260 to the Washington State Department of Agriculture for *Spartina* control activities for the 2001-03 biennium. This is a substantial funding increase from the previous biennia. Prior to this budget enhancement, WSDA received \$718,000 per biennium for the *Spartina* program. This enhanced budget will allow the agency to eradicate all known infestations of *Spartina* in Puget Sound, Hood Canal, Strait of Juan De Fuca and Grays Harbor over a period of four years and begin the first real reduction in Willapa Bay, eradicating nearly a quarter of the 4,500 plus solid acres of *Spartina* in the first two years. Specifically, the WSDA plan provides funding to:

- Double the previous Interagency Agreement dollar amounts and work plans in Skagit, Island and Snohomish counties.
- Double the previous Interagency Agreement dollar amount and work plan with the Washington State Department of Fish and Wildlife (WDFW) for eradication of the outlying *Spartina* clones in Willapa Bay and Grays Harbor.
- Double the previous Interagency Agreement dollar amount and work plan with the Swinomish Tribal Community for eradication of infestations found on tribal land.

- Purchase, equip, staff and operate two tracked utility vehicles equipped with tandem disk harrow implements to use for cutting *Spartina* root mass and rollers to suppress seed set.
- Contract for large-scale mechanical control of 1,000 acres of solid *Spartina* meadows in Willapa Bay each year.
- Amend the Noxious Emergent Plant Management Final Environmental Impact Statement to include an evaluation of Imazapyr, a herbicide currently being tested on *Spartina*.

Graphs 1 shows WSDA *Spartina* acreage projections for Willapa Bay and Puget Sound with the enhanced budget. These scenarios assume other participating state and federal agencies continue to allocate the same levels of resources for *Spartina* eradication in the future.

Graph 1. Projected solid acres of *Spartina* with enhance budget, Willapa Bay/Puget Sound



NPDES Issues Arise

On March 12, 2001, the Ninth Circuit Court of Appeals filed its decision in *Headwaters, Inc., et al. v Talent Irrigation District*, No. 99-35373. The plaintiffs, two environmental advocacy groups, filed suit against the Talent Irrigation District (TID), located in Oregon, to stop the district's use of an herbicide (Magnacide H, which contains the active ingredient acrolein) in irrigation canals for weed and algae control. The plaintiffs claimed that these treatments could not occur without the defendant first obtaining a permit under the National Pollution Discharge Elimination System (NPDES). The plaintiffs claimed that failure to have an NPDES permit violated the Clean Water Act, which prohibits the discharge of pollutants from a point source into navigable waters of the U.S. unless authorized by an NPDES permit.

The Ninth Circuit found in favor of the plaintiffs and ruled that an NPDES permit was required for the treatment to continue. This decision by the Ninth Circuit Court of Appeals in *Headwaters, Inc. v. Talent Irrigation District*, could be interpreted to require an NPDES permit prior to application of any aquatic pesticide in to the navigable waters of the state.

In response to this decision, WSDA suspended all herbicide applications for control of *Spartina* until the issue was resolved. This resulted in no herbicide use during the 2001 season. WSDA and cooperators continue to work with the Department of Ecology (DOE) to obtain a permit for the 2002-2007 treatment seasons.

Mechanical Control of *Spartina*

The absence of herbicide use in response to the NPDES issues presented an excellent opportunity for the partner agencies to further develop mechanical control tools for *Spartina* control.

During the 2001 *Spartina* control season, state and federal agencies aggressively pursued the treatment of meadows using large-scale mechanical control. WSDA rebuilt the Otter tracked utility vehicle that was purchased at the end of the 2000 treatment season, and purchased a larger used tracked utility vehicle during the middle of the 2001 season. WDFW received surplus tracked utility vehicles from the Bonneville Power Administration and leased several other vehicles for testing purposes. The Department of Natural Resources (DNR) purchased an amphibious tracked vehicle. The United States Fish and Wildlife Service (USFWS) tested a rototilling implement for use with the Quality Machine during the winter of 2001, and purchased a new large scale amphibious machine at the end of summer 2001. All machines focused on large meadows with the goal of suppressing seed production and dispersal and reducing next season regrowth. Several different implements were also tested for usefulness in *Spartina* control, such as tandem disk harrows, rollers and rototillers.

The agencies treated a total of approximately 900 solid acres of *Spartina* during the 2001 season using the various mechanical methods.

Arsenal[®] Research and Registration

Dr. Kim Patten with the Washington State University Long Beach Research and Extension Unit continues to conduct research on new alternative chemical controls for *Spartina*. The focus of this work has been the efficacy, non-target effects, and fate and persistence of Arsenal[®] (imazapyr).

This research has indicated that Arsenal is very effective on *Spartina*. The product has demonstrated good efficacy using low volume application methods. This enables much more cost-effective applications than is currently being experienced with glyphosate (1/4 to 1/3 the cost and 10 to 30 fold increase in acres treatable per day). Arsenal, not federally registered for aquatic uses at this time, is currently going through the aquatic registration process and it may be available for use during the 2003 or 2004 season.

WSDA Activities

In 2001, the WSDA *Spartina* Eradication Program activities included the following:

- working collaboratively with partner agencies to update and distribute six regional *Spartina* Management Plans;
- working cooperatively with partner agencies to compile information requested for the NPDES permit application, and working with DOE to obtain an NPDES permit;
- providing funding through interagency agreements, personal services contracts and direct cost-share to state and local government agencies and private landowners;
- hiring, equipping and coordinating a crew to treat all infestations in Clallam, Jefferson, Kitsap and King counties, assist the Swinomish and Suquamish tribal communities with control work on their property and work cooperatively with the WDFW on infestations in Willapa Bay;
- organizing and facilitating the exchange of *Spartina* eradication information through many regional planning and informational meetings, including presenting an overview of the 2001 mechanical control to the State Noxious Weed Conference;
- continuing to explore with partner agencies more efficient and cost-effective ways to eradicate *Spartina* including developing, staffing and operating several new *Spartina* eradication machines in Willapa Bay; and

Summary of 2001 Statewide *Spartina* Eradication Activities

There are ten counties in western Washington with one or more infestation of *Spartina alterniflora*, *Spartina anglica*, or *Spartina patens*. This includes Clallam, Grays Harbor, Island, Jefferson, King, Kitsap, Pacific, San Juan, Skagit and Snohomish counties. These infestations are equivalent to approximately 5,000 to 5,500 solid acres of *Spartina* (if all populations were one contiguous meadow) and are spread over more than 20,000 acres of intertidal mudflats. All but approximately 10 solid acres are located in Pacific, Snohomish, Island and Skagit counties. In 2001, WSDA, partner state and federal agencies, local governments, tribal entities, commercial landowners and private landowners treated approximately 1,150 solid acres of *Spartina*. Table 1 summarizes the statewide control effort by county and year for the past five years.

Table 1. Acres of *Spartina* Treated in Washington State – 1997 through 2001

County	<i>Spartina</i> Present in 2001	<i>Spartina</i> Treated, 1997 - 2001	Treatment Methods
Pacific (Willapa Bay)	Approx. 4,500 solid acres spread over > 15,000 acres	'97 - approx. 742 solid acres '98 - approx. 450 solid acres '99 - approx. 600 solid acres '00 - approx. 800 solid acres '01 - approx. 900 solid acres	Mow, mow/herbicide, herbicide, seedling removal, mechanically rip 2001 treatment consisted of mechanical and physical control only
Grays Harbor	Scattered clones and seedlings 0.25 acres in size	'97 - all treated '98 - all treated '99 - all treated '00 - all treated '01 - all treated	Mow, mow/herbicide, herbicide, seedling removal 2001 treatment consisted of mechanical and physical control only
Snohomish	Approx. 500 solid acres spread over > 4,500 acres	'97 - approx. 89 solid acres '98 - approx. 126 solid acres '99 - approx. 90 solid acres '00 - 158 solid acres '01 - approx. 75 solid acres	Mow, mow/herbicide, herbicide, seedling removal, dig 2001 treatment consisted of mechanical and physical control only
Island	Approx. 250 solid acres spread over >1,000 acres	'97 - approx. 250 solid acres '98 - approx. 160 solid acres '99 - approx. 155 solid acres '00 - 130 solid acres '01 - approx. 72 solid acres	Mow, mow/herbicide, herbicide, seedling removal 2001 treatment consisted of mechanical and physical control only
Skagit	Approx. 40 solid acres spread over > 2,000 acres	'97 - approx. 91 solid acres '98 - approx. 57 solid acres '99 - all treated '00 - approx. 60 solid acres '01 - approx. 33 solid acres	Mow, mow/herbicide, herbicide, seedling removal, dig 2001 treatment consisted of mechanical and physical control only
Clallam	1 infestation < 0.001 acres in size	'97 - treated twice '98 - treated three times '99 - treated twice '00 - treated three times '01 - treated four times	Mow/herbicide, dig 2001 treatment consisted of mechanical and physical control only
Jefferson	14 infestations – approx. 0.02 solid acres total New infestation found in Port Ludlow	'97 - all treated '98 - all treated twice '99 - all treated twice '00 - all treated twice '01 - all treated three times	Mow, mow/herbicide, dig, seedling removal 2001 treatment consisted of mechanical and physical control only
Kitsap	8 infestations - approx. 1.6 solid acres total	'97 - all but 2 tribal sites '98 - all treated '99 - all treated twice '00 - all treated '01 - all treated	Mow mow/herbicide, dig, seedling removal 2001 treatment consisted of mechanical and physical control only
King	2 infestations – single clones and a few seedlings New infestation found on Maury Island	'97 - monitored '98 – all treated '99 – all treated '00 – all treated twice '01 – all treated twice	Dig 2001 treatment consisted of mechanical and physical control only
San Juan	Re-growth found at one site. 2 other sites clean for four consecutive years	'97 - all treated '98 - all treated '99 - monitored '00 – all treated '01 – all treated	Survey, dig 2001 treatment consisted of mechanical and physical control only

Willapa Bay Status

Due to the issues raised by the TID case out of the Federal Ninth Circuit Court of Appeals, herbicide was not used in Willapa Bay this season. Although this was a major set back, it did present an excellent opportunity for all the agencies to further develop mechanical control of *Spartina*. WSDA, WDFW, DNR and USFWS all operated large-scale mechanical control

equipment. With the exception of small-scale tests done by WSDA on tandem disk harrow use, all mechanical control work was conducted on large meadows with the goal of reducing seed set and dispersal and reducing next season regrowth.

At the beginning of the 2001 season, there were an estimated 4,500 solid acres of *Spartina* spread over 15-16,000 acres in Willapa Bay. State and federal agencies controlled approximately 900 solid acres by mowing, digging, crushing, disking and tilling. Efficacy and acreage killed will be determined after the completion of post treatment monitoring, which will be carried out during the 2002 treatment season. The acres treated in 2001 are slightly more than in previous years, however, the participating agencies anticipate that the acreage killed will be substantially less due to the lack of herbicide use for control.

WSDA has begun working with the Department of General Administration to develop a contract for large-scale mechanical control of *Spartina* in Willapa Bay. WSDA anticipates having a contract out for bid by the end of January 2001. The contract will be for control of 1,000 acres of *Spartina* with 90% eradication per year.

The University of Washington's Olympic Natural Resource Center (ONRC) continues to develop the biological control program. ONRC scientists released approximately 200,000 additional insects during the spring of 2001 and continued to monitor their progress. Insects released during the spring of 2000 successfully over-wintered in Willapa Bay. This is the first step in establishing a viable, self-sustaining biological control.

Grays Harbor Status

Grays Harbor landowners and managers continue to be concerned about potential large-scale invasion of *Spartina* due to the magnitude of the problem in Willapa Bay. Surveys of Grays Harbor in 2001 continued to find small *Spartina* infestations, with the largest being approximately 50 square feet. WDFW treated all known *Spartina* infestations in Grays Harbor in 2001.

Puget Sound and Hood Canal Status

The estimated area of *Spartina* within Puget Sound and Hood Canal in 1997 was approximately 1,000 solid acres spread over more than 8,000 acres. Estimates compiled during the 2001 control season by WSDA and partners indicated the solid acres of *Spartina* had been reduced to approximately 810 or by 20% since 1997. WSDA and partners continued to reduce small outlier infestations and resorted to containing large infestations due to the lack of herbicide use this season. Specific accomplishments by county are summarized below.

Snohomish County

All known *Spartina* infestations within Port Susan were treated and a substantial mowing effort was carried out in Skagit Bay (Snohomish County). Isolated *Spartina* infestations on LeQue Island and along the Stillaguamish River were treated using mechanical means and the Warm Beach region was maintained *Spartina* free.

Island County

Approximately 95% of all known *Spartina* infestations on Whidbey Island were treated and many sites, including Deer Lagoon and Cultus Bay, are being brought close to eradication. In fact, control work conducted at Deer Lagoon and Cultus Bay have resulted in these two areas being identified as high priorities for further restoration projects as part of the WRIA 6 Salmon Recovery Strategy. Also, a large-seed producing meadow located in Livingston Bay (Camano Island) was treated entirely with mechanical means in preparation for next season herbicide applications.

Skagit County

All known *Spartina* infestations in Skagit County excluding a sizeable infestation on Swinomish tribal land, were treated entirely. Many sites are now being maintained free of *Spartina* through surveys and seedling digs.

Clallam, Jefferson, Kitsap, King and San Juan counties

All known *Spartina* infestations within Clallam, Jefferson, Kitsap, King and San Juan counties were treated in 2001. With the exception of tribal lands, all sites are virtually *Spartina* free and can be maintained that way with yearly surveys and seedling digs. Two out of three sites in San Juan County previously infested with *Spartina* are now considered eradicated (four consecutive years without *Spartina*).

***Spartina* Eradication Program**

Introduction

Spartina, commonly known as cordgrass, is a noxious weed that severely disrupts native saltwater ecosystems, alters fish, shellfish and bird habitat, and increases the threat of floods. Three different species of *Spartina* have been introduced to western Washington and all pose essentially the same problems and eradication challenges.

Spartina alterniflora is a species native to the east coast of North America. It was introduced to Willapa Bay in the late 1800's when it was used as packing material for the shipment of east-coast oysters to the Bay. Using acreage increase estimates calculated through the 1994 and 1997 aerial infrared photo sets, WSDA determined there were approximately 4,500 solid acres of *Spartina* spread over more than 15,000 acres of mudflat in Willapa Bay at the beginning of the 2001 season. Figure 9 (*see p. 37*) shows *Spartina alterniflora* invading a mudflat in Willapa Bay. In Puget Sound, *Spartina alterniflora* is known to exist in Skagit County within Padilla Bay, Clallam County within Sequim Bay, and Jefferson County within Thorndyke Bay. It was intentionally introduced by a landowner in Puget Sound during in the 1960's in an attempt to stabilize shorelines. *Spartina alterniflora* has also been discovered at several locations within Grays Harbor and along the lower reaches of the Copalis River.

Spartina patens is present at only one known location in Washington State, Dosewalips State Park in Jefferson County. It was first discovered at this site in the early 1990's and its mode of introduction is not known. During the 2001 control season, WSDA staff found and treated approximately 15 small clumps. Figure 10 (*see p. 37*) shows the largest of the *Spartina patens* clumps found in during the 2000 treatment season.

Spartina anglica is present in Skagit, Snohomish and Island counties. It has also been found in San Juan, King, Kitsap and Jefferson counties. Figure 11 (*see p. 38*) shows *Spartina anglica* colonizing a site in Island County. It was intentionally introduced into Puget Sound in the early 1960's at a farm located on the eastern shore of Port Susan Bay, three miles south of Stanwood, Washington. The purpose of the original introduction was for dike stabilization and potential forage for cattle grazing on the bay. The hybrid vigor of *Spartina anglica* is amazing. An employee from the former Washington State Department of Game first observed *Spartina anglica* in Port Susan prior to 1979. At that time its estimated total area was less than 15 acres. In 1997, there were approximately 1,000 solid acres of *Spartina* spread over more than 8,000 total acres throughout Puget Sound and Hood Canal.

In all, there are ten counties in western Washington with one or more infestations of either *Spartina alterniflora*, *Spartina anglica* or *Spartina patens*. These include Clallam, Grays Harbor, Island, Jefferson, King, Kitsap, Pacific, San Juan, Skagit and Snohomish counties. *Spartina* infestations range from one infestation in Clallam County measuring only a few square feet to more than 4,500 solid acres (if contiguous) spread throughout Willapa Bay in Pacific

County. All totaled, *Spartina* infests approximately 5,000 to 5,500 solid acres spread over more than 20,000 total acres.

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

- 1) Preventing an existing infestation from producing seed;
- 2) Treating an existing infestation for several consecutive years using integrated pest management (methods include mowing, applying herbicides, mechanically ripping and hand pulling or a combination of these methods);
- 3) After successful eradication is achieved, monitoring the area and removing new seedlings to ensure no re-establishment occurs;
- 4) Continuing to survey shorelines, educate the public and follow-up on possible sightings of new infestations.

New Developments and Challenges

Enhanced Budget

As part of the 2000 Report to the Legislature, WSDA recommended for an enhancement of the previous operating budget. This recommendation was presented to the legislature in the form of a budget enhancement proposal. A total of \$1,480,000 was requested in the enhancement package. These additional requested funds were included in the final passage of the 2001-2003 budget. This budget enhancement brings the total biennium budget for the WSDA *Spartina* Program to \$2,166,260.

This enhanced budget expands on the current successful cooperative efforts in Puget Sound and Grays Harbor and brings new mechanized eradication tools to the efforts in Willapa Bay, including a tool with the potential ability to eradicate the larger meadows that are producing the majority of the seed in the Bay.

The WSDA enhanced budget will result in the eradication of all known infestations of *Spartina* in Puget Sound, Hood Canal and Grays Harbor over a period of four years. It will also begin the first real reduction in Willapa Bay, eradicating nearly 25 percent of the 4,500 plus solid acres of *Spartina* in the first two years.

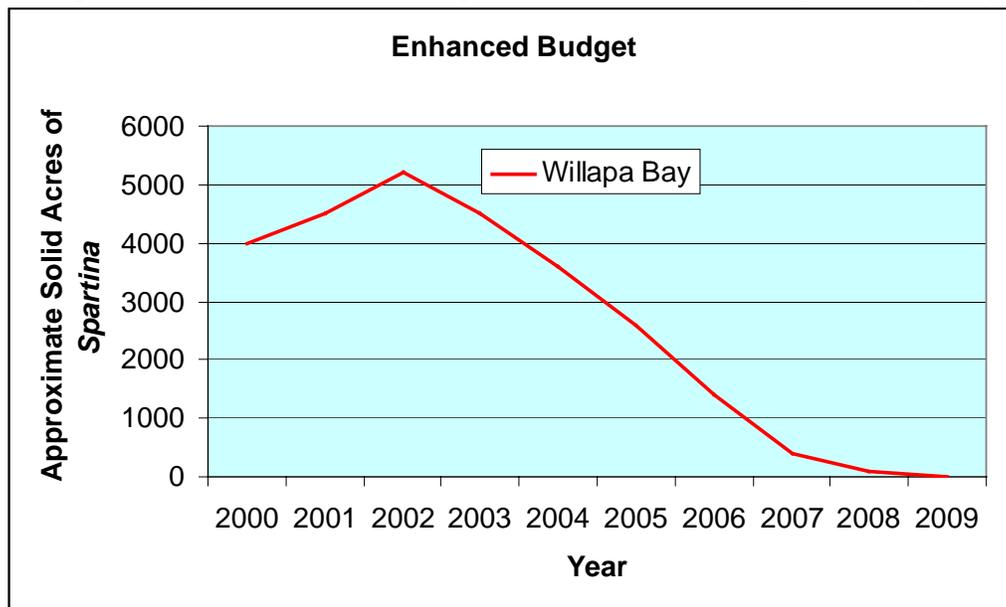
Specifically the budget has allowed WSDA to:

- Double the current Interagency Agreement dollar amounts and work plans in Skagit, Island and Snohomish counties.
- Double the current Interagency Agreement dollar amount and work plan with WDFW for eradication of the outlying *Spartina* clones in Willapa Bay and Grays Harbor.

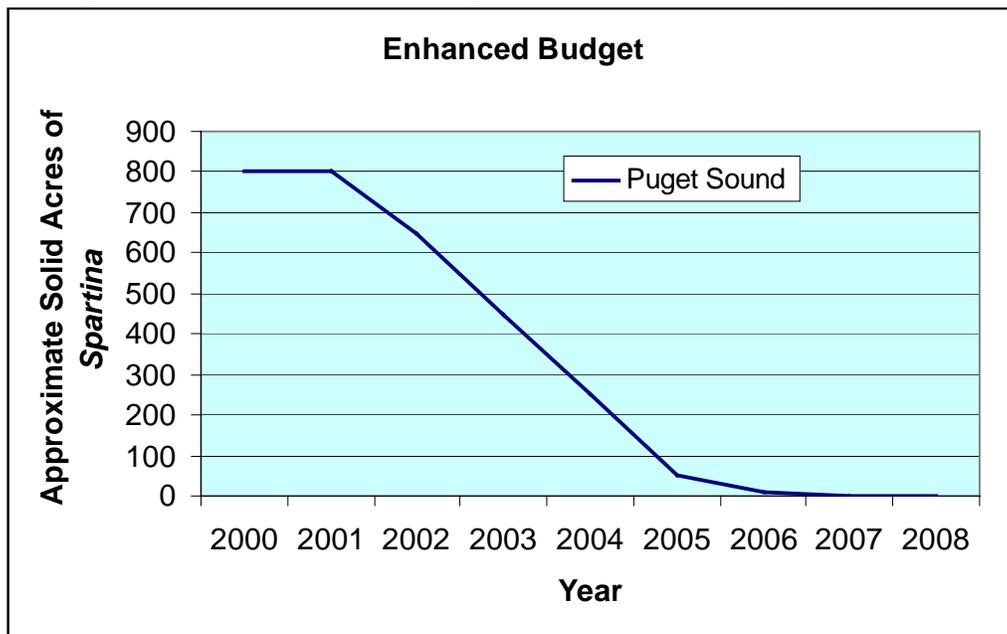
- Double the current Interagency Agreement dollar amount and work plan with the Swinomish Tribal Community for eradication of infestations found on tribal land.
- Purchase, equip, staff and operate two tracked utility vehicles equipped with tandem disk harrow implements to use for cutting *Spartina* root mass and rollers to suppress seed set.
- Hire, equip and support two *Spartina* crew members six months each year for *Spartina* eradication work in Clallam, Jefferson, Kitsap, Mason, Thurston, Pierce and King counties. This crew will also be responsible for survey of Whatcom and San Juan counties and for coordinating treatment of *Spartina* infestations on tribal property in Kitsap County.
- Contract for control of 1,000 acres of solid *Spartina* in meadows in Willapa Bay each year, with a contract performance guarantee of 90% eradication. WSDA is aware of at least one company, based out of Lawrence, Kansas, that is interested in building a large machine modeled after one they currently use to carry out submerged aquatic vegetation management projects for state and federal agencies in Texas, Florida and Vermont.
- Amend the Noxious Emergent Plant Management Final Environmental Impact Statement to include an evaluation of imazapyr, a herbicide currently being tested on *Spartina*.

Graphs 1 and 2 show WSDA *Spartina* acreage projections for Willapa Bay and Puget with the enhanced budget. These scenarios assume other participating state and federal agencies continue to allocate same levels of resources for *Spartina* eradication in the future.

Graph 1. Projected solid acres of *Spartina* with enhanced budget, Willapa Bay



Graph 2. Projected solid acres of *Spartina* with enhance budget, Puget Sound



NPDES Issues Arise

On March 12, 2001, the 9th Circuit Court of Appeals filed its decision in *Headwaters, Inc., et al. v Talent Irrigation District*, No. 99-35373.

The plaintiffs, two environmental advocacy groups, filed suit against the Talent Irrigation District (TID), located in Oregon, to stop the district's use of an herbicide (Magnacide H, which contains the active ingredient acrolein) in irrigation canals for weed and algae control. The plaintiffs claimed that these treatments could not occur without the defendant first obtaining a permit under the National Pollution Discharge Elimination System (NPDES). The plaintiffs claimed that failure to have an NPDES permit violated the Clean Water Act, which prohibits the discharge of pollutants from a point source into navigable waters of the U.S. unless authorized by an NPDES permit.

The 9th Circuit found in favor of the plaintiffs and ruled that an NPDES permit was required for the treatment to continue. This decision by the Ninth Circuit Court of Appeals in the TID case could be interpreted to require an NPDES permit prior to application of any aquatic pesticide into the navigable waters of the state.

In response to this decision, WSDA suspended all herbicide applications for control of *Spartina* until the issue was resolved. This resulted in the partner agencies not using herbicides to control *Spartina* during the 2001 season.

The Statewide *Spartina* Program Coordinator spent a large amount of time during the 2001 season working with the Department of Ecology (DOE) to ensure that the control program would not have to forgo the use of herbicide for another year. Through several meetings with WSDA and other partner state and county entities, DOE identified the information and data needs

required to apply for an NPDES permit. WSDA compiled the information and data in collaboration with the statewide *Spartina* Taskforce.

WSDA and the *Spartina* Taskforce continue to be involved in the permit development process. DOE held several advisory meetings for the purpose of identifying concerns of the various affected groups. DOE staff have stated they anticipate issuing a permit by the end of May or the beginning of June 2002.

Mechanical Control of *Spartina*

Spartina infestations throughout Willapa Bay have been expanding substantially in past years primarily due to the difficulty in controlling large meadows. Past work by WSDA and USFWS has demonstrated that technology is available to mow these large infestations. However, mowing alone does not eradicate *Spartina*. In order to achieve eradication, the mowed out areas must be treated with additional methods, which may include herbicide applications and digging of small isolated plants, at a cost of approximately \$1,500 to eradicate one solid acre of *Spartina*.

WSDA and its partners learned a key lesson from the past amphibious mowing machine projects – disrupting the root mass of *Spartina* effectively kills it. A local Willapa Bay clam farmer and crab fisherman, Mr. Ernie Soule, demonstrated this concept on a small scale. Mr. Soule effectively used a home-built ripping implement mounted to a tractor to rip and cut the roots of *Spartina* and kill it. Mr. Soule's major limitation was lack of traction with his wheeled tractor. Learning from Mr. Soule's experience, WSDA pursued the mechanical eradication of *Spartina*.

During the fall of 2000 and winter of 2001, WSDA purchased, tested and improved a small tracked utility vehicle called the Otter Remote Access Tracked Vehicle (Otter). WSDA operated the machine for approximately 30 hours, treating 5 acres. Through this trial operation period it was identified that the machine needed substantial improvements to accomplish the desired results. During the winter of 2001, WSDA worked with Applied Industrial Technologies out of Longview, Washington and Bay Machine Shop in Nachotta, Washington to completely re-fabricate the Otter. This work resulted in a machine with a larger, more powerful engine, a more reliable hydrostatic drive system and a stronger frame.

Another lesson learned through test runs of the Otter was that a disking implement could be used to gain the same, if not better, results than a sub-soiling implement. A disk harrow exerts much less stress on the machine, resulting in fewer breakdowns and problems. Figure 12 (page 38) shows the WSDA Otter pulling a disk harrow through an infestation in Willapa Bay.

With the decision to not use herbicide during the 2001 season, the agencies took what was learned through the development of the Otter and previous work done by the USFWS Quality machine and pursued large-scale mechanical tools for control of *Spartina*.

WDFW made one of the best discoveries for mechanical control during the 2001 season. Les Holcomb with WDFW worked with Bonneville Power Administration (BPA) to acquire a tracked utility vehicle called a Bombardier. WDFW received the machine from BPA through a no cost surplus donation. WDFW used this machine to crush large meadows, preventing seed set

and dispersal. Figures 13 and 14 (page 39) show the Bombardier mechanically treating a large meadow in north Willapa Bay. WDFW received a second Bombardier from BPA in the fall of 2001.

Following the lead of WDFW and its work with the Bombardier, WSDA purchased a similar machine in August of 2001. This machine, known as an LMC 1800, is based on the same design as the Bombardier. The WSDA LMC was also used to crush infestations, as well as pull a tandem disk harrow, with the purpose of damaging root structure and causing additional stress and mortality. Figures 15 and 16 (page 40) show the LMC crushing infestations in Oysterville, Washington.

DNR also pursued large-scale mechanical control during the 2001 season. DNR leased a Marsh Master 1 in July of 2001. This is a smaller version of the Marsh Master 2 that was used by WSDA during the 1998 season. This machine was used to crush infestations throughout the Bay, resulting in the prevention of seed set and dispersal in those areas. DNR purchased the machine at the end of October 2001 and will continue to operate it throughout the fall of 2001 and winter 2002. Figure 17 (page 41) shows an area that had been crushed previously by the Marsh Master 1.

The USFWS also continues to be a lead in the development of large-scale mechanical control tools. During the winter of 2001 the USFWS tested a rototilling implement for its Quality Machine. This implement is similar but substantially larger than a rototiller used in gardening. With this implement the USFWS was able to control approximately 80 solid acres in the Porters Point area. Preliminary results indicate that this control work resulted in approximately 80% reduction of the infestation in the treatment area.

Improving on this newly tested method of control, the USFWS purchased a new larger amphibious machine and rototilling head at the end of the 2001 season. This machine, known as the Wilco, will be used throughout the fall of 2001 and winter of 2002.

All the partner agencies continue to test new methods and implements for mechanical control. This is not only a response to the herbicide unavailability during the 2001 season but also an effort to extend the treatment season. The goal is to find mechanical tools that can be used during the fall and winter months when the *Spartina* has gone dormant and the above ground biomass is no longer a barrier to successful treatment. Continued work with large-scale mechanical tools shows promise and is likely to bring the agencies closer to eradicating *Spartina* from Willapa Bay.

Arsenal[®] Research and Registration

Dr. Kim Patten with the Washington State University Long Beach Research and Extension Unit continues to conduct research on new alternative chemical controls of *Spartina*. The focus of this work has been the efficacy, nontarget effects, and fate and persistence of Arsenal[®] (imazapyr).

Preliminary research showed that *Spartina* control with imazapyr consistently produced better efficacy than control with glyphosate. Favorable control of *Spartina* with imazapyr was

achieved during every application period (July to October), but response to July applications was more variable. There were occasions, however, when imazapyr applications failed to provide control. It is unclear from these studies what the causative factors leading to poor performance of imazapyr are. Adequate dry time, however, seems to be imperative for good efficacy.

Application areas with *Spartina* in the upper salt marsh, which had more than 24 hours dry time, produced consistently excellent control, whereas applications to *Spartina* in lower tidal zones, which had less than 4-6 hours dry time, did not always have excellent control.

Previous WSU research indicated imazapyr had no effect on the native eelgrass. Imazapyr, however, will kill Japanese eelgrass when it is applied to sites where the eelgrass canopy has good drying conditions. Sites which retained a film of water on them were unaffected by imazapyr applications. Locations where Japanese eelgrass was killed by imazapyr were fully recovered and had a complete canopy cover by the end of the following growing season according to WSU research. There was no residual effect of imazapyr on the establishment of *Salicornia*. Within one year of application, plot areas where *Spartina* was controlled by imazapyr were infested by *Salicornia*; areas not controlled (check plots or glyphosate treatments) had no *Salicornia*. Based on the seawater challenge tests, acute exposure of imazapyr in concentration from 50 to 1,600 μ g/l had no effect on the osmoregulatory capabilities of Chinook salmon smolts. Samples for fate and persistence have been collected, and are pending analysis. That data will be completed by early 2002.

In summary, imazapyr could be a very cost-effective control tool for *Spartina*. It provides good efficacy when applied at low-spray volumes and has a very good environmental risk profile. As a control method, it would allow hundreds of acres to be controlled in a week, compared to the hundred of acres we currently control in a year. EPA has the aquatic use of imazapyr in its 2002 review plan. Consequently, pending an expedited Supplemental EIS review, it may be possible to have a 24C registration of imazapyr for *Spartina* control by 2003 or 2004.

Basic Program Components

Chapter 255, Laws of 1995 designated WSDA as the lead state agency for the eradication of *Spartina*. As lead agency, WSDA has coordinated the development of strategies and management plans for eradicating *Spartina*, streamlined regulatory process requirements by obtaining “umbrella” water quality permits, provided resources to state and local government and private landowners, and explored with its partners more efficient and cost-effective ways to eradicate *Spartina*.

The WSDA *Spartina* program has several basic components including budget, county activities, cost share activities, water quality permits and management plans. These components are detailed in this section of the report.

Budget

WSDA allocated \$2,166,260 of its appropriation from the Aquatic Lands Enhancement Account (ALEA) for *Spartina* activities this biennium. Table 2 illustrates how WSDA is using these funds. The table shows projected expenditures for FY02 and FY03.

Table 2. Budget Activity by Area – FY02 and FY03
 (\$2,166,260 total - \$ in thousands)

Activity	Puget Sound/Oly. Peninsula		Willapa Bay		Total	
	FY02	FY03	FY02	FY03	FY02	FY03
¹ WSDA Coordination and control activities	\$179,065	\$179,065	\$179,065	\$179,065	\$358,130	\$358,130
² Arsenal Evaluation	\$50	0	\$50	0	\$100	0
³ Large-scale Mechanical Control	\$45	\$45	\$400	\$400	\$445	\$445
⁴ Purchased Services					\$220	\$220
- Skagit	\$40	\$40				
- Island	\$50	\$50				
- Snohomish	\$50	\$50				
- Swinomish Tribe	\$10	\$10				
-WDFW (Pacific County)			\$60	\$60		
- Other	\$5	\$5	\$5	\$5		
⁵ Direct Cost Share	\$5	\$5	\$5	\$5	\$10	\$10
TOTAL	\$434,065	\$384,065	\$699,065	\$649,065	\$1,133,130	1,033,130

Notes for Table 2:

1. WSDA Coordination and Control Activities: These expenses include agency administrative expenses, salaries,
2. A second herbicide option is important to achieving *Spartina* control. Because the herbicide imazapyr is not addressed in the current Environmental Impact Statement, funding is dedicated toward developing a Supplemental EIS.
3. Large-scale mechanical control will involve contracting for the elimination of *Spartina* on 1000 acres of Willapa Bay tidelands.
4. Purchased Services: WSDA wrote two-year contracts this biennium for county work crews in Skagit, Island and Snohomish counties. WSDA also wrote Interagency Agreements for the WDFW to conduct work in Pacific County and for the Swinomish Tribal Community to conduct work on their property in Skagit County.
5. Direct Cost Share: These amounts include only payments to landowners as reimbursement for equipment/supplies.

County Activities

In 2001, WSDA continued to allocate funding, labor and equipment for *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 the WDFW in Pacific County. WSDA staff conducted field audits throughout the control season and facilitated coordination meetings periodically to assure contract priorities were being adequately addressed.

Cost Share Program

As directed by RCW 17.26.007, WSDA offered limited financial assistance to private landowners for *Spartina* control and eradication in 2001. However, due to the issues raised by the TID case and WSDA's decision not to use chemical control tools during the 2001 season, no financial assistance was requested. WSDA anticipates that financial assistance to landowners will be requested again in during the 2002 season if chemical control is in use again. Table 3 describes how WSDA will provide this assistance.

Table 3. WSDA Cost Share Options

Eradication/Control Method	WSDA Contribution	Landowner Contribution
County work crews mow and/or apply herbicide	WSDA grants county funds to treat priority areas in '00 control season	Must treat once in '02 season or agree to pay herbicide expenses
Direct cost share - Landowner applies herbicide	100% of herbicide and adjuvant	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

Because private landowners most often request the services of the county work crews, WSDA allocates the majority of cost share funding for this option (through interagency agreements). However, during the 2000 season WSDA provided approximately \$6,000 in direct cost share to landowners in Willapa Bay and plans on providing approximately \$10,000 of assistance for direct cost share during the 2002 season. No assistance was requested during the 2001 season because herbicide use was not an option.

Water Quality Permits

Due to the issues raised by the TID case, DOE plans to combine its existing Short Term Water Quality Modification permitting program and the NPDES permitting process into one program.

WSDA continues to work with DOE to obtain an NPDES permit for control of *Spartina*. DOE has indicated to WSDA that the permits should be completed and issued by the end of May or the beginning of June 2002.

Management Plans

In the winter and spring of 2001, WSDA staff worked with the county noxious weed control board coordinators, staff from the WDFW, DNR, USFWS, tribal communities, and private landowners, to prepare six regional *Spartina* management plans. These management plans are developed for North Puget Sound, South Puget Sound, Hood Canal, Strait of Juan de Fuca,

Grays Harbor and Willapa Bay. The management plans provide information on the effects of *Spartina* to the intertidal ecology of these areas, describe previous control efforts/results, and outline the control strategy for the coming year. Copies of 2001 plans are available by contacting the WSDA Statewide *Spartina* Eradication Program Coordinator. WSDA will update all management plans prior to the 2002 control season.

Program Results by Geographic Area

Willapa Bay

This waterbody 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

There are different ways to measure and quantify the *Spartina* infestation in Willapa Bay. The first step in analyzing the extent of infestation is to calculate the solid acres of *Spartina*. DNR created Geographical Information System (GIS) layers for these calculations using color infrared aerial photography. This mapping method accounts for *Spartina* patches larger than three feet in diameter. Seedlings and one to two-year-old clones are not included in these numbers. Using these maps, DNR determined that in 1994 there were approximately 2,025 solid acres of *Spartina* (if contiguous) and 3,250 in 1997. This indicates a 17% increase in solid *Spartina* throughout Willapa Bay per year.

The next step is to calculate the affected acres of *Spartina*. Ongoing analysis is being conducted by DNR to arrive at this figure. This will be accomplished by taking the solid acreage figures and essentially adding the space between those infestations. Field observations will also be used in this analysis to help compensate for the undetectable patches of *Spartina* (smaller than three feet in diameter). Past inventory efforts and expert estimations indicate that the affected acres for the 1997 *Spartina* infestation are thought to be on the order of 12,000 to 15,000 acres. Willapa Bay contains approximately 47,000 acres of intertidal mud flats. Using the numbers for 1997, an estimated 25%-32% of the Willapa Bay intertidal area was infested with some level of *Spartina*.

DNR took infrared aerial photographs of the Willapa Bay region in September 2000 and acreage calculations from these photos have not yet been made available. However, based on the growth rate calculated using the 1994 and 1997 aerial photos and the estimated reductions resulting from the 2000 treatment season, resource managers estimate that at the beginning of the 2001 treatment season there were more than 4,500 solid acres of *Spartina* present in Willapa Bay

Roles and Responsibilities of Participating State and Federal Agencies in 2001

In 2001, the participating agencies pursued the use of various medium and large scale mechanical control tools and conducted other activities. The following list outlines the role each agency played in Willapa Bay during the 2001 control season.

- **WSDA** – Worked with Ecology to identify NPDES permit information needs, completed NPDES permit application, provided funding to WDFW, conducted pre-eradication activities with WDFW crews on private land on the Long Beach peninsula, purchased a used tracked utility vehicle for control work and continued operating the Otter tracked utility vehicle.
- **DNR** – Leased and operated a Marsh Master I amphibious machine, conducted control work on Natural Area Preserves and maintenance sites, managed the infrared aerial photography and mapping program, developed and implemented a *Spartina* control monitoring program and supported the scientific research of *Spartina* being carried out by the University of California at Davis.
- **WDFW** – Received two surplus tracked utility vehicles from BPA, participated in control operations in north Bay and at maintenance sites, conducted control work with WSDA on private property on the Long Beach peninsula and supported the biological control research program.
- **USFWS** – Operated the Quality Machine (an amphibious flail mower), provided a base of operations for participating agencies, began working with a rototilling implement for the Quality Machine, purchased a new large scale amphibious machine known as the Wilco machine.

2001 *Spartina* Control Monitoring Program, Willapa Bay

During the 2001 field season, the *Spartina* control monitoring program was implemented. The purpose of monitoring our *Spartina* control efforts is to determine if we are accomplishing our goals. The collection of long-term monitoring data will contribute to control efforts by providing a quantitative evaluation of how effectively we are eradicating *Spartina* and restoring the native mudflat conditions in Willapa Bay.

Monitoring data will be used to assess how well we are meeting our management goal, the effectiveness of current control methods, and the natural recovery of eelgrass and native salt marsh species.

Monitoring sites were selected in areas where chemical or mechanical control has been conducted for at least one year. Additional sites were selected where (1) *Spartina* has not invaded in the upper marsh and (2) *Spartina* control has not been conducted, which will serve as a reference for comparison to the control sites. To date, the treatment sites include the following:

- Willapa River meadow, treated by the WDFW Bombardier in 2001.
- Smith Creek clone field, treated with herbicide by WDFW in 1999 and 2000.
- Oysterville, mowed by WSDA in 2001.
- Oysterville, treated by the WDFW Bombardier in 2001.
- O'Meara Cove and Stanley Point, treated by DNR Marsh Master 1 in 2001.
- South Bay, rototilled by USFWS in the spring of 2001.

Following site selection, a pilot study was conducted to determine the appropriate number of quadrats to sample per site, as well as the most efficient quadrat size. Using variance calculated from the pilot sampling effort, a sample-size power analysis was conducted to determine the number of samples needed to obtain 90 percent statistical power. Once the statistically appropriate number of samples was determined, four transects were randomly-located in each of sites, and quadrats were systematically sampled along them. Within a quadrat, the number of *Spartina* stems, percentage of the stems in flower, and percent cover of eelgrass were recorded.

Preliminary data analysis will be conducted in the winter 2001-2. Data collection will continue during the 2002 field season.

Highlights of the 2001 Season in Willapa Bay

Since herbicide use was unavailable during the 2001 treatment season, the agencies changed the focus of control. In past treatment season the agencies followed a plan based on prioritizing specific geographic areas for control. The bay wide infestation was broken into different categories. The categories were as follows:

- I. Maintenance Sites: These are sites at which past control work has substantially reduced the infestation to a relatively “*Spartina* free” state, or the site lacked any sizable infestation. The goal at these sites is to maintain the relative *Spartina* free state.
- II. Primary Sites: At primary sites, 100% of the *Spartina* populations are targeted for treatment. The main goal being to substantially reduce the size of the infestation and eventually be upgraded to a maintenance site.
- III. Secondary Sites: Secondary sites were designated for control of seed set and included measures to reduce and contain growth such as large-scale mowing with the amphibious mower. The locations of these sites were typically near and of direct impact to the primary sites and/or maintenance sites. The goal for secondary sites was to suppress seed set in order to avoid re-infestation of adjacent sites. This work was also done to prepare these areas for future upgrade to primary site status.
- IV. Tertiary Site: These sites are located where control had been conducted in the past and where continued control was warranted because of ecological significance, financial investment and public support.
- V. WSDA/Private Landowner Cost-Share Sites: The WSDA Cost-Share Program allows private landowners to actively participate in *Spartina* control with financial/resource assistance from WSDA, WDFW and/or DNR. To get the most benefit from limited resources, the agencies focused assistance on the Long Beach Peninsula in Willapa Bay.

During the 2001 treatment season, the focus changed from the above prioritization strategy to one based primarily on the ability to access sites easily with large tracked utility vehicles and areas where substrate allowed the vehicles to successfully maneuver around without getting

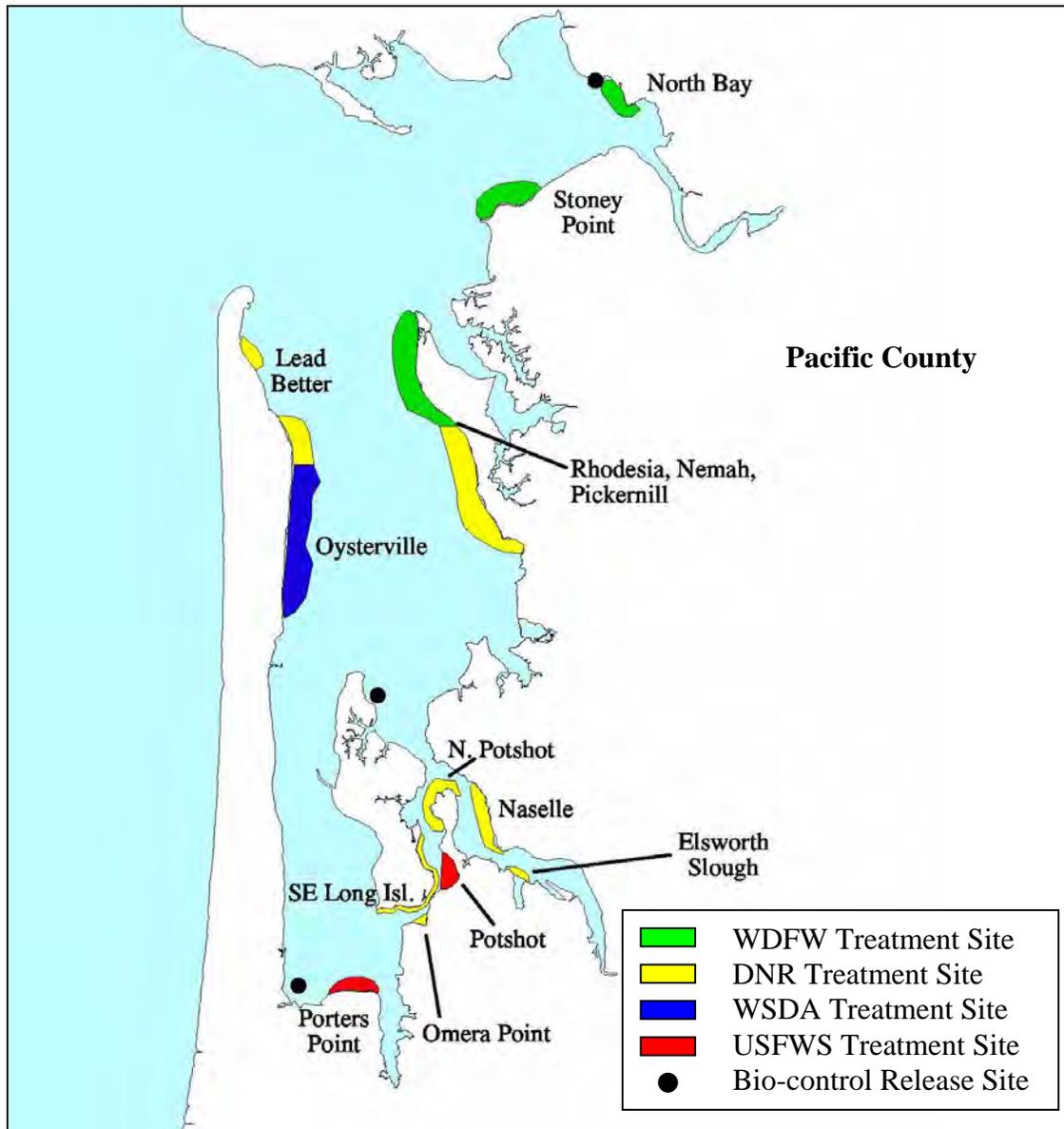
stuck. Although the strategy had to change, control work was conducted mainly at existing primary, secondary and cost share sites.

In 2001, the cooperative *Spartina* eradication effort in Willapa Bay resulted in treatment of approximately 900 solid acres of *Spartina*, or about 20% of the overall infestation. Table 5 shows what areas of the Bay were treated, who conducted treatment and what kind of treatment was done at all sites. Figure 1 shows the approximate locations of all treatment sites.

Table 5. Summary of 2001 Willapa Bay *Spartina* Eradication Effort

Site	Solid Acreage Treated	Entity Conducting Treatment	Treatment Method Used
Maintenance Sites			
Nemah Public Beach	1.5	WDFW	Dig
Rhodesia Beach	1.5	DNR	Dig
Primary Sites			
O'meara	14	DNR	MM I Crush
Pot Shot	20	USFWS	Quality Mow
Porters Point	600	USFWS	Quality Mow, rototill
North Bay	45	WDFW	Bombardier Crush
Secondary Sites			
SE Long Island	2	DNR	Dig
North Pot Shot	80	DNR	MM I Crush
Tertiary Sites			
Leadbetter Point	13	DNR	MM I Crush
Stoney Point	20	WDFW	Bombardier Crush
Elsworth	18	DNR	MM I Crush
Naselle	25	DNR	MM I Crush
Cost Share			
Long Beach Peninsula (Oysterville)	60	WSDA, WDFW, DNR	Crush, Mow, Disk, Dig
Total	903		

Fig. 1. Approximate Location of 2001 Interagency Willapa Bay Treatment Sites



Despite the increase in total *Spartina* within Willapa Bay and the lack of herbicide use during the 2001 season, substantial acreage was treated and seed set and dispersal are reduced. Figures 19, 20, 21, and 22 (*see p. 42-45*) are infrared aerial photos of four areas mechanically treated during the 2001 season. WSDA expects significantly more acreage will be treated in 2002 than any previous year due to the addition of large scale mechanical control and the anticipated resumption of herbicide applications.

The biological control program continued to grow during the 2001 season. Scientists with the University of Washington Olympic Natural Resource Center (ONRC) released an additional 200,000 insects (planthoppers) at the three original release sites within the bay. These sites included Smith Creek, Tarlatt Slough and Lewis Slough, *see map 2* for approximate release

locations. In addition to releasing more insects, field surveys indicate that approximately 2 million were laid throughout the three sites and that within the release cages, plant damage from the bio control agent is beginning to show. The release sites all consist of large infestations that are currently a low priority for other control tools, therefore presenting a perfect area for the development and unhindered expansion of released populations.

If funding remains at the same level in 2002, and herbicide is an option, the agencies will be able to greatly increase the amount of acreage treated and killed and begin to reduce the overall size of the infestation in Willapa Bay.

Grays Harbor

This waterbody includes the mouth of Grays Harbor, Grays Harbor, all the rivers, creeks and streams that run into Grays Harbor and the Copalis River drainage. Figure 2 show the approximate locations of the 2001 treatment sites in Grays Harbor.

Fig. 2. Approximate Locations of WDFW Grays Harbor Treatment Sites in 2001



Extent of the Infestation in Grays Harbor

Property managers and landowners in Grays Harbor have been concerned about the potential invasion of *Spartina* due to the magnitude of the problem in neighboring Willapa Bay. This threat was originally validated when one large *Spartina* clone was discovered in Grays Harbor in 1992 by DNR staff. This was the only known infestation at the time in Grays Harbor and DNR mowed it repeatedly throughout the growing season.

Beginning in 1995, WDFW began conducting yearly surveys and control work in Grays Harbor. At the beginning of the 1995 season there was approximately 2 solid acres of know *Spartina* within the Grays Harbor management area. During each past treatment season, WDFW has treated all know *Spartina* infestations in Grays Harbor and surveyed for new infestations.

In 2001, WDFW, WSDA and DNR put strong emphasis on preventing *Spartina* establishment in Grays Harbor. Specifically, the majority of known infestations were treated by the end of the 2001 season. Surveys conducted at the end of the 2001 turned up a few small infestations that will be treated during the 2002 season. Due to inclement weather conditions during the end of October, an extensive aerial survey was not conducted. However, an aerial survey will be conducted at the beginning of the 2002 treatment season. The total acreage treated mechanically and physically in Grays Harbor in 2001 was approximately 0.25 acres.

Puget Sound and Hood Canal

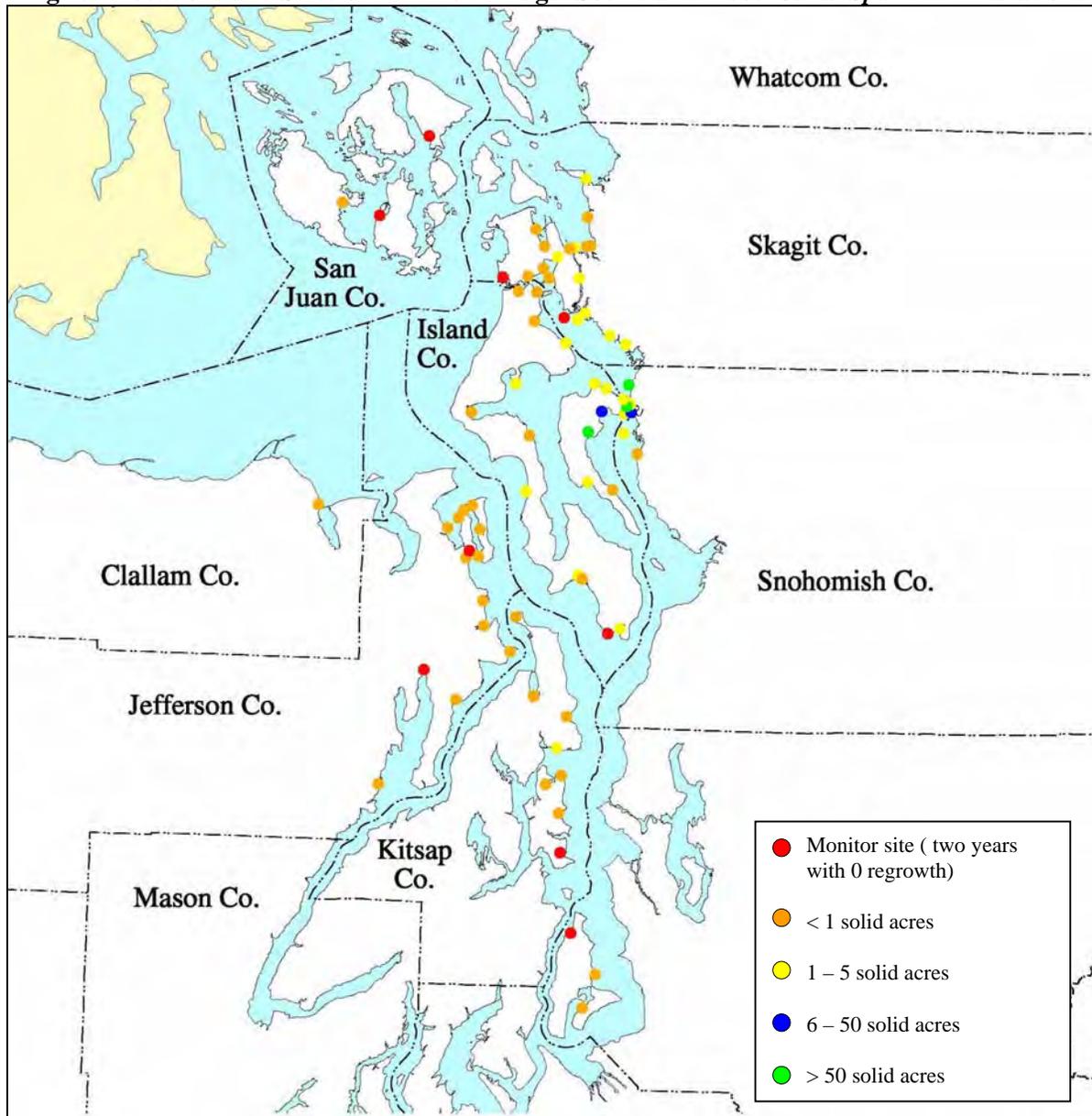
For purposes of the WSDA *Spartina* Program, Puget Sound and Hood Canal refers to San Juan, Skagit, Island, Snohomish, Clallam, Jefferson, Kitsap and King counties. Figure 3 shows approximate locations and sizes of all known *Spartina* infestations in Puget Sound and Hood Canal. Figure 3 also shows locations of monitor sites, which are defined as sites of previous infestation with at least two consecutive years of no regrowth.

Extent of the Infestation in Puget Sound and Hood Canal

In 1997 and 1999, WSDA and its partners completed two surveys to quantify the extent of *Spartina* colonization within Puget Sound. Two measurements were made to characterize the infestation. The first measurement estimated the total affected area or the area in which *Spartina* had invaded but not yet become one contiguous meadow. The second measurement was the solid area or actual abundance of *Spartina* if it were isolated in monoculture.

WDFW took infrared aerial photographs of known Puget Sound *Spartina* infestations at a 1:6,000 scale in August 1997. From these color photos, WDFW ocularly measured the *Spartina* with a hand lens and ruler. Patches smaller than three feet in diameter were not discernible in the photographs. WDFW calculated both the affected and solid area of *Spartina* at each site. WDFW then conducted field reconnaissance to ground verify the data. WSDA, WDFW, and Snohomish, Island, and Skagit County Noxious Weed Board crews manually measured infestations not photographed.

Fig. 3. Locations and Sizes of All Known Puget Sound and Hood Canal *Spartina* Infestations



In the summer of 1999, WSDA, WDFW and the Snohomish, Island and Skagit County Noxious Weed Board crews conducted field audits of all sites including some new sites discovered since 1997. Solid *Spartina* acres were estimated by comparing the infrared photos taken in 1997 with the amount of *Spartina* present at the site in 1999 and by measuring new infestations.

The estimated area of *Spartina* within Puget Sound and Hood Canal in 1997 was approximately 1,000 solid acres, spread over approximately 8,000 acres. At the beginning of the 1999 control season, there were an estimated 900 solid acres within Puget Sound and Hood Canal. This

amounts to a 10% decrease in the overall *Spartina* population in Puget Sound and Hood Canal from 1997 to 1999.

During the 2001 treatment season, WSDA, WDFW, and Skagit, Island and Snohomish County Noxious Weed Board crews conducted a field audit again to determine the extent of the infestation. Audit results indicate the size of the Puget Sound and Hood Canal infestation at approximately 800 solid acres, an 11% decrease from 1999.

Summary of the 2001 *Spartina* Eradication Effort in Puget Sound and Hood Canal

Snohomish County

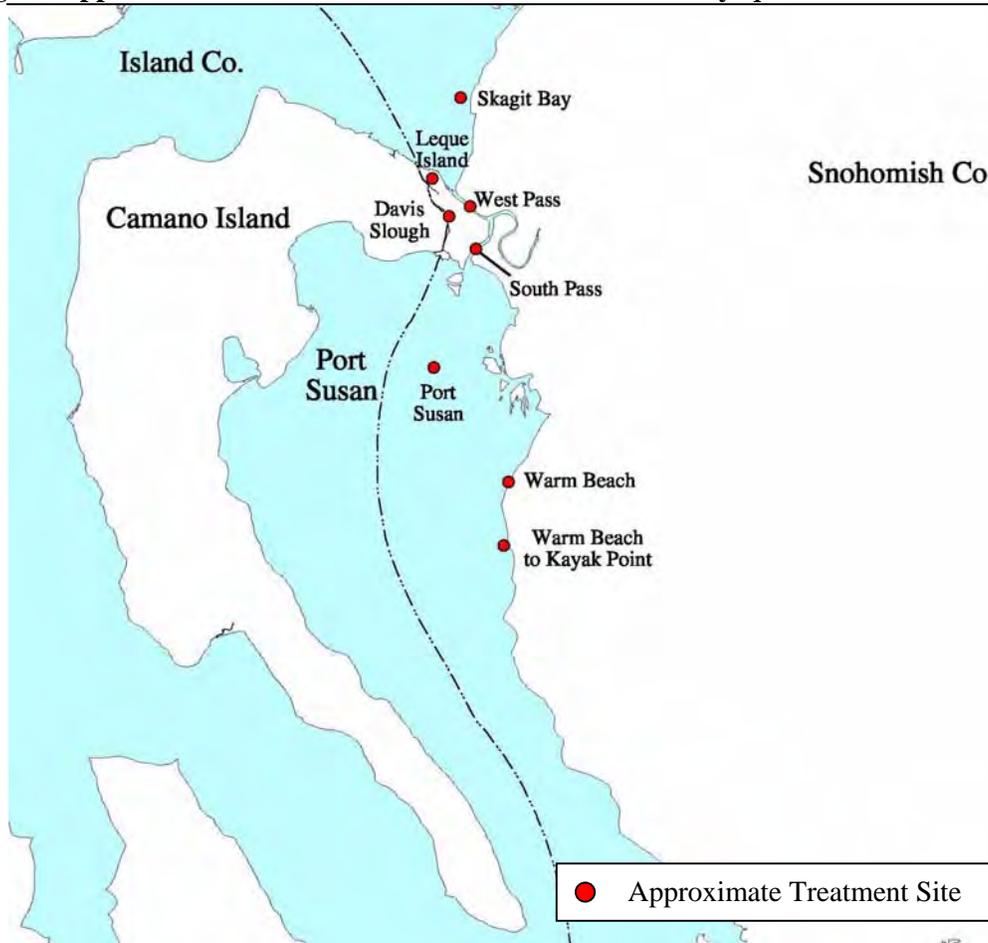
WSDA provided \$50,000 to the Snohomish County Noxious Weed Control Board (SC) for *Spartina* eradication activities in 2001. WDFW also conducted a substantial amount of control work in Snohomish County during the 2001 season.

In total, 74.5 solid acres of *Spartina* were treated in Snohomish County in 2001. Table 6 shows the solid acres treated, who did the treatment, and the treatment methods used on every site in Snohomish County. Figure 4 shows the approximate location of the infestations.

Table 6. Summary of 2001 *Spartina* Eradication Effort in Snohomish County

Site	Solid Acreage treated	Entity Conducting Treatment	Treatment Method used
Port Susan	5	SC	Mow
Skagit Bay	26	SC	Mow
Davis Slough	2.5	WDFW	Mow
LeQue Island	19	WDFW	Mow, Crush
Warm Beach	0	SC	Mow, Dig
West Pass	4	SC	Mow
Kayak Point to Warm Beach	0.0001	SC	Mow,Dig
South Pass	18	SC	Mow
Total Solid Acres Treated	74.5		

Fig. 4. Approximate Locations of all 2001 Snohomish County *Spartina* Treatment Sites



All known *Spartina* infestations within Port Susan were treated. This treatment totaled about 5 solid acres, however, this 5 acres was scattered throughout the entire 1,815 acre bay, thus protecting the entire 1,815 acres from infestation. Also, approximately 26 acres of the largest infestation in Puget Sound (south Skagit Bay) were mowed in preparation for herbicide applications in 2002. Isolated *Spartina* infestations on LeQue Island and along the Stillaguamish River were also mechanically controlled by WDFW using two tracked utility vehicles, and the Warm Beach region was maintained *Spartina*-free by SC.

Although the enhanced budget allowed WSDA to double the interagency agreement dollar amounts for SC, inability to utilize herbicide as a control tool prevented large-scale *Spartina* acreage reductions in Snohomish County during the 2001 season. Snohomish County was unable to treat large acreages in south Skagit Bay to reduce seed set and infestation size. This setback will most likely result in losses in the progress made in earlier years in south Skagit Bay.

Island County

WSDA provided \$50,000 to the Island County Noxious Weed Control Board (IC) for *Spartina* eradication activities in 2001. IC sub-contracted the majority of *Spartina* eradication work to a

private contractor, Wildlands Management (WM). In addition, WDFW conducted a large amount of control work in Island County during the 2001 season. Residents of the Skatchet Head community (SH), located on southern Whidbey Island, also contributed labor during community-organized cooperative *Spartina* digs within Cultus Bay.

In total, 72 solid acres of *Spartina* were treated in Island County in 2001. Table 7 shows the solid acres treated, who did the treatment and the treatment methods used. Figure 5 shows the approximate locations of the treatment sites.

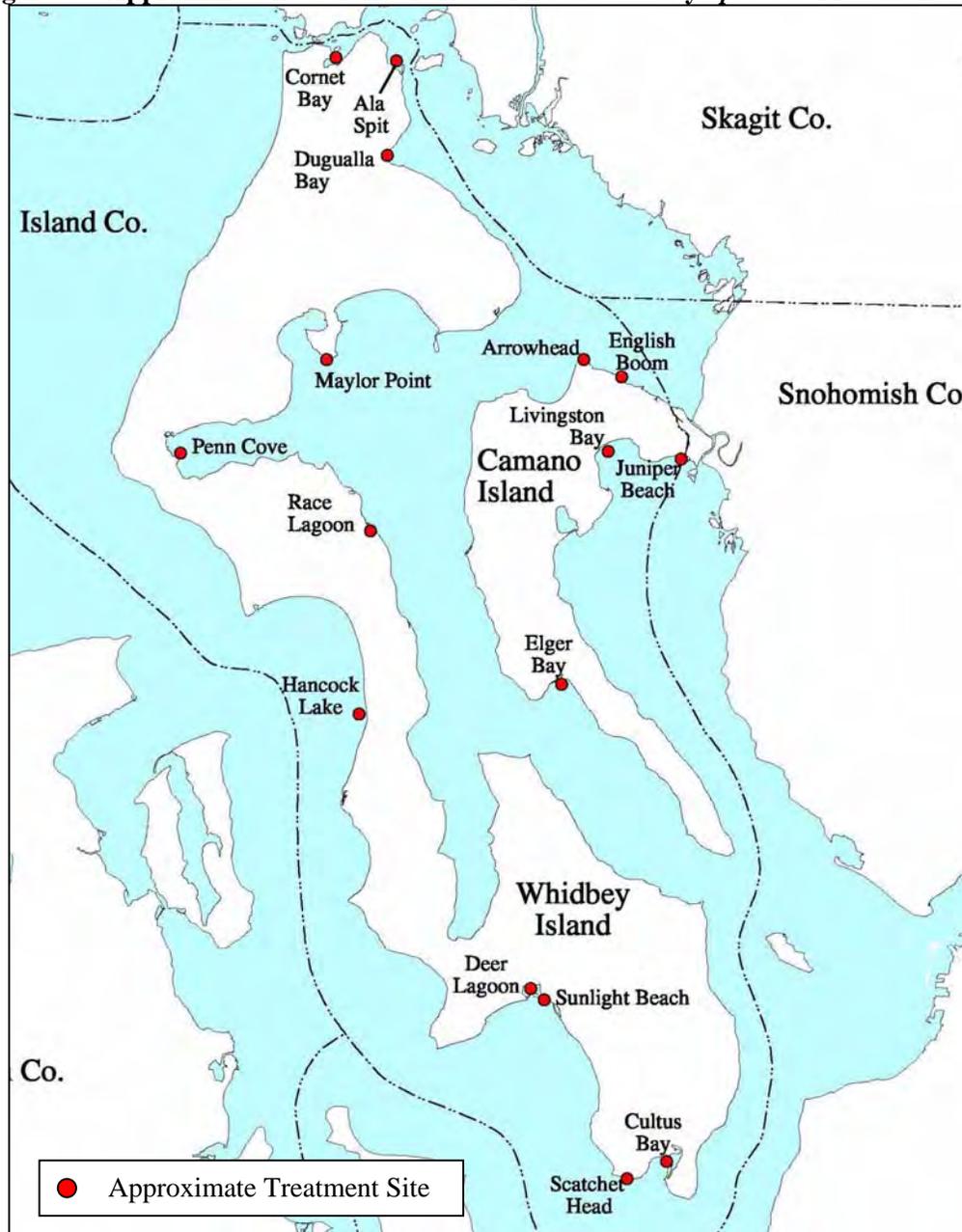
Table 7. Summary of 2001 *Spartina* Eradication Effort in Island County

Site	Solid Acreage Treated	Entity Conducting Treatment	Treatment Method
Ala Spit	0.1	IC	Dig
Cornet Bay	0.1	WDFW	Mow, Dig
Dugwalla Bay	0.75	WM/WDFW	Mow, Dig
Race Lagoon	0.08	WM/WDFW	Mow, Dig
Arrowhead Beach	1.5	WM	Mow
Livingston Bay	55	WDFW, WM	Mow, Disk
Deer Lagoon	1.5	WM, WDFW	Mow, Dig
Cultus Bay	1.5	WM, WDFW, SW, WSDA, SH	Dig
English Boom	4.25	WM	Mow, Dig
Maylor Marsh	0.001	WM, IC, WSDA, WDFW	Dig
Hancock Lake	0.001	WM, IC, WSDA, WDFW	Dig
Scatchet Head	0	DNR	Survey
Elger Bay	2.5	WDFW	Mow
Sunlight Beach	0.01	WM/WDFW	Mow, Dig
Juniper Beach	5	WM/WDFW	Mow
Penn Cove	0.01	WDFW, IC	Mow, Dig
Total Solid Acres Treated	72.3		

Nearly all of the smaller outlier infestations have been brought close to eradication in Island County. Control work this year focused on preparing all small infestations for herbicide treatment next season, as well as mechanically and physically reducing the existing small infestations.

On Camano Island, small outlier infestations remain at Elger Bay on the west side and in a few lagoons on the east side. An infestation located at Arrowhead Beach, which was treated for the first time in 2000, will need considerable follow-up treatment. The approximate mile stretch of beach known as English Boom will also require multi-year monitoring and treatment to prevent re-infestation from the south Skagit Bay seed source.

Figure 5. Approximate Locations of all 2001 Island County *Spartina* Treatment Sites



Livingston Bay, located on eastern Camano Island, has been a huge source of seed set in past years. During the 2000 treatment season, WM and WDFW treated the entire infestation in Livingston Bay. This treatment resulted in approximately 50% reduction in acreage. Although herbicide was not in use during the 2001 season, WM and WDFW continued to make progress in Livingston Bay. The entire infestation was mechanically controlled using a small amphibious vehicle with a tandem disk harrow and by mowing, resulting in extremely little seed set. The 2001 mechanical treatment will also enhance the efficacy of the herbicide applications that may take place during the 2002 season. Figure 18 (page 41) shows the tracked utility vehicle and implement used by WM in Livingston Bay.

Skagit County

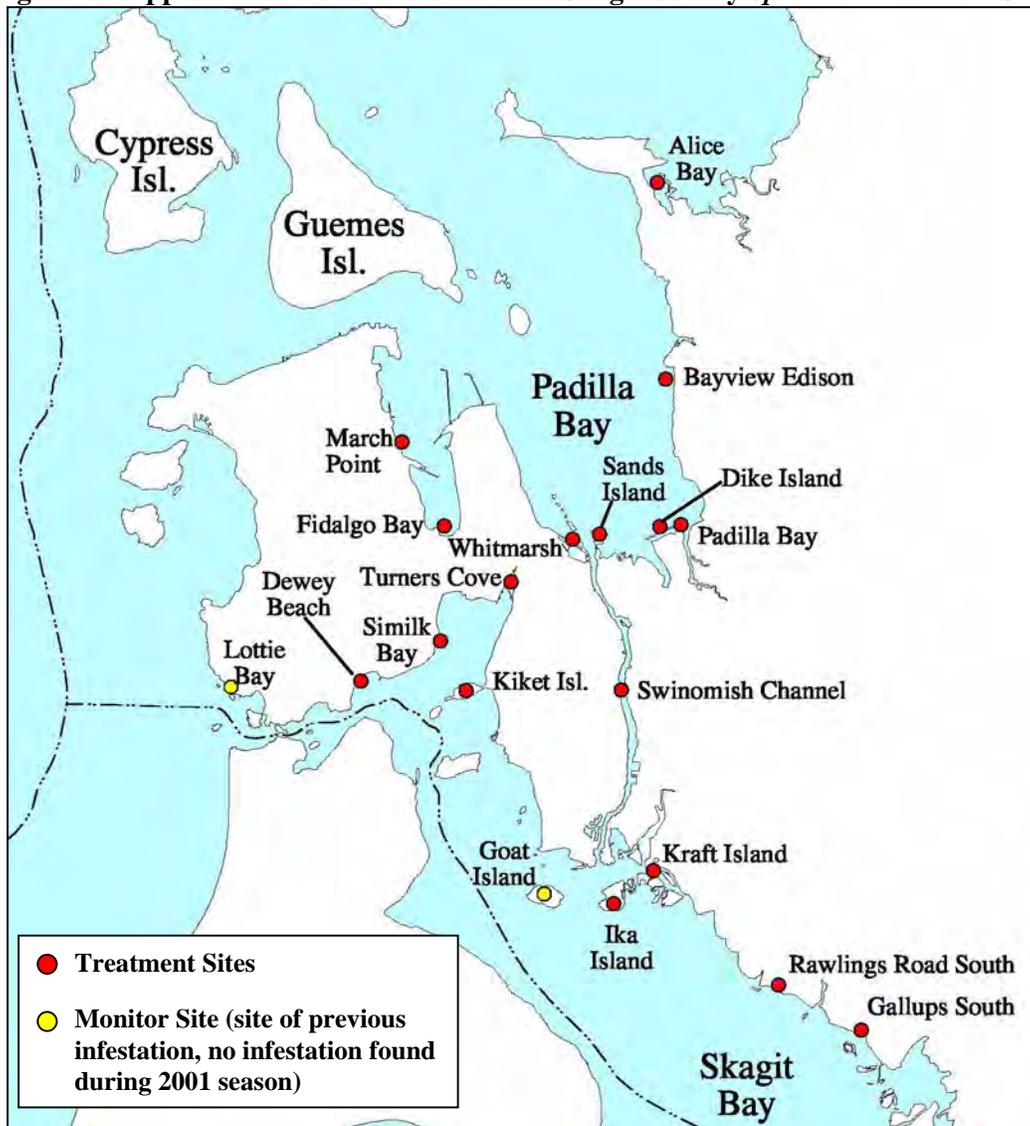
WSDA provided \$40,000 to the Skagit County Noxious Weed Control Board (SK), and \$10,000 to the Swinomish Tribal Community (SW) during the 2001 control season. In addition, SK procured and contributed \$16,500 from a Skagit Fisheries Enhancement Grant and the SW, WDFW, Washington Department of Ecology (DOE) and Wildlands Management (WM) allocated resources towards *Spartina* eradication activities.

In total, 34 solid acres of *Spartina* were treated in Skagit County in 2001. All known *Spartina* infestations were treated with exception of a few infestations on Swinomish tribal land. Table 8 shows the solid acres treated, who did the treatment, and the treatment methods used on every site in Skagit County. Figure 6 shows the approximate locations of all Skagit County 2001 treatment sites.

Table 8. Summary of 2001 *Spartina* Eradication Effort in Skagit County

Site	Solid Acreage Treated	Entity Conducting Treatment	Treatment Method
Gallups South	10	SK	Dig, mow
Rawlings Rd. South	5	SK	Dig, mow
Kiket Island	0.62	SK	Dig, mow
Sands Island	1	SK	Dig, mow
Kraft Island	2.25	SK	Dig, mow
Ika Island	1.33	SK	Dig, mow
Dike Island	2.03	WM	Dig, mow
Padilla Bay	1.6	DOE	Dig, mow
Similk Bay	0.008	SK	Dig
Bayview Edison	0.001	SK	Dig
Alice Bay (Samish Island)	5	SK,WDFW,DOE	Mow/Dig
Turners Cove	2	SW, SK, WSDA	Mow/Dig
Lottie Bay	0	SK	Monitor
Goat Island	0	SK	Monitor
Dewey Beach	0	SK	Monitor
Fidalgo Bay	0.003	SK	Dig
March Point	0	SK	Monitor
Whitmarsh	0	SK	Monitor
Swinomish Channel	2.75	SK, SW	Mow
Total Solid Acres Treated	33.59		

Figure 6. Approximate Locations of all 2001 Skagit County *Spartina* Treatment Sites



The Swinomish Indian Tribal Community has been working with the Washington State Department of Agriculture to develop an integrated approach towards controlling *Spartina* infestations on reservation land.

Past control work on reservation land has allowed for the use of all control options excluding herbicide. The SW along with assistance from WSDA is working to develop a control approach that will allow for the use of herbicide on at least one infestation site.

SW has been very successful over the past years at controlling the smaller infestations on tribal land using mechanical and physical methods. However, a few of the infestations have proven difficult to control with these methods due to their larger size.

San Juan, Clallam, Jefferson, Kitsap, King Counties

In 2001, the San Juan County Noxious Weed Control Board Coordinator (SJC) conducted surveys and dug *Spartina* at one site, Argyle Lagoon. Figure 7 shows where these surveys and dig took place. WSDA hired a roving crew to work in Clallam, Jefferson, Kitsap and King counties. Figure 8 shows the locations of all 2001 WSDA treatment sites. The U.S. Navy assisted WSDA with control on the Indian Island infestations by providing labor and access to restricted areas. Table 9 shows the solid acres treated, who did the treatment, and the treatment methods used on every site in San Juan, Clallam, Jefferson, Kitsap, and King counties.

Figure 7. Approximate Locations of 2001 San Juan County *Spartina* Treatment/Survey Sites

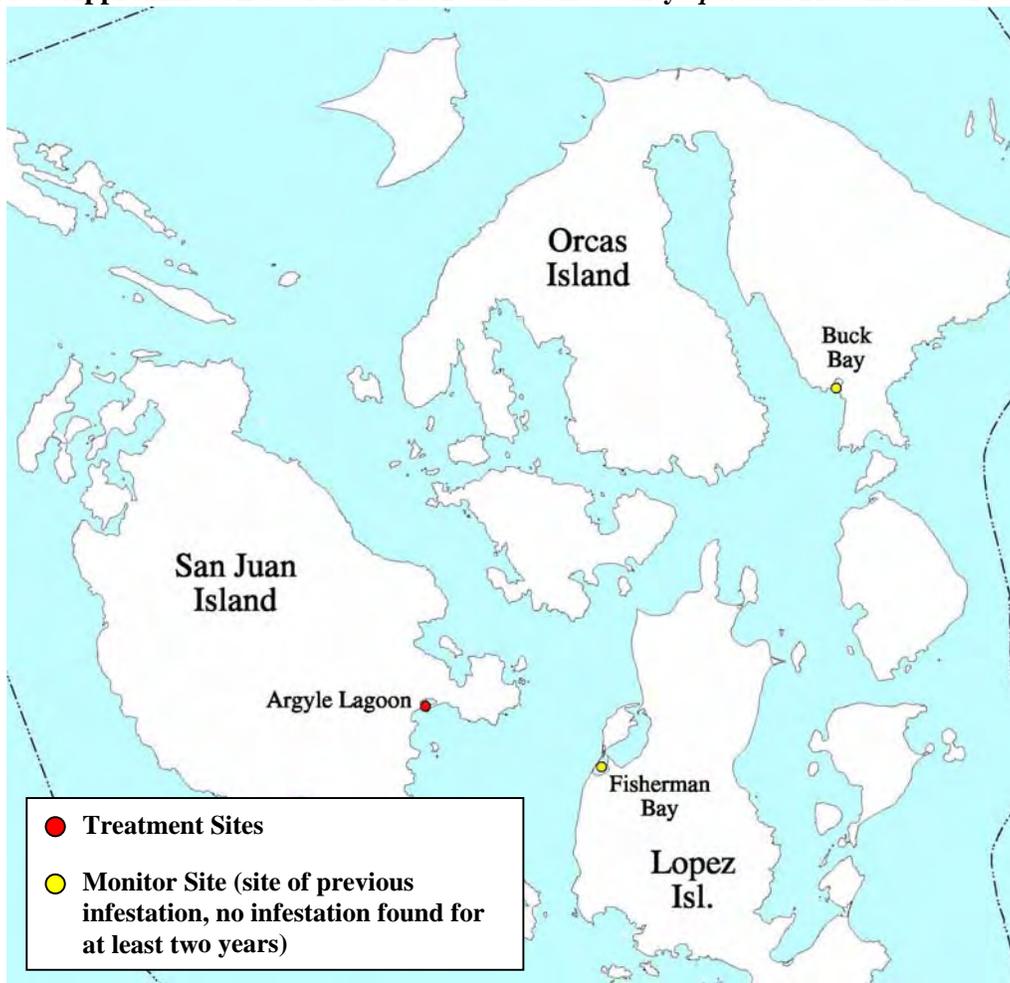
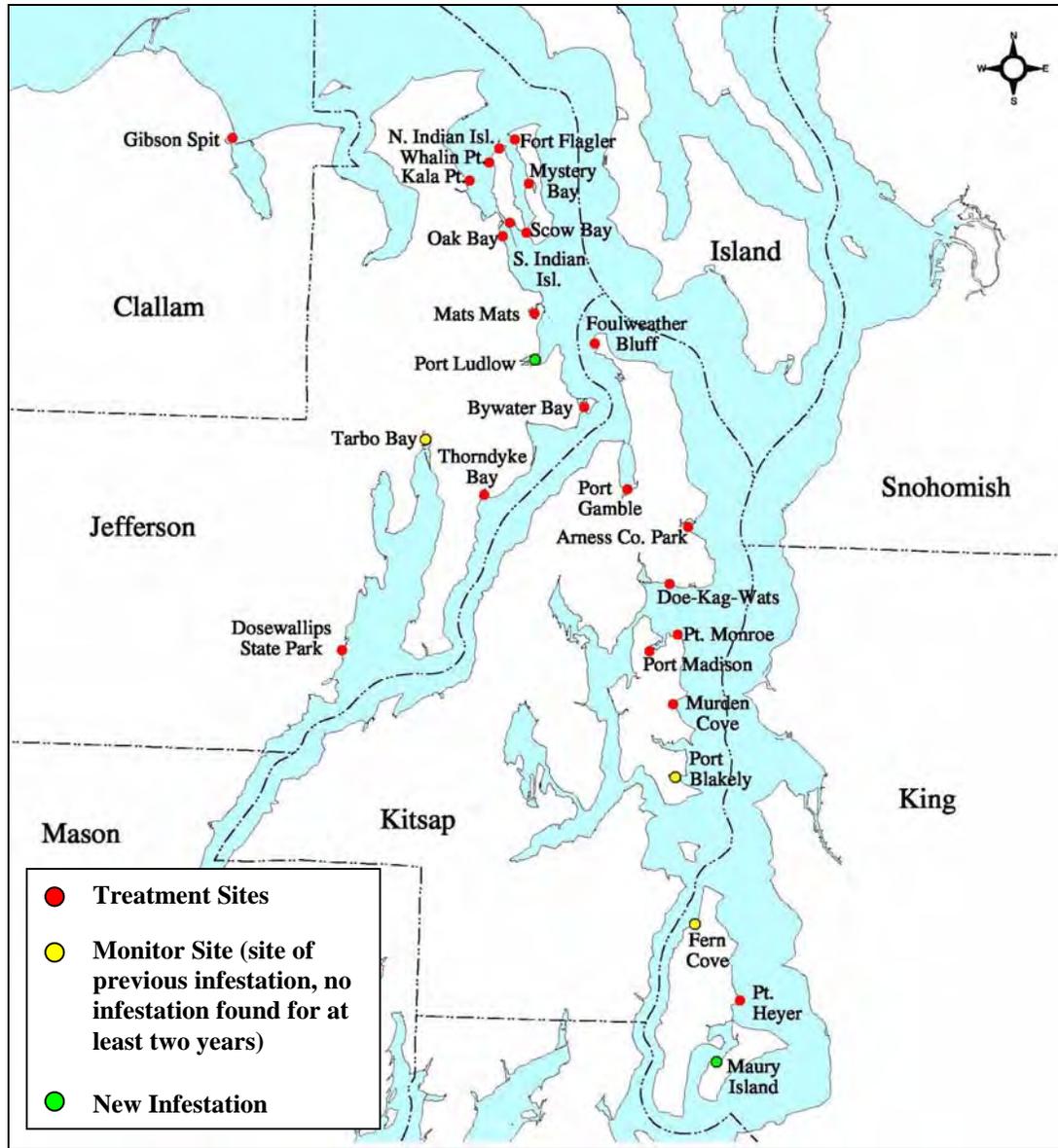


Figure 8. Approximate Locations of all 2001 Clallam, Jefferson, Kitsap and King county *Spartina* infestations



WSDA crews substantially reduced all known infestations in Clallam, Jefferson, Kitsap and King counties during the past four years. With the exception of the Doe-Kag-Wats infestation located on the Suquamish Reservation in Kitsap County, all sites are nearing eradication, and will continue to progress towards that end with yearly surveying and physical control. The Doe-Kag-Wats infestation will require substantial labor to dig and mow.

Table 9. Summary of 2001 *Spartina* Eradication Effort in San Juan, Clallam, Jefferson, Kitsap and King Counties

Site	Solid Acreage Treated	Entity Conducting Treatment	Treatment Method
San Juan County			
Argyle Lagoon	0.001	SJC	Dig
Fisherman Bay	0	SJC	Monitor
Buck Bay	0	SJC	Monitor
Clallam County			
Gibson Spit	0.001	WSDA	Dig
Jefferson County			
Dosewallips State Park	0.001	WSDA	Dig
Thorndyke Bay	0	WSDA	Monitor
Tarboo Bay	0	WSDA	Monitor
Oak Bay	0.001	WSDA	Dig
Mats Mats	0.001	WSDA	Monitor,dig
Scow Bay	0.001	WSDA	Dig
Whalin Point	0.001	WSDA/Navy	Dig
Kala Point	0.001	WSDA	Dig
Bywater Bay	0	WSDA	Monitor
South Indian Island	0.001	WSDA	Dig
North Indian Island	0.01	WSDA/Navy	Dig
Fort Flagler	0.001	WSDA	Dig
Port Ludlow	0.001	WSDA	Dig
Mystery Bay	0	WSDA	Monitor
Kitsap County			
Murden Cove	0	WSDA	Monitor
Blakely Harbor	0	WSDA	Monitor
Point Monroe	0.0001	WSDA	Dig
Foulweather Bluff	0.1	WSDA	Mow, dig
Port Gamble	0.001	WSDA	Dig
Doe-Kag-Wats	1.5	WSDA	Mow, dig
Arness Park	0.001	WSDA	Dig
Port Madison	0.01	WSDA	Dig
King County			
Fern Cove	0	WSDA	Monitor
Point Heyer	0.001	WSDA	Dig
Total Solid Acres Treated	1.62		

Figure 9. *Spartina alterniflora* in Willapa Bay, Pacific County, Washington (2000)



Figure 10. *Spartina patens* at Dosewalips State Park, Jefferson County, Washington (2000)



Figure 11. *Spartina anglica* at English Boom prior to control, Island County County, Washington (1997)



Figure 12. WSDA Otter mechanically controlling infestation (2001)



Note for Figure 12

The implement being used in this photo is called a tandem disk harrow. Preliminary results indicate that control with this and similar implements show substantial efficacy.

Figure 13. WDFW Bombardier crushing an infestation in North Willapa Bay (2001)



Figure 14. North Willapa infestation several weeks after being crushed by Bombardier (2001)



Figure 15. WSDA LMC crushing infestation at Oysterville site (2001)



Figure 16. WSDA LMC pulling roller at Oysterville site (2001)



Figure 17. North Potshot infestation previously crushed by DNR Marsh Master 1 (2001)



Figure 18. Wildland Management Max tracked vehicle and implement (2001)



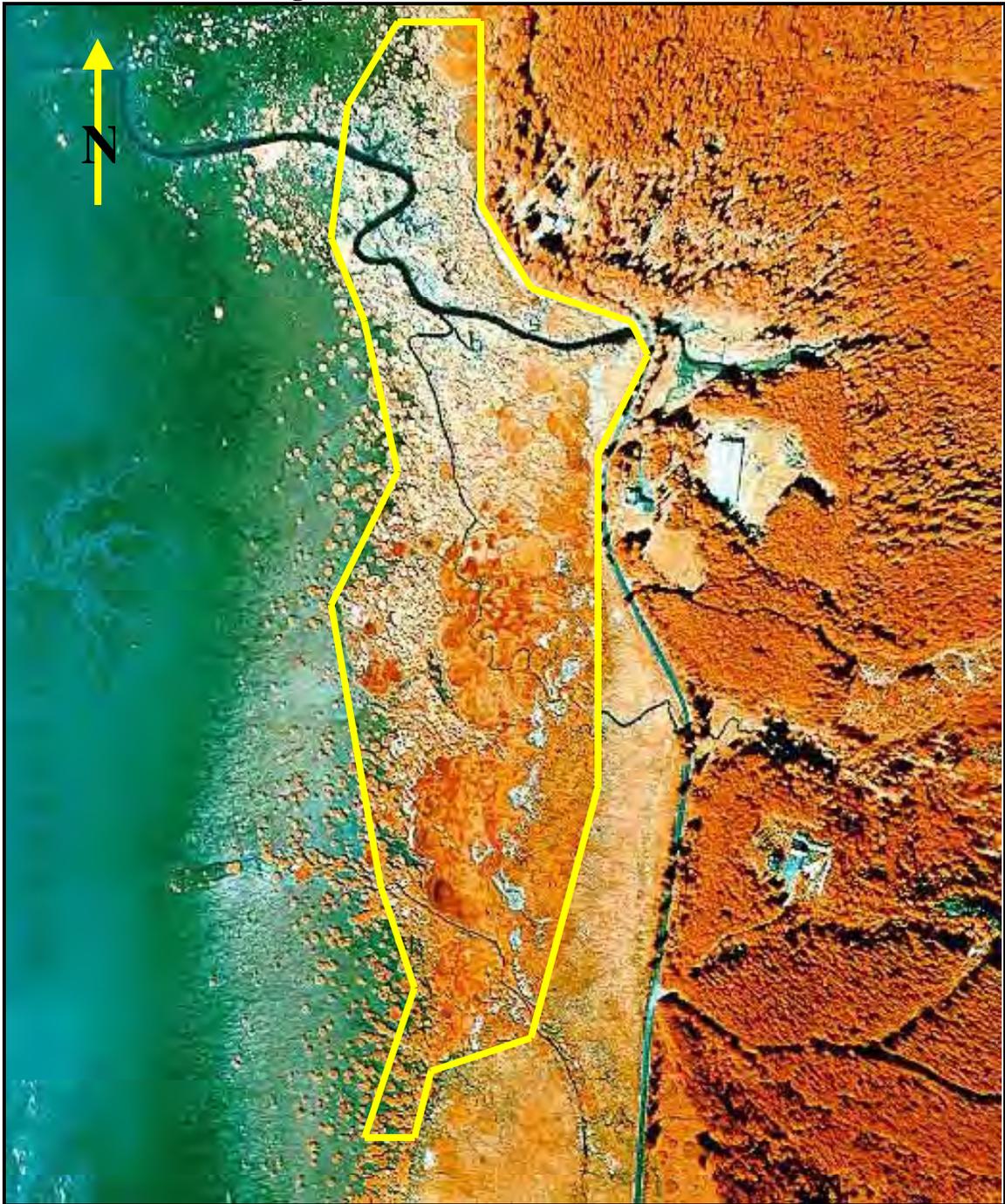
Figure 19. North Bay Mechanical Control Site



Note for Figure 19

The outlined area in this photo, taken in 2000, shows the area that was mechanically controlled by WDFW using the Bombardier tracked utility vehicle 2001. The Bombardier was surplused to WDFW by Bonneville Power Administration at no cost to WDFW. WDFW mechanically controlled approximately 45 acres at this site.

Figure 20. Naselle Mechanical Control Site



Note for Figure 20

The outlined area in this photo, taken in 2000, shows the area that was conducted by DNR with the Marsh Master 1 amphibious machine. DNR controlled approximately 43 solid acres in the Naselle area. Eighteen of the 43 acres were controlled along Elsworth Slough.

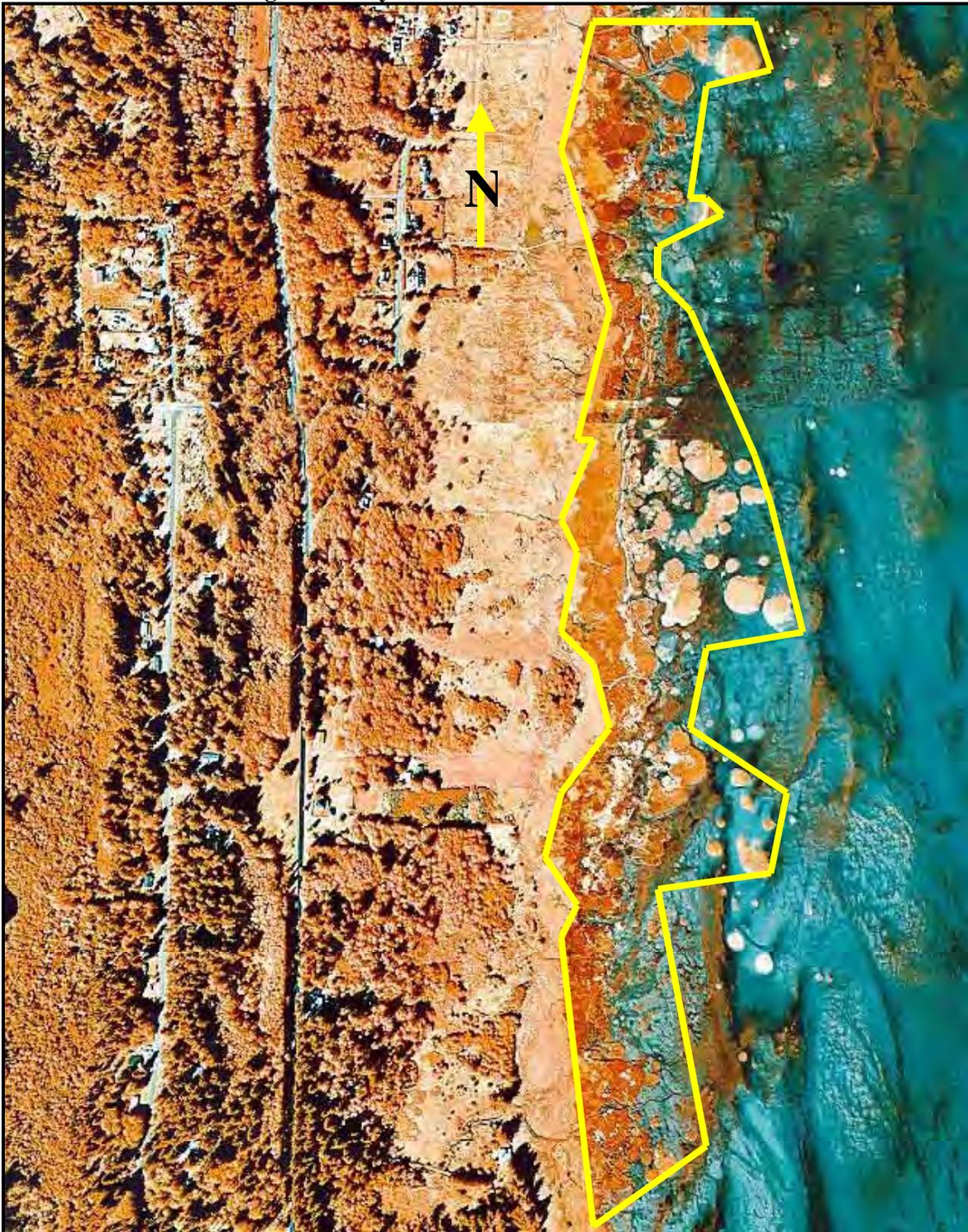
Figure 21. Porters Point Mechanical Control Site



Note for Figure 21

The above aerial photo highlights a portion of the Porters Point work area. The control work conducted in Porters Point was done by the USFWS, using the Quality Machine with both a flail mowing head and a rototilling head and the Wilco machine with a rototilling implement. Notice the majority of the highlighted area had already been mechanically controlled at the time of this photo.

Figure 22. Oysterville Mechanical Control Site



Note for Figure 22

The Oysterville control work was conducted by WSDA, DNR and WDFW. The above highlighted area was controlled by WSDA and represents approximately 25 acres.

Recommendations for the Future

The Puget Sound Water Quality Action Team identified *Spartina* as a key indicator of Puget Sound health in its widely released publication *Puget Sound's Health 2000* and in its recently released *Puget Sound Health 2001*. The Washington State Conservation Commission identified *Spartina* as a serious threat to salmonid survival in the Stillaguamish and Island County Water Resource Inventory Areas (WRIAs) at the beginning of 2000. In addition, a valuable shellfish industry is in danger of being severely impacted in Willapa Bay because of habitat loss associated with *Spartina* colonization.

Research indicates that the number one factor contributing to the endangerment of any species is habitat destruction; the number two factor is introduction of non-native species. *Spartina* is a non-native species that destroys habitat. *Spartina* has the potential to invade every mud flat, cobblestone beach and salt marsh in Washington State if allowed to grow uncontrolled. To date, *Spartina* has already impacted more than 8,000 acres in Puget Sound and approximately 16,000 acres in Willapa Bay.

Strategies for eradicating *Spartina* have evolved over time with treatment efforts each year being built on the results of the previous years' efforts. Equipment to access and treat *Spartina* has also evolved. The agencies now use airboats to transport equipment and personnel; large scale tracked utility vehicles to stop seed production and till infestations; high pressure spray systems to treat large clones and fringes of meadows; and volunteers, landowners and students to dig seedlings. Because of these new tools and our experiences in the past few years, we are more confident than ever that it is possible to eradicate *Spartina* from Washington State provided adequate resources are available. To achieve this goal, WSDA requested and received an additional \$1,480,000 for *Spartina* eradication statewide during the 2001-2003 biennium.

The enhanced budget will allow WSDA to expand on the current successful cooperative efforts in Puget Sound and Grays Harbor and bring new mechanized eradication tools to the efforts in Willapa Bay, including a tool with the ability to eradicate the larger meadows that are producing the majority of the seed in the Bay.

With this additional funding WSDA will eradicate all known infestations of *Spartina* in Puget Sound, Hood Canal and Grays Harbor over a period of four years and begin the first real reduction in Willapa Bay, eradicating nearly a quarter of the 4,000 plus solid acres of *Spartina* in the first two years.

This goal is only achievable if WSDA continues to be fully funded at this level in the future. Any decrease in the budget will require the cooperating entities to revert to a containment only approach, especially in Puget Sound. Past efforts in Puget Sound have substantially pushed the infestation back to areas of large continuous infestations. Without the additional funding, WSDA will not have the resources available to target these large infestations for eradication.