B.C. SPARTINA TREATMENT PLAN

June 2025 – June 2028

B.C. SPARTINA
Working Group
protecting our shorelines

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On Behalf Of

The British Columbia *Spartina* Working Group

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B.C. *Spartina* Treatment Plan

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BACKGROUND

Spartina species (*anglica, alterniflora, densiflora*, and *patens*) are invasive aquatic intertidal cord grasses on the Pacific Coast of Canada that modify natural tidal mudflats. Over a relatively short period of time (measured in years), these naturally sloping areas can be transformed into elevated *Spartina* meadows with a steep seaward edge. As a result, water circulation patterns change (increasing the risk of flooding), mudflats are converted into monotypic grass stands (resulting in loss of migratory bird and salmon habitat, as well as loss of economically important shellfish) and navigation channels may be altered. Since the 1980's, *Spartina* plants have expanded Northward from the U.S. states of California, Oregon and Washington. The BC *Spartina* Working Group (BC SWG) formed in 2004 to employ early detection and rapid response methods to eradicate *Spartina* in BC. The BC SWG includes members of government and non-government organizations representing a diversity of responsibilities including environment, migratory birds, habitat restoration, and public use. The province's contributions in funding, technical expertise, and leadership are an integral part of the BC SWG and the accomplishments of the *Spartina* Early Detection and Rapid Response Program. Furthermore, the Province of BC has been instrumental in establishing the federal and provincial permits and registrations necessary for aquatic herbicide to be used as part of an integrated pest management approach. The team also liaises with San Francisco Estuary *Spartina* Project and the Washington State Department of Agriculture, which are two U.S. agencies involved in *Spartina* eradication along the Pacific Coast.

The B.C. Government has been a key annual funding source towards these efforts since 2005. Three out of four known invasive *Spartina* species are present in BC, *Spartina anglica*, *Spartina densiflora*, and *Spartina patens*. The fourth species, *Spartina alterniflora*, is yet to be found in BC, but it remains a target species of the BC SWG in case it appears. To date, *Spartina* species cover approximately 2.14 ha spread over 479 ha. In BC, *S. anglica* is present in Boundary Bay and Robert's Bank extending to the Tsawwassen Ferry Terminal inter-causeway in the Lower Mainland. *S. anglica* poses significant threat to the intertidal zone due to its rapid growth rate and ability to establish lower in the intertidal zone, displacing important mudflat habitat. *S. patens* is found in both Burrard Inlet (east of second narrows bridge in the Maplewood Flats conservation area, Pacific Coast Terminals, and Old Mill Park in Port Moody), Sturgeon Bank along the Coast of Richmond, and in Baynes' Sound primarily around Courtenay/Comox harbour. *S. patens* is limited to the high salt marsh region of the intertidal zone, but still poses a significant threat due to its mat-like growth which can displace native vegetation in the high salt marsh. *S. densiflora* is found throughout Baynes' Sound from Seabank Rd in Comox to Deep Bay near Bowser on Vancouver Island, on Sandy Island and the Seal Islets, and on Denman and Hornby Islands. *S. densiflora* is found in the high salt marsh and cobble beach areas of the foreshore.

From 2003 to 2012, *Spartina* control work in BC, led by the BC SWG, only used digging and excavation to control *S. anglica* and was unsuccessful in achieving containment of the species. In 2010 the BC *Spartina* Working Group formed a small sub-group, the herbicide technical committee, to begin working with staff from provincial and federal Canadian agencies to determine the requirements and process to use herbicide as a means of control on *Spartina* in BC. The sub-group reviewed ecological impacts and best management information based on the success of using specific aquatic herbicides to control *Spartina* in the United States (Washington, Oregon and California). Based on the *Spartina* control progress achieved by United States partners, the severity of the threat of invasive *Spartina*, and an inability to achieve containment after over a decade of digging, it was decided that herbicide treatment would be required as part of an integrated pest management approach to contain and eradicate invasive *Spartina* from BC's shores. The subgroup determined that BC would require an annual federal Emergency Use Registration (EUR) from Health Canada's Pest Management Regulatory Agency (PMRA) in addition to three-year provincial Pesticide Use Permits (PUP) from the BC Ministry of Environment (ENV) in order to apply

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the most effective and well-suited aquatic herbicide known by the US trade name, Habitat (active: ingredient imazapyr). These authorizations were maintained by the Ministry of Forests (FOR) Invasive Plant Program from 2013 to 2021. The Canadian equivalent aquatic herbicide formulation known by the trade name, Habitat Aqua (active ingredient: imazapyr) was registered by Health Canada's PMRA in 2021. From that point forward, the FOR Invasive Plant Program was required to maintain only the three-year provincial Pesticide Use Permits in order effectively contain and reduce the invasive *Spartina* populations. From 2013 to 2024, there have been four sets of Pesticide Use Permits (PUP) established to control invasive *Spartina* species on BC's coast.

SPARTINA SPECIES OVERVIEW

Table 1. *Spartina* Species Ecology and Status in BC, Dec. 31, 2024.

***Spartina* Species**	***S. anglica* (English cordgrass)**	***S. densiflora* (dense flowered cordgrass)**	***S. patens* (salt meadow cordgrass)**
Location in BC	Boundary Bay & Robert's Bank	Denman Island, Hornby Island, Sandy Island and the Seal Islets, East Coast of Vancouver Island (Baynes Sound)	Burrard Inlet, Denman Island, Hornby Island, Sandy Island and the Seal Islets, East Coast of Vancouver Island (Baynes Sound) Primarily Comox Estuary,
Tidal Range Growth Pattern	High marsh zone to intertidal mudflat Seedlings expand via rhizomes to form circular clones	High marsh to mid-intertidal; Grows in tufts and expand via rhizomes	High marsh zone Mat forming and expand via rhizomes
Leaf Area (ha)	0.031	0.007	2.102
Abundance (# of plants)	980	982	2439
Impacted Area (ha)	195	71	213
Distribution	Several well - spaced patches or clumps of species, and several sporadically occurring individuals	Several well - spaced patches or clumps of species and several sporadically occurring individuals or clumps of species	Continuous dense occurrence of a species and A few patches or clumps of a species

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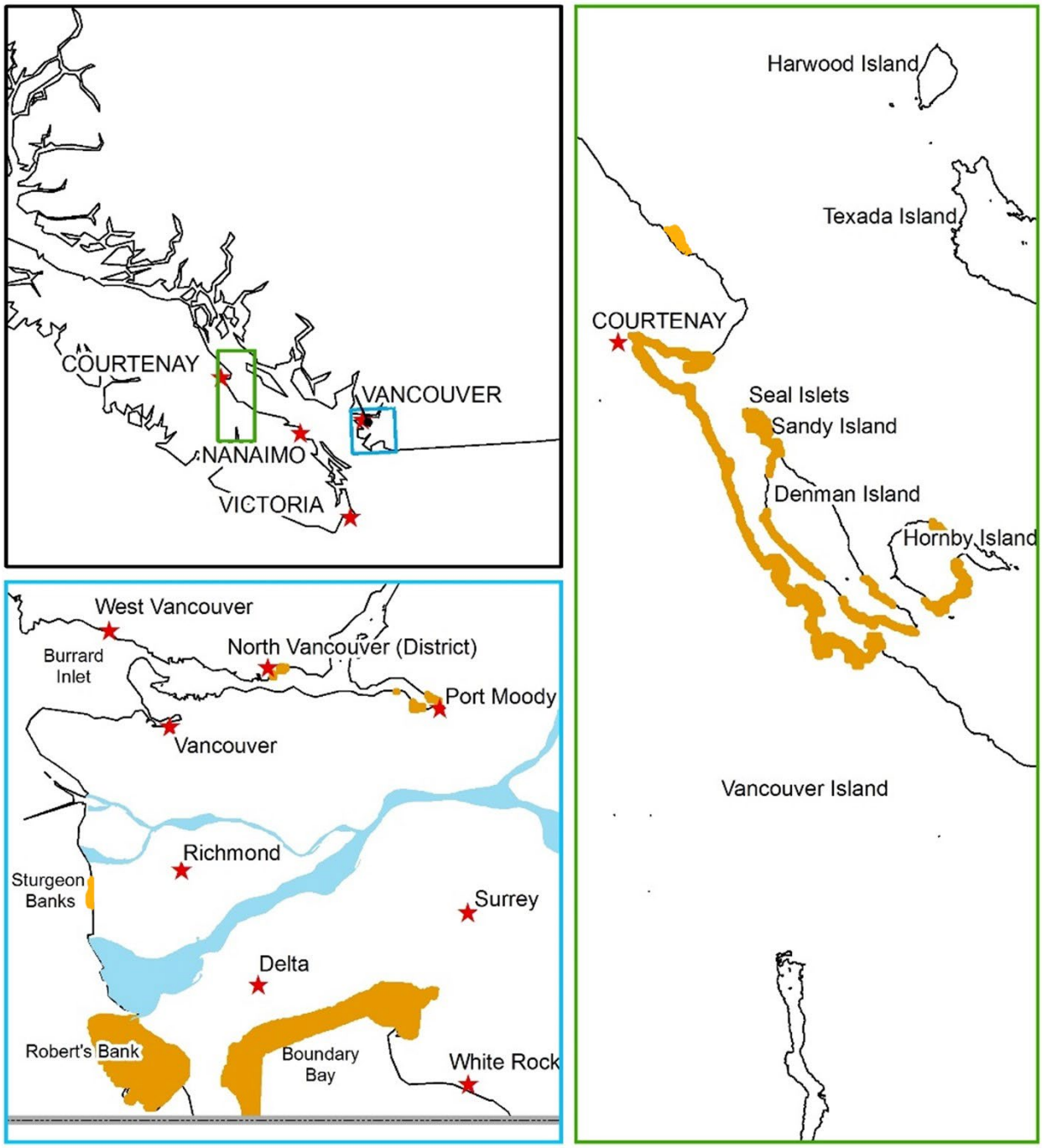

Figure 1. General locations where *Spartina* is found throughout British Columbia. Blue represents the Lower Mainland and green represents Baynes' Sound. The approximate distribution of *Spartina* is shown in orange.

CONTROL PROGRAM PROGRESS & ACCOMPLISHMENTS

There have been several successes in the treatment of *Spartina* species within BC since the implementation of herbicide within the integrated pest management approach. The abundance of all species of *Spartina* has dropped from over 27,000 plant individuals to approximately 4,400 between 2016 and 2024. Total impacted area by *Spartina* species has been reduced from approximately 1400 ha to under 500 ha in the same time period.

In 2024, the 20th year of the program, the overall population of *S. anglica* dropped below 1000 individuals for the first time since 2009 (n= 980; Table 1). The abundance of *S. anglica* infestations has declined by approximately 96% since 2016, when abundance peaked at 23,260 individuals. Likewise, the extent of the *S. anglica* population has dropped by 80% from 972 ha to 195 ha, and the estimated leaf area of *S. anglica* has been reduced by 98% since 2016, from 16,373m^2 to just 306 m^2.

The *S. densiflora* overall population also dropped to under 1000 individuals in 2023 for the first time since the mapping of *S. densiflora* began (n= 982; Table 1), a reduction of approximately 96% from 14,090 individuals mapped in 2015. The extent of the *S. densiflora* population has decreased by 76% from its peak in 2016 of 292 ha, to 71 ha at present. The estimated leaf area, which peaked in 2018 at 0.4950 ha, has dropped by 98.6% to just 0.007 ha in 2024. Note that the abundance, impacted area, and leaf area peaked for *S. densiflora* in different years because of differences in spread, and plant/patch size.

Non-herbicide control methods on *S. patens* have had very limited effectiveness and full treatment of the known *S. patens* population in BC has yet to be achieved. The program has faced several hurdles to achieving full-scale treatment on Vancouver Island and the Gulf Islands. Scheduling efficient treatments is already a challenge given strict tidal, weather, wind, and lighting requirements. Other confounding factors included inclement weather in the Fall season (when the plant is significantly easier to identify), herbicide reluctance in a few small communities requiring public education, and remote sites with difficult access. Due to these challenges, and the fact that *S. patens* is the most established *Spartina* species in BC, likely present since at least 1979, the overall population of *S. patens* has not been reduced to the same extent as the other two species, but progress is being made.

Abundance of *S. patens* has increased over time, partially due to the discovery of previously unknown populations. However, the treatments that have occurred on the *S. patens* population have been successful. Jáji7em and Kw'ulh Marine Park (a.k.a. Sandy Island Marine Park) was first treated in 2019 and saw an 80% reduction in estimated leaf area in one season. Sites where consecutive annual treatments have been achieved show promising results, such as the Maplewood Flats Conservation Area where estimated leaf area has dropped by 94% since peak levels.

In 2024, a previously unknown satellite population of *S. patens* was discovered at Sturgeon Bank off the coast of Richmond. A notable achievement was that project resources were quickly allocated, and full treatment of this population occurred within two weeks of discovery. Full-scale treatment of the entirety of Lower mainland *S. patens* populations was achieved in 2024. Re-arranging project resources towards achieving full-scale *S. patens* treatment across all of BC will occur in 2025. The successful reductions in the other two species will allow the program more flexibility to carry-out earlier treatment of *S. patens* which will help reduce the occurrence of weather-related delays and provide greater tidal access windows for remote sites.

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B.C. *Spartina* Treatment Plan

TREATMENT HISTORY

Between 2003 and 2013, the BC *Spartina* Working Group (BC SWG) focused on the use of mechanical means to control *Spartina*. Building on previous work from Washington State, BC partners have used and/or evaluated the following non-herbicide control techniques: digging by hand, digging by excavator, seed head clipping, and covering (with geotextile, plastic sheeting, and combinations of both). Due to high costs, the inability to achieve containment, and consideration for unintended impacts of non-herbicide methods, in 2010 the BC SWG began pursuing herbicide treatments to control *Spartina* in BC. In 2013, the BC SWG introduced chemical treatment as part of an integrated pest management plan.

While herbicide treatments were successfully being used to gain a foothold on containing and reducing *S. anglica* populations, non-herbicide methods continued to be explored for controlling *S. patens* and *S. densiflora* until 2019. *S. densiflora* has responded well to repeated removals by hand and excavator. For *S. patens*, these efforts have included several iterations of shade trials and digging, both by hand and with an excavator with limited success (see Figure 2). The results were low efficacy in *S. patens* control or significantly altered shoreline habitat or both. Herbicide treatments in Burrard Inlet have been extremely successful in reducing *S. patens* with native vegetation returning to previous *S. patens* locations within 1-2 years. Therefore, the BC SWG will use herbicide as the primary removal method in 2025 and beyond.

Table 2. Management Tool Cost, Timing and Location.

Management Tool	Target Species	Estimated Cost per Hectare[1]	Timing	Location
Digging – by hand	*S. densiflora*	$123,000–$247,000/ha	Year Round Primary emphasis on Fall (September – November) & Winter removals (January – March)	East Coast Vancouver Island, Sandy Island and Seal Islets, Denman Island, Hornby Island
Herbicide – backpack sprayer or hand pump sprayer	*S. anglica* *S. patens*	$11,000 / ha	May – November Annually	Lower Mainland, East Coast of Vancouver Island, Sandy Island & the Seal Islets, Denman Island and Hornby Island

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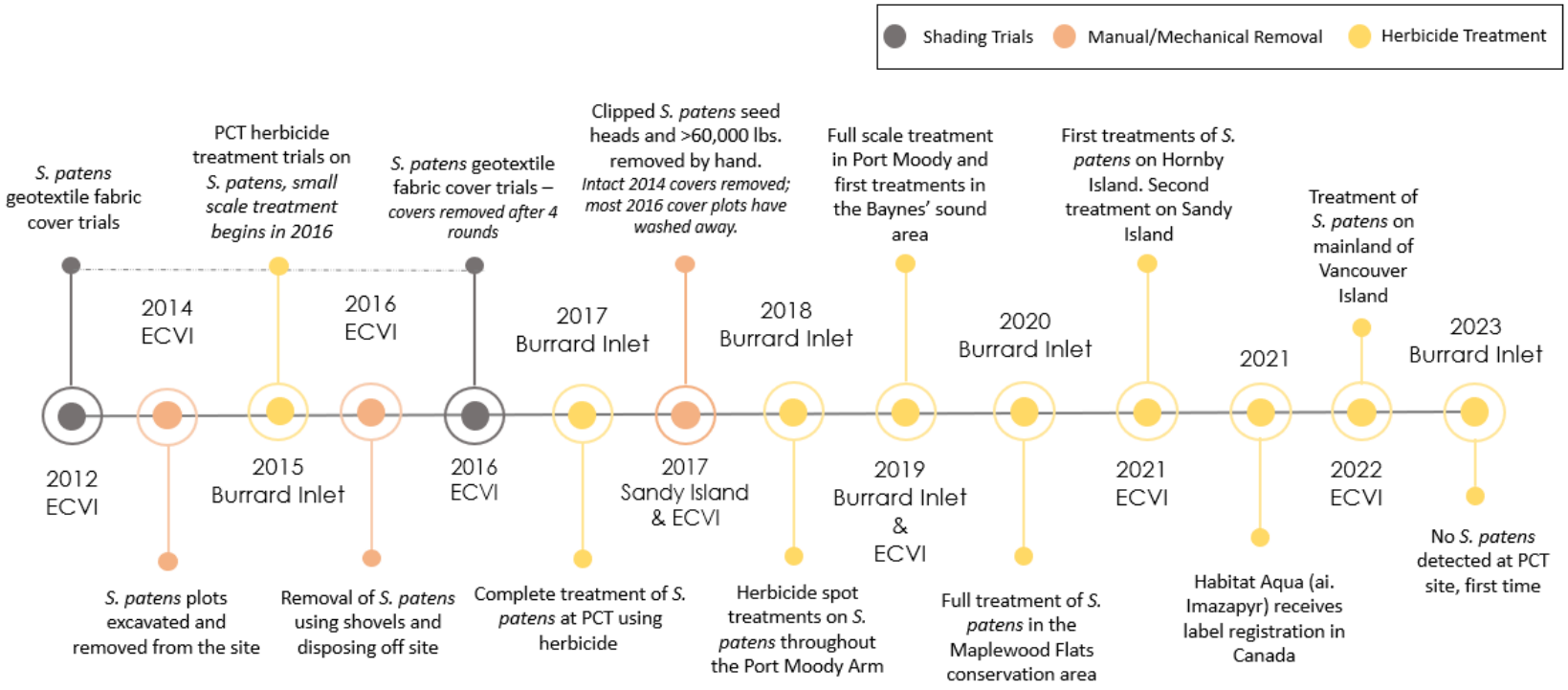

Figure 2 *S. patens* control since 2012. Grey represents shading trials, orange represents manual/mechanical removals and yellow represents herbicide treatments.

TREATMENT METHODS & TIMING

The BC SWG will continue to use an integrated approach of both manual and herbicide techniques based on the successes of each treatment method for each species.

METHODS

MANUAL/EXCAVATOR REMOVALS

Manual techniques (e.g. digging) on *S. anglica* is an option for individuals located in areas where a minimum of 4 hour drying time cannot be obtained. However, the current known extent of the *S. anglica* population is located within areas that meet this requirement, and manual removal is not used regularly as herbicide is far more effective.

Since implementing dedicated manual/mechanical control measures for *S. densiflora* populations have been significantly reduced in size. All plants that are detected are removed every year in late summer/early fall. Given the success in reducing plant size and population abundance of *S. densiflora* in recent years removals will continue to be managed by hand digging.

S. patens removal by hand or excavator is not recommended due to concerns for altering shoreline topography, disrupting native plant communities, and virtually no success in eradicating the plant. *S. patens* mechanical removal should only be undertaken in areas where a minimum of 4 hour drying time cannot be obtained. *S. patens* is predominantly found in the high salt marsh surrounded by native plants making it hard to determine the edge and if the entire plant has been removed. Small plants can be hard to distinguish among other salt marsh grasses; herbicide will minimize the disturbance area and foster faster re-generation of native plants into treated areas.

HERBICIDE CONTROL

Herbicide treatment will be used as the primary means of control for *S. anglica* and *S. patens*. *S. anglica* is most commonly found in the lower intertidal region where native vegetation is scarce making it easy to spot and target. *S. patens* is predominantly found in the upper intertidal among native vegetation. Herbicide treatment is more precise than digging and the salt marsh begins recolonizing with native plants faster than after shading or digging control methods. Herbicide treatment on *S. densiflora* is recommended as a secondary treatment option if manual methods become ineffective at controlling the current population.

HERBICIDE SELECTION

A review of the herbicides used to eradicate *Spartina* in the US Pacific Coast jurisdictions revealed that the combined application of active ingredients imazapyr and glyphosate maximized efficacy in controlling *Spartina*. The BC SWG has elected to use only imazapyr to minimize the quantity and volume of pesticide being used while still achieving control and population reduction. This decision was further supported by the results of *Spartina* herbicide treatment efficacy trials between 2013 and 2015. The BC SWG found that glyphosate did not achieve significant control at the study site to justify including it in the tank mix for *Spartina* herbicide treatments. To date in BC, we have only used imazapyr in an operational capacity with application rates matching those used in Washington State and San Francisco (Table 3). Habitat P.C.P. # 30841 was the herbicide product used in association with the annual Emergency Use Registration granted to the Province of B.C. by the Health Canada's Pest Management Regulatory Agency (PMRA) for the purposes of *Spartina* control from 2016 to 2021. Aquatic herbicide Habitat Aqua P.C.P. # 32374 received full registration in Canada in winter 2021 and is now the herbicide used to control invasive *Spartina* species in B.C.

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Table 3. Herbicide Formulation Used in Washington and California (Leson and Associates, 2005).

	Spray Volume	Formulation	Active Ingredient	Surfactant	Colorant
Imazapyr P.C.P. # 30841	934 L/ha	0.52-0.75% solution (.56 - .75 L/100L)	1.12 - 1.68 kg a.e./ha	0.5% v/v Ag Surf II (0.5 L/ 100 L)	8.2 L/378 L

SURFACTANT SELECTION

Similar to the protocol used in the states of Washington and California, a surfactant will be added to improve the ability of the herbicide to bind to *Spartina*. The Integrated *Spartina* Program in San Francisco completed an environmental assessment of the impact of imazapyr on the water quality, biological resources, and human health and safety (Leson & Associates, 2005). A review of potential surfactants considered in the United States indicates Agridex has the least impact on fish and other biological resources. However, in Canada this and related surfactants are not registered. The PMRA Environmental Review Panel conducted an ecotoxicology review of suitable surfactants resulting in the recommendation of Ag-Surf II by IPCO as the most appropriate surfactant to use in combination with Habitat Aqua for *Spartina* herbicide treatments. Ag-Surf II P.C.P. # 30071 is the product used in association with herbicide Habitat Aqua for the *Spartina* control program.

HERBICIDE APPLICATION

Herbicide will be applied through ground-based direct application using pressurized hand pump backpack sprayers. Application will be conducted by applicators with certificates in the Industrial Vegetation and Noxious Weed category. Drift will be minimized by shrouding and using low drift nozzle and pressure configurations. Herbicide will not be applied without wind shrouds when winds are in excess of 8 km/h and will not be applied at all when winds are in excess of 20 km/h or when inversion conditions exist, or when wind could carry spray drift into inhabited areas and sensitive areas. All equipment will be properly calibrated prior to use. Application will occur on a low or receding tide when practical and will allow for a minimum 4-hour post treatment drying window from tides and rain. Following initial herbicide treatment, treatment areas will be re-visited to identify and flag missed plants that were not treated. Missed plants will include plants not yet emerged, plants too small for adequate herbicide uptake (e.g. less than 12” high) or overlooked due to human error.

TRAINING

The BC *Spartina* Working Group will prepare a training program for herbicide treatment. The training will be provided by the hired contractor principle and/or crew supervisor. A field season planning meeting will occur in May/June to complete the detailed coordination of herbicide treatment crews, follow up crews, and monitoring with regards to herbicide application. The Ministry of Forests (FOR) Invasive Plant Program will coordinate with Ducks Unlimited Canada to directly contract and oversee the herbicide treatment crews.

APPLICATION RATES AND QUANTITIES

Assuming herbicide is required on all *Spartina* sites in 2025, the maximum annual herbicide volume required will be less than 350 litres of Habitat Aqua. The Pesticide Use Permit will be maintained to allow for a maximum treatment area of 50 hectares even though the actual treatment area is expected to be considerably less. This will allow for the treatment of all invasive *Spartina* plants, including those newly detected. See Table 4 for the breakdown by geographic area. Habitat Aqua herbicide will be calibrated to between 0.52% - 0.75% concentration in the spray mixture. Ag-Surf II will be calibrated to a 0.5% concentration in the spray mixture.

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Table 4. Proposed Herbicide Requirements to Treat All *Spartina* in All Locations.

	Trade Name	Active Ingredient (a.i.)	Product P.C.P. #.	Hectares (ha)	Application Rate (litres of product/ ha)	Maximum Total Amount Herbicide to be used per year (L)
Lower Mainland	Habitat Aqua	Imazapyr	32374	10	4.67-7.0	47-70
	IPCO Ag-Surf II	Alcohol ethoxylate	30071	10	4.67	47
Baynes' Sound	Habitat Aqua	Imazapyr	32374	40	4.67-7.0	187-280
	IPCO Ag-Surf II	Alcohol ethoxylate	30071	40	4.67	187

TREATMENT LOCATIONS

The specific location of *Spartina* treatment sites will not be known until the mapping is completed at the end of June 2025 and in June of each consecutive year, however the mapping in previous years provides a good indication of locations for *S. anglica, S. patens, and S. densiflora* treatment (see Appendix 1). Based on previous years, treatment for *S. anglica*. will likely occur in the Lower Mainland in the intertidal areas of Boundary Bay, Mud Bay, and the Roberts Bank areas, the tidal marsh along the Tsawwassen First Nations lands, as well as the Deltaport and Tsawwassen Ferry terminal causeways. Most treatments will occur within 1200m of the surrounding dikes. For the Lower Mainland, *S. patens* treatment will likely occur in False Creek, Port Moody Arm, the Maplewood Flats Conservation Area, and Sturgeon Bank off the coast of Richmond.

Treatments on the East Coast of Vancouver Island on *S.patens* and *S. densiflora* will likely occur from Deep Bay in Bowser, North to the Courtenay River estuary and Goose Spit in Comox, as well as the shoreline between the Little River Ferry Terminal and the start of Seal Bay Regional Nature Park within the Comox Regional District. Treatments *on S. patens* and *S. densiflora* will also likely occur on the shorelines of Hornby Island, Denman Island, and Jáji7em and Kw'ulh Marine Park (a.k.a. Sandy Island Marine Park).

Final specific locations and timing will be dependent on input from local stakeholders including local governments, First Nations, local stewardship groups, landowners and the aquaculture industry.

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TIMING

Specific timing of the applications will be dependent on weather, low tides, location of plants in the tidal zone, applicator availability and plant development as outlined in (Table 5).

Table 5. Timing of Herbicide Treatments for *Spartina* Plants (adapted from Patten and Milne 2009).

Plant type/site	May – August	September - November
Spartina likely to go to seed	These should be a spray priority; at least two search and spray events should be done at sites that went to seed in the previous year	
Spartina low in the mudflat	Best window during lowest tides	
Spartina high in the salt marsh	First to spray since it will be the tallest first	Last to spray since most visible and maybe only plants with good canopy left
All *Spartina*	Plants should ideally be at least 12 to 20” high before treatment	

To achieve a high control of *Spartina*, the following procedures, adapted from Patten and Milne 2009, will be undertaken:

1. Treatment areas will be clearly marked so treatment crews do not need to search and identify *Spartina* and can focus on targeted, systematic treatment of the clones. In areas where *Spartina* density is extremely high, treatment lanes ranging from 1 to 3 meters wide will be delineated with flags to guide applicators and ensure systematic treatment of an area.
2. Treatment crews will be certified and receive project specific training provided by the hired contractor principle and/or crew supervisor in advance of treatments.
3. Treatment crews make multiple passes throughout the treatment season (June to November) to treat new or missed plants.
4. A separate treatment monitoring crew will follow the treatment crew to provide feedback to individual members of the treatment crew on *Spartina* plants missed. The follow up team will flag any *Spartina* plant that lacked spray dye or had poor coverage of dye over the entire canopy. This can be done after the tide is no longer suitable for spraying, yet still low enough to find *Spartina*.
5. Each *S. anglica* and *S. patens* occurrence should be visited three or more-times per season, once for initial mapping, once for treatment, once or twice for treatment monitoring and second-pass mapping and treatment.

HERBICIDE HANDLING, SPILL PREVENTION & SPILL RESPONSE

HERBICIDE USE

- All herbicides shall be applied by or under the direct supervision of trained, certified or licensed applicators and in accordance with the product label and pesticide use permit associated with the project
- On-site mixing and filling operations shall be confined to areas appropriately bermed or otherwise protected to minimize and contain spread or dispersion of spilled herbicide or surfactant into surface waters

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HERBICIDE STORAGE

Proper herbicide storage is one of the keys to using herbicides safely. Always wear rubber gloves when handling herbicides in storage, and review product labels for specific storage instructions.

General rules for herbicide storage include:

- Keep all herbicides in their original containers.
- Store herbicides in a locked shelter away from children and animals.
- Store herbicides in a dry cool and well- ventilated area.
- DO NOT subject herbicides to freezing or extremely high temperatures.
- Store herbicides separately from seed, fertilizer, insecticides and food.
- Make periodic inspections of storage facilities and storage containers. Check for possible leaks, spills and other similar problems.
- Keep appropriate absorbent material in the storage area at all times as well as a plastic container for storing damaged material.
- Reject any broken or leaking containers when herbicides are delivered.
- Do not store herbicides in office or break areas where employees congregate.

CONTAINER DISPOSAL

Empty herbicide containers must be disposed of according to government regulations or returned to the manufacturer for disposal. Empty containers not returned to the manufacturer can be handled according to the procedures below, as long as local, provincial and federal laws are followed:

- Triple rinse containers with water. Always pour the rinse-water into an appropriate receptacle.
- Rinsed containers should be disposed of in a landfill approved for pesticide disposal or in accordance with applicable government procedures. Check with your supervisor to find out if and when herbicide containers may be handled in this manner.

SPILL RESPONSE

Under all circumstances, it is the responsibility of the applicator to assure that all precautions are taken prior to initiating work to assure protection of water quality and the environment. The applicator is also responsible for the provision of a Spill Response Kit that is appropriate for the work being undertaken.

The following procedures should be followed in the case of a non-petroleum chemical spill:

- Put on protective gloves, eyewear, a long-sleeved shirt and pants before cleanup
- If a container is leaking, immediately transfer the remaining herbicide to another appropriate container to prevent further spillage
- If the herbicide was spilled on a person, remove the contaminated clothing and rinse the product from the body. If necessary, perform appropriate first aid.
- Cover the spill area with an absorbent material to soak up the herbicide. Common cat litter, sawdust, soil or sand can all be used for this purpose. Consult the manufacturer for more specific clean up recommendations.
- Remove any contaminated items from the spill area to prevent further contamination
- Remove the absorbent material with a broom and or shovel after the spill has been absorbed. Make sure all contaminated soil is removed from the spill area as well.
- Place the contaminated soil and absorbent material into a suitable container, and dispose of the container in an approved landfill area
- ***Do not wash down the area with water*** using a high-pressure hose. You may spread the spill and make the herbicide more difficult to contain and clean up.
- When a spill occurs on a site or is large enough that you need help to contain of clean it up, contact a supervisor immediately. In case of a major spill, call the manufacturer or Emergency Management BC 1-800-663-3456.

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SPILL RESPONSE KIT

A Spill Response Kit should be provided at the work site and be immediately accessible to all personnel. Some or all of the following items may be included in a Spill Response Kit.

Consider site-specific conditions and the chemicals to be used to determine which of the following items are appropriate**.**

- PVC Gloves or equivalent (to mid forearm)
- Half-face respirator equipped with approved pesticide cartridge
- PVC boots or equivalent
- Chemical resistant splash goggles

PETROLEUM FUEL SPILL PREVENTION AND RESPONSE

Spills of gasoline or other petroleum products, required for operation of motorized equipment, into or near open water could degrade water quality, with potential for toxicity of contaminant bioaccumulation. Several types of equipment used for treatment of

Spartina may present opportunities for petroleum spills. Equipment used in *Spartina* control activities include:

- Air boats and outboard motor boats
- Offroad Vehicles (ATV, Side-by-Side, Amphibious Vehicles)

FUELING

Fueling of land-based excavators should be done offsite at fueling stations or suitable staging areas. A suitable staging area shall be equipped with sufficient protection to prohibit a petroleum spill from migrating beyond the immediate fueling area (e.g., an impermeable plastic tarp set between raised berms, a catch basin or similar portable device).

Water-based excavators, airboats and outboard motorboats shall be fueled offsite at commercial fueling stations or designated locations such as equipment maintenance yards. When fueling is done on or adjacent to treatment sites, a spill prevention and response plan must be prepared and implemented.

Gas powered, handheld machinery *(e.g., brushcutters)* shall be refueled on a non-absorbent tarp or mat placed under machinery to catch any spills. In addition to spills during refueling operations, small amounts of oil or fuel may leak from improperly maintained equipment. Before using any equipment in the marsh, check to make sure that it is in good working order with no signs of leakage or corrosion that might indicate the potential for inadvertent spills on the work site. Transport vessels and vehicles, and other equipment (e.g., mower, pumps, etc.) shall not be serviced or fueled in the field except under emergency conditions.

Under all circumstances, it is the responsibility of the applicator to assure that all precautions are taken prior to initiating work to assure protection of water quality and the environment. The applicator is also responsible for the provision of a Spill Response Kit that is appropriate for the work being undertaken.

- Vice grip pliers
- Phillips head screwdriver (2)
- Shovels
- Brooms, dustpan
- Clay granules or a sawdust
- Activated charcoal or other appropriate absorbent material
- Tyvek coveralls (2 pair) or neoprene coveralls
- First aid kit
- Recovery drums
- DOT triangular reflector kit
- Source of clean water and soap
- In the case of refueling or mixing activities planned on open mudflats the spill response kit should include a portable wet vacuum or other pumping equipment

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PREVENTING SPILLS

The following procedures will help to minimize the risk of spills occurring:

- Keep bags and cardboard containers dry at all times
- Prevent or correct leaks in herbicide containers and application equipment
- Properly dispose of all empty pesticide containers
- Tie down or otherwise secure containers when transporting pesticides to prevent them from falling from a vehicle
- Store herbicides only in their original containers or properly labeled service containers
- Stay alert and attentive when handling or using herbicides where on-site or in-field transfer of liquid chemicals (herbicide mixtures, fueling operations) are planned.

CONTAINING & PREVENTING *SPARTINA* SPREAD

Sanitation measures will be used by all crews to prevent the spread of invasive *Spartina* propagules (reproductive plant parts such as seeds or roots) from known impacted areas. Measures will include:

1. Ensuring all equipment and personal gear arrives and departs the work site in a clean condition and is maintained free of fluid leaks and aquatic plants and animals, especially invasive species.
2. Applying the principles of Clean, Drain, Dry to minimize disturbance and prevent propagule spread of aquatic invasive species:
    - Clean: Absent visible Aquatic Invasive Species or attached vegetation, dirt, debris or surface deposits including mussel shells or residue on the watercraft, trailer, outdrive or equipment that could mask the presence of attached mussels, or other aquatic invasive species;
    - Drain: To the extent practical, all water drained from any live-well, bait-well, storage compartment, bilge area, engine compartment, deck, ballast tank, water storage and delivery systems, cooler or other water storage area on the watercraft, trailer, engine or equipment; and,
    - Dry: No visible sign of standing water, or in the case of equipment, wetness on or in the watercraft, trailer, engine or equipment.
3. Wash, refuel, service machinery, and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances or invasive species from entering the water.
4. Brush sand, mud or other debris off boot treads, booties, and waders before leaving a *Spartina* impacted area. Brushing-off should ideally be done over a rough surface, such as gravel, away from any flat pavement, waterbody, or stormwater drains to ensure any removed plant material cannot spread into any suitable habitat.
5. Before surveying new sites or changing geographical areas, boot treads, booties, or waders are washed thoroughly a second time off-site.
6. When conducting mechanical removals, transport *Spartina* plant material in a contained vessel to prevent spread and introduction of propagules to new areas.
7. Dispose of removed *Spartina* plant material in a manner that will not permit regeneration or spread to a new location, such as by disposal at the nearest local landfill with material slated for burial. At remote sites, covered burial may be done on-site upland of the highest high-water mark and allowed to decompose in-situ, this may include obtaining special permission from landowners or property managers.

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SPARTINA CONTROL IN SENSITIVE AREAS

Spartina control activity areas include sensitive wildlife habitat and species, First Nations use, aquaculture activities and public recreation areas. Descriptions and proposed mitigation strategies for each of these sensitive components include:

SENSITIVE WILDLIFE HABITAT AND SPECIES

All of Boundary Bay, Roberts Bank and Sturgeon Bank are part of a RAMSAR wetland designation, Western Shorebird Reserve Network designation, and Wildlife Management Area thereby demonstrating the critical value of these areas to wildlife. The manager of these sites (FOR) recognizes the importance of removing *Spartina* from the area to ensure these areas continue to provide the critical habitat for migratory birds. Sites of rare and endangered wildlife species and habitats are detailed in Appendix 3. Within 500 m three different red and blue listed ecological communities can be found, two species of invertebrate, five vascular plants and two vertebrate animals. All the rare ecological community occurrences within 500 m of *Spartina* are within a provincial and regional parks, prior to *Spartina* control activities the park staff will be engaged. Sand-verbena Moth and Yellow Sand-verbena are both associated with rare ecological communities protected by provincial and regional parks. The BC SWG will work with parks staff and ecosystems efforts to minimize disturbance to these species and habitats should *Spartina* occur there. Currently the closest *Spartina* plant location is > 200 m. Green Heron have an occurrence within 50 m of *Spartina*. Crews will watch for any birds, especially if endangered and rare, that are nesting, feeding or migrating and will adjust the work plan accordingly.

Core Strategies to mitigate the impact on these species include:

1. No herbicide application at the sites when these species are present. At lowest tide, the bird species (green heron, double crested cormorant, great blue heron (Fannini subspecies), Brant) have limited use of the sites.
2. For herbicide treatments of nearby *Spartina*, low drift nozzles and pressure techniques in addition to wind shrouding will minimize any potential drift to sensitive plants and habitats.
3. For herbicide treatments, digging, and mapping, crews will, within reasonable means, avoid walking through these sensitive habitats. If necessary, crews may walk the perimeter of these habitats.
4. *Spartina* digging should also minimize disturbance to any wildlife and plants.
5. Apply herbicide at the label rate which has a low toxicity to vertebrate bird species (green heron, double crested cormorant, great blue heron (Fannini subspecies), Brant) and invertebrate species (Audouin's Nightstalking Beetle).
6. Henderson's checker mallow occurs higher in the tidal zone than *Spartina*, and more than 150m from the nearest *Spartina* plant. Washington Springbeauty, Roell's Brotherella, Needle-leaved Navarretia, Black Knotweed, Vancouver Island Beggarticks, Yellow Sand-verbena,and Chaffweed also occur more than 150m from the nearest *Spartina* plant. Therefore, herbicide application for *Spartina* can occur without any impact on this species. However, should *Spartina* be next to any of these existing plants, no herbicide application will occur.

FIRST NATIONS CULTURALLY SIGNIFICANT AREAS

The intertidal foreshore was and continues to be an important area for First Nations food, social and ceremonial purposes. During the consultation process for the provincial Pesticide Use Permit (PUP), First Nations are consulted to document concerns and recommendations for the *Spartina* control program. The BC SWG continues meaningful engagement throughout the PUP duration and delivery of *Spartina* control activities for capacity building of both

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First Nations communities and the eradication program. First Nations community members have local knowledge and expertise that can improve *Spartina* detection and response. *Spartina* control activities such as mapping, mechanical and chemical treatments involve First Nations in the planning and implementation to ensure activities do not negatively impact First Nation's rights and interests in areas where *Spartina* occurs.

AQUACULTURE ACTIVITIES

In the event that *Spartina* management activities interface with intertidal cultivated or wild aquatic (shellfish or plant) tenures or licenses, specific and relevant consultation related to each intertidal harvest operation will occur in collaboration with the Aquaculture Division, B.C. Ministry of Water, Lands, and Resource Stewardship to ensure the impact of *Spartina* treatments to aquaculture and food collection are minimized.

S. patens and *S. densiflora* infestations are typically nearby but not within existing tenures. In 2022, 47 tenures occurred are within 1000 m of *S. patens* in the Baynes Sound and Comox Estuary; three tenures were located within 100 m of *S. patens* in the Comox estuary and only one aquaculture tenure had *S. patens* within the tenure boundary. Six of the seven tenures within 1000 m of *S. patens* were located within "Area 14 - Pacific Region Sanitary Closures - Closure 14.1"[2] which has had an annual closure since February 2014 (Appendix 4). However, some shellfish harvesters have obtained exemptions to the closure via DFO granted depuration permits (permits that require additional shellfish sanitation pre-consumption). Imazapyr has a low bioaccumulation factor (BAF) of 3, suggesting low potential for bioconcentration in aquatic organisms (Leson & Associates 2005). The US Environmental Protection Agency (EPA) considers compounds with a BAF less than 100 to have a low bioaccumulation potential. Proposed *Spartina* herbicide treatments present a low risk of impact to aquaculture due to the low herbicide application rate, preventing imazapyr from bioaccumulating in shellfish tissue, the low number of tenures within a 100 m proximity of an aquaculture tenure, and the additional steps for sanitation required by DFO for harvest in the Comox Estuary Closure. The *Spartina* Program will engage with registered, active aquaculture and plant harvesters within or immediately adjacent to *Spartina* sites proposed for herbicide treatment to ensure the impact of *Spartina* treatments to aquaculture and food collection are minimized.

S. anglica typically interfaces with a single license issued for the collection of *Salicornia* plants in Boundary Bay. The BC SWG, led by FOR and Ducks Unlimited Canada, completes an annual spatial interface analysis to identify the sites and total area where *Salicornia* occurs within one metre of *Spartina*. Based on this analysis, there are 231.6 ha of *Salicornia* in Boundary Bay, 1.1 ha of which is intermixed with *Spartina*. The *Spartina* Program works in partnership with provincial permitting agencies to engage with the harvester annually to plan when herbicide treatments will occur, minimizing the impact *Spartina* herbicide treatments have on the *Salicornia* harvest while still effectively controlling *S. anglica* populations in Boundary Bay.

There is also typically one license issued for the collection of Salicornia plants in Baynes' Sound. Again, the BC SWG works with provincial permitting agencies and the harvester to minimize the impact *Spartina* treatments have on Salicornia harvest while still effectively controlling and reducing *Spartina* populations.

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PUBLIC RECREATION AREAS

The proposed herbicide application has potential to overlap areas used by birders, cyclists, joggers, pedestrians, and users of beaches and parks (Appendix 5a, Appendix 5b). To minimize risks to the public, mitigation measures for herbicide treatment methods will be implemented in treatment activities. Such measures include, but are not limited to, the following:

1. Post signs at access points at least 24 hours prior to treatment. The signs should inform the public that the area will be sprayed with Habitat Aqua herbicide for invasive *Spartina* spp. control, advise "no entry" for humans and animals for 48 hours after treatment, and the treatment date and time should be stated. A 24-hour contact number may be provided. Signs will be removed at least 14 days after treatment of an area to avoid misleading public concern and plastic sign pollution.
2. Not all access points are documented in this treatment plan and some areas of shoreline have unlimited accessibility; signage will be posted in the most-likely locations viewed by the public.
3. Clearly mark treatment areas by visibly identifiable means.
4. Minimize drift. Manage herbicide application to minimize potential for herbicide drift. Herbicide must not be applied when winds are in excess of 20 km per hour, inversion conditions exist, or wind could carry spray drift into inhabited areas.
5. Avoid application within 24 hours of high use areas/periods, such as weekends or certain holidays.

MONITORING

Annual mapping will occur prior to treatment and the following year after treatment to evaluate efficacy and ensure treatment applications are containing and reducing *Spartina* populations. In addition, visual inspections are made at several sites months after treatment, to monitor that the plants are succumbing to treatment. The results will appear in annual reporting provided by the BC SWG.

Mapped *Spartina* plants represented as points

Hectare Grid Cell showing the total number of plants in each cell representing total abundance

Site Summary (site boundary shown in red)

Figure 3. *Spartina* invasion tracking and evaluation analyses

To effectively track and convey the status of the *Spartina* invasion a few different metrics are used.

1. the number of plants detected;
2. the size of those plants (single seedling, clone <0.3m, clone 0.3m - 1.0m, clone > 1.0m in diameter, or 5m area of single plants);

3. the estimated leaf area (size x number of plants = ~ how many square meters a dispersed population would occupy if all *Spartina* plants were grouped together);
4. how much shoreline is impacted (a measure of how many 1-hectare (Ha) grid cells had one or more *Spartina* occurrence points); and
5. Site level reporting (a roll up of metrics 1 - 4 at the site level)

These numbers are evaluated at the species level across the province, by region, and the site level. Tracking and reporting across all these metrics gives a better indication of the species status/control progress provincially while lending insights to site specific nuances. Additionally, after herbicide treatment crews walk through and flag any plants that were missed for follow up treatment. Throughout the season a site is returned to two or three times to check for new plants and observe signs of herbicide efficacy.

CONTROL PROGRESS TO DATE

The additional information collected by crews can be used to guide project efforts. For example, the area impacted might decline while the number of plants in the lowest size class increases, which shows that the containment boundary is getting smaller but there is likely a seedbank or seed source generating many new small plants. Size class information can give important information about the stage of invasion. Due to the colonial nature of *S. patens* and *S. anglica*, there is a trend toward smaller size classes of plants as the population is reduced and larger colonies break up. This can cause misleading statistics, as the abundance of plants may appear to increase as large colonies, once mapped as single patches, break up into a series of smaller patches or individuals. This can be visualized for each species (below; figures 4-9). Metrics like impacted area can also help to visualize containment. The results so far are indicative of progress being made in the *Spartina* control program as a result of an integrated pest management approach.

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SPARTINA ANGLICA

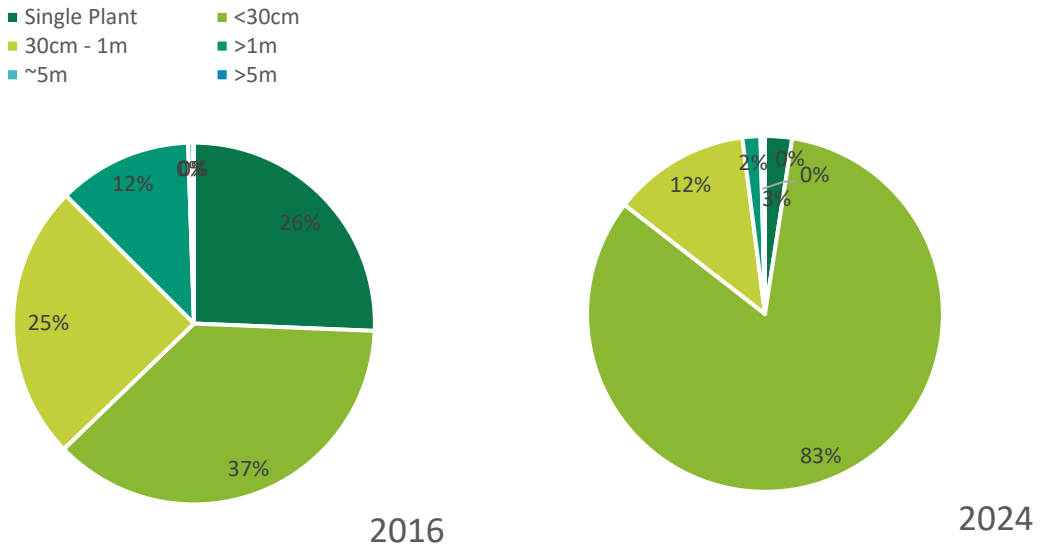

Figure 4. Proportions of *S. anglica* plants found in BC of different size classes, in 2016 and 2024.

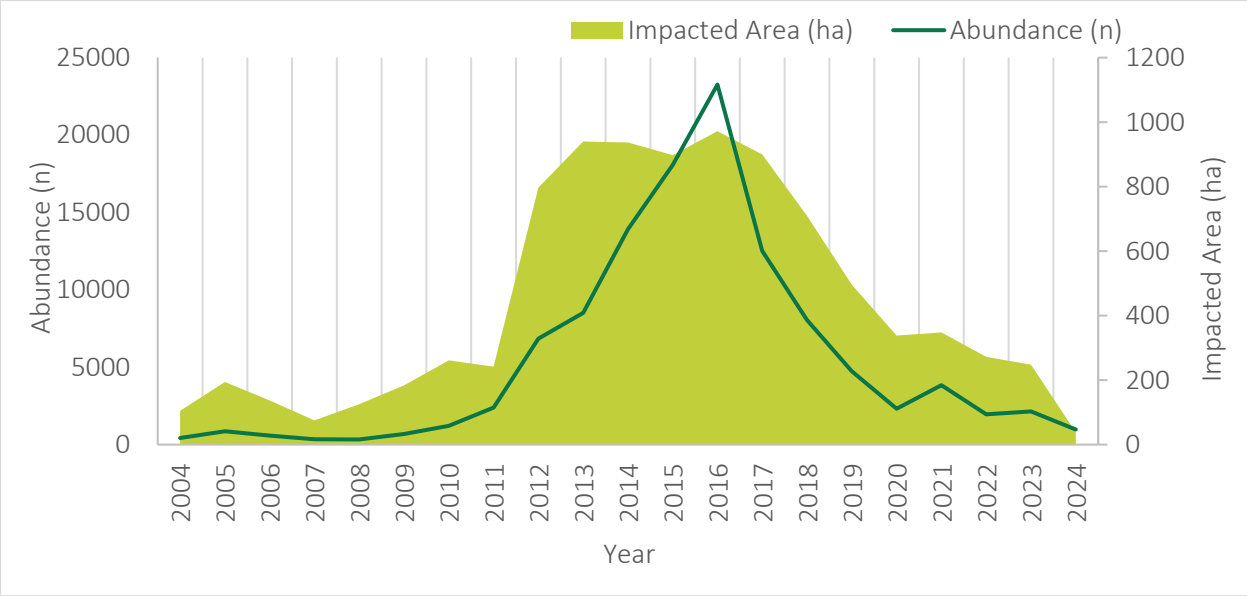

FIGURE 5. *S. ANGLICA* IMPACTED AREA AND ABUNDANCE IN BC SINCE 2004.

SPARTINA DENSIFLORA

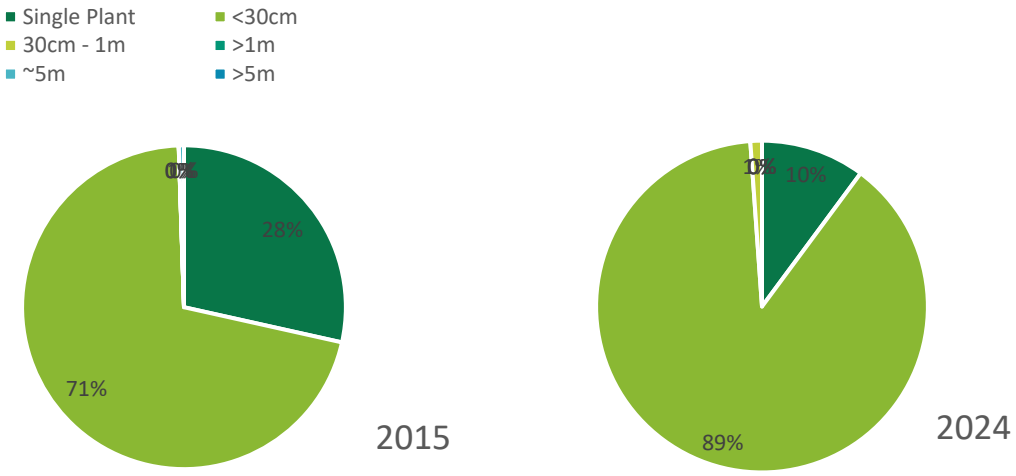

Figure 6. Proportions of *S. densiflora* plants found in BC of different size classes, in 2015 and 2024.

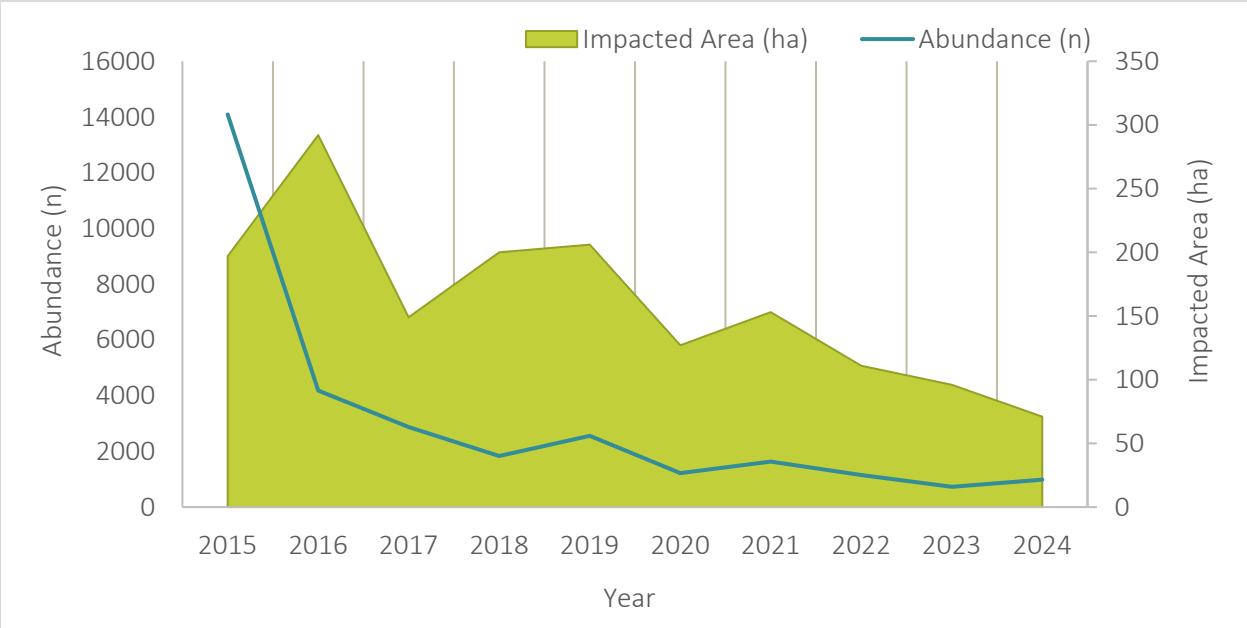

Figure 7. *S. densiflora* impacted area and abundance in BC since 2015.

SPARTINA PATENS

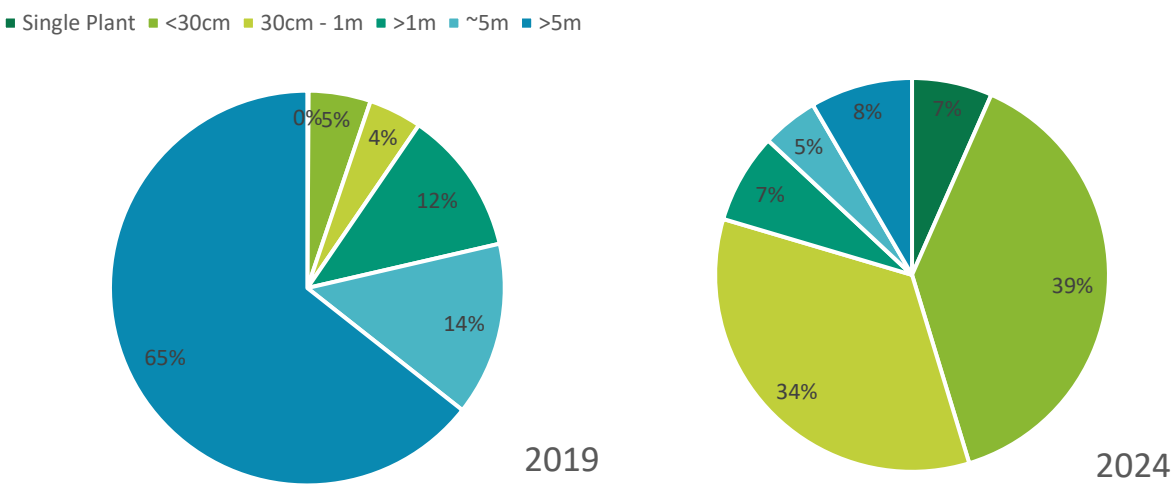

Figure 8. Proportions of *S. patens* plants found in BC of different size classes, in 2019 and 2024.

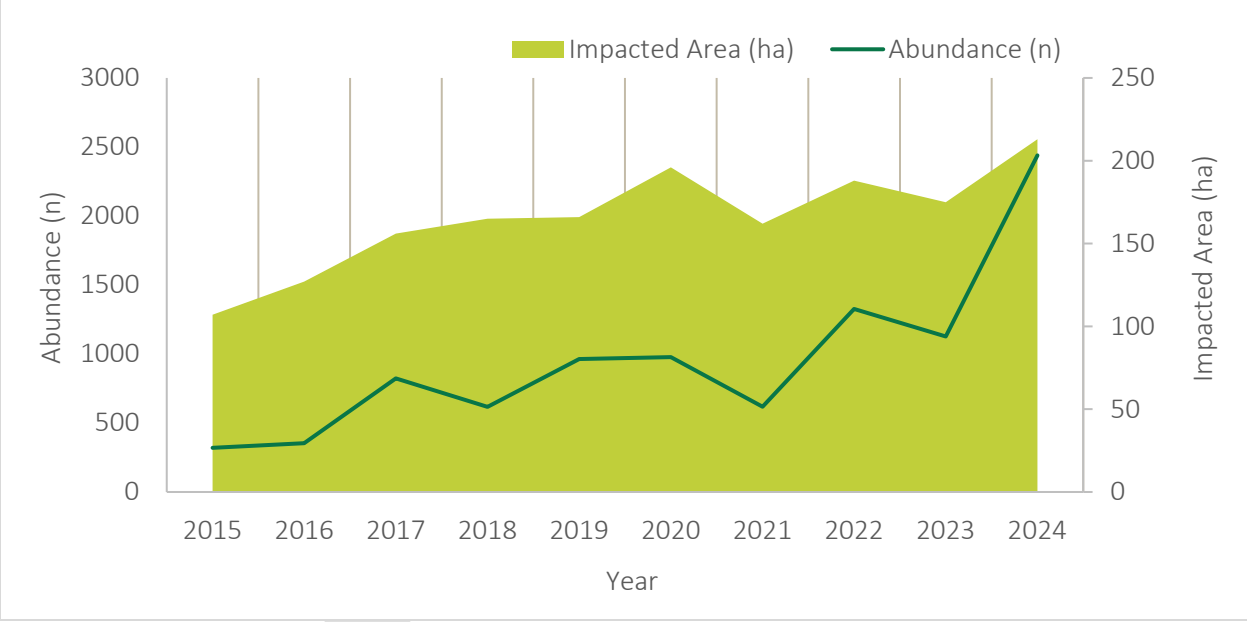

Figure 9. *S. patens* impacted area and abundance in BC since 2015.

COMMUNICATION

A sandwich board sign is placed at work sites and along paths while mapping or spraying *Spartina* with information on what *Spartina* is, how it is treated, and where to get more info.

A notice of the Pesticide Use Permit issued is published in at least one community newspaper circulated within each treatment area. The notice details the permit holder, number, method of application, treatment area, pesticide being used, dates for commencement and completion of the work and information on how the public can contact the permit holder to obtain any related pesticide information.

The FOR Invasive Plant Program maintains project information on a public website on an ongoing basis, including annual management plans, active Pesticide Use Permits, maps of proposed treatment areas, Frequently Asked Questions, and reporting options.

Pesticide treatment area boundaries are clearly marked with flags and accompanied by signs that explain what the flags mean.

At least 24 hours prior to any herbicide treatment, pesticide use signs are posted at main access points to the treatment area advising of future pesticide use. The signs include information on treatment timing, locations, precautions, and contact information. The signs remain in place for a period of two weeks after pesticide application.

Detailed information on proposed, current and past management activities are available upon request. This information is also located in the publicly accessible provincial invasive plant mapping application, Invasives BC (https://invasivesbc.gov.bc.ca/Map). Ducks Unlimited Canada and the Ministry of Forests will continue to respond to requests for information and oversee the general *Spartina* control program on behalf of the BC *Spartina* Working Group, which includes mapping, treatment (herbicide, mechanical) and monitoring.

Annual progress reports are available online at www. spartina.ca.

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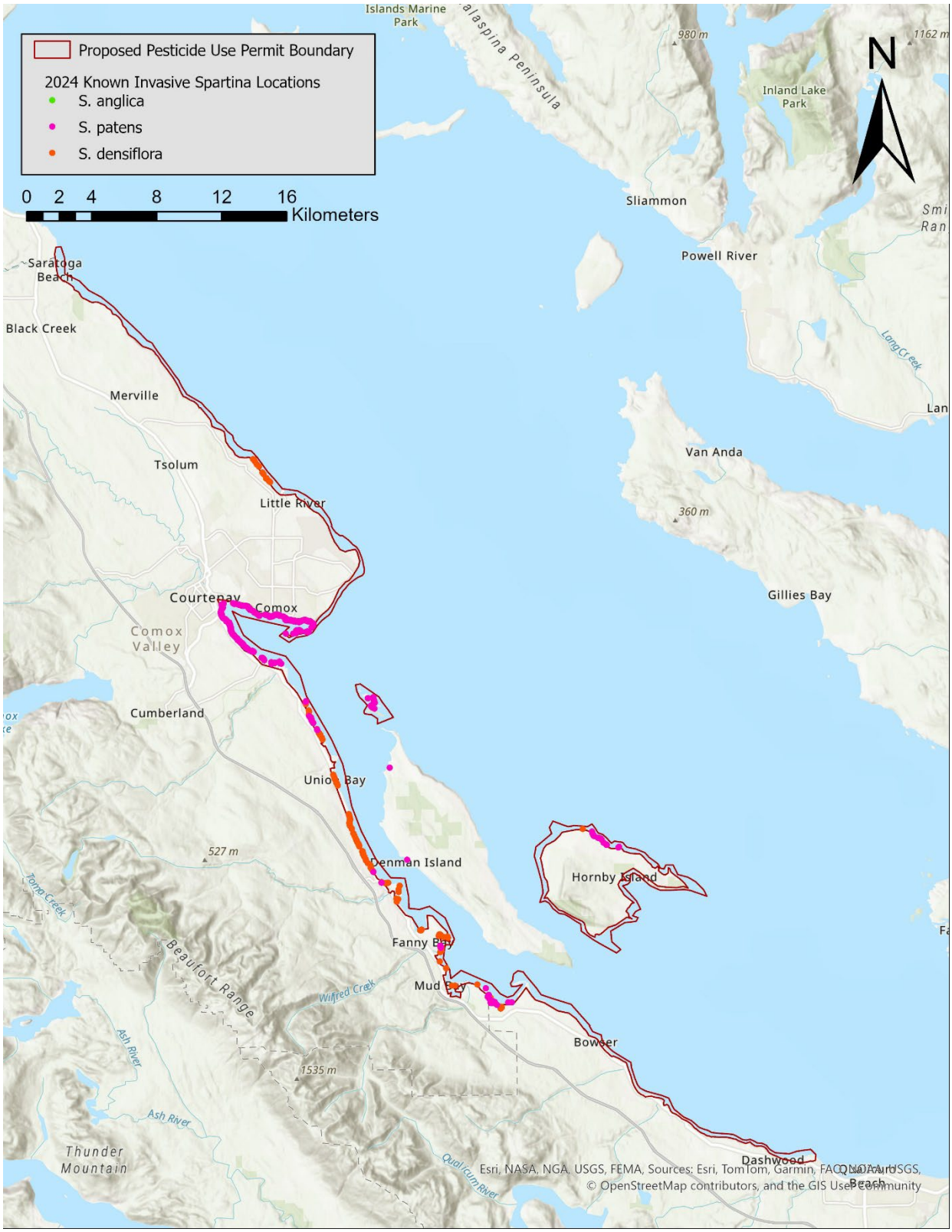
APPENDIX 1 – PROPOSED 2025-28 *SPARTINA* TREATMENT AREAS IN THE LOWER MAINLAND

B.C. *Spartina* Treatment Plan

APPENDIX 2-PROPOSED 2025-28 *SPARTINA* TREATMENT AREAS IN BAYNES' SOUND



APPENDIX 3A – RECORDED INCIDENCES OF RARE AND ENDANDEGERED SPECIES AND HABITATS IN PROXIMITY TO *SPARTINA SPP.*

		Baynes' Sound		Lower Mainland	
ENGLISH NAME	**SCIENTIFIC NAME**	**# of CDC Occurences**	**Minimum Distance to Nearest *Spartina* Plant (m)**	**# of CDC Occurences**	**Minimum Distance to Nearest *Spartina* Plant (m)**
Ecological Community					
Garry oak / California brome	*Quercus garryana / Bromus carinatus*	2	4704.6		
Trembling Aspen / Pacific Crab Apple / Slough Sedge	*Populus tremuloides / Malus fusca / Carex obnupta*	2	6856.13		
Douglas-fir / Alaska Oniongrass	*Pseudotsuga menziesii / Melica subulata*	1	6602.22		
Northern Wormwood - Red Fescue / Grey Rock-moss	*Artemisia campestris - Festuca rubra / Racomitrium canescens*	1	71.24	1	572.59
Large-headed Sedge Herbaceous Vegetation	*Carex macrocephala Herbaceous Vegetation*			3	229.25
Dune Wildrye - Beach Pea	*Leymus mollis ssp. mollis - Lathyrus japonicus*			3	45.04
Vertebrate Animals					
Brant	*Branta bernicla*	1	1023.49		
Western Screech-owl, Kennicottii Subspecies	*Megascops kennicottii kennicottii*	1	8413.64		
Great Blue Heron, Fannini Subspecies	*Ardea herodias fannini*	3	459.31	2	4741.56
Green Heron	*Butorides virescens*			4	35.96
Painted Turtle - Pacific Coast Population	*Chrysemys picta*			2	4065.53
Double-crested Cormorant	*Phalacrocorax auritus*			1	1318.25
Invertebrate Animals					
Common Woodnymph, Incana Subspecies	*Cercyonis pegala incana*	1	3555.82		
Edith's Checkerspot, Taylori Subspecies	*Euphydryas editha taylori*	2	7458.37		
Propertius Duskywing	*Erynnis propertius*	2	5851.79		
Sand-verbena Moth	*Copablepharon fuscum*	2	169.52		
Dun Skipper	*Euphyes vestris*	1	6734.61		
Threaded Vertigo	*Nearctula sp.*	1	1936.41		
Blue Dasher	*Pachydiplax longipennis*			1	5374.35
Audouin's Night-stalking Tiger Beetle	*Omus audouini*			2	495.62
Autumn Meadowhawk	*Sympetrum vicinum*			1	7475.96
Johnson's Hairstreak	*Callophrys johnsoni*			1	4051.98
Nonvascular Plants					
Banded Cord-moss	*Entosthodon fascicularis*	1	6316.76		
Roell's Brotherella	*Brotherella roellii*			3	950.9
Vascular Plants					
Henderson's Checker-mallow	*Sidalcea hendersonii*	2	86.09		
Nuttall's Quillwort	*Isoetes nuttallii*	2	5089.6		
Coastal Wood Fern	*Dryopteris arguta*	3	4247.2		

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Yellow Sand-verbena	*Abronia latifolia*	2	449.75		
Black Knotweed	*Polygonum paronychia*	1	218.77		
Fragrant Popcornflower	*Plagiobothrys figuratus ssp. figuratus*	1	5079.97		
White-top Aster	*Sericocarpus rigidus*	1	7004		
Yellow Montane Violet	*Viola praemorsa var. praemorsa*	1	5816.55		
Chamisso's Montia	Montia chamissoi	1	902.76		
Coast Microseris	Microseris bigelovii	1	6620.64		
Macoun's Meadow-foam	Limnanthes macounii	1	6326.48		
Vancouver Island Beggarticks	Bidens amplissima	1	464.22	5	332.1
Washington Springbeauty	Claytonia washingtoniana			1	7791.65
Vancouver Island Beggarticks	Bidens amplissima			5	332.1
Near Navarretia	Navarretia propinqua			1	7224.4

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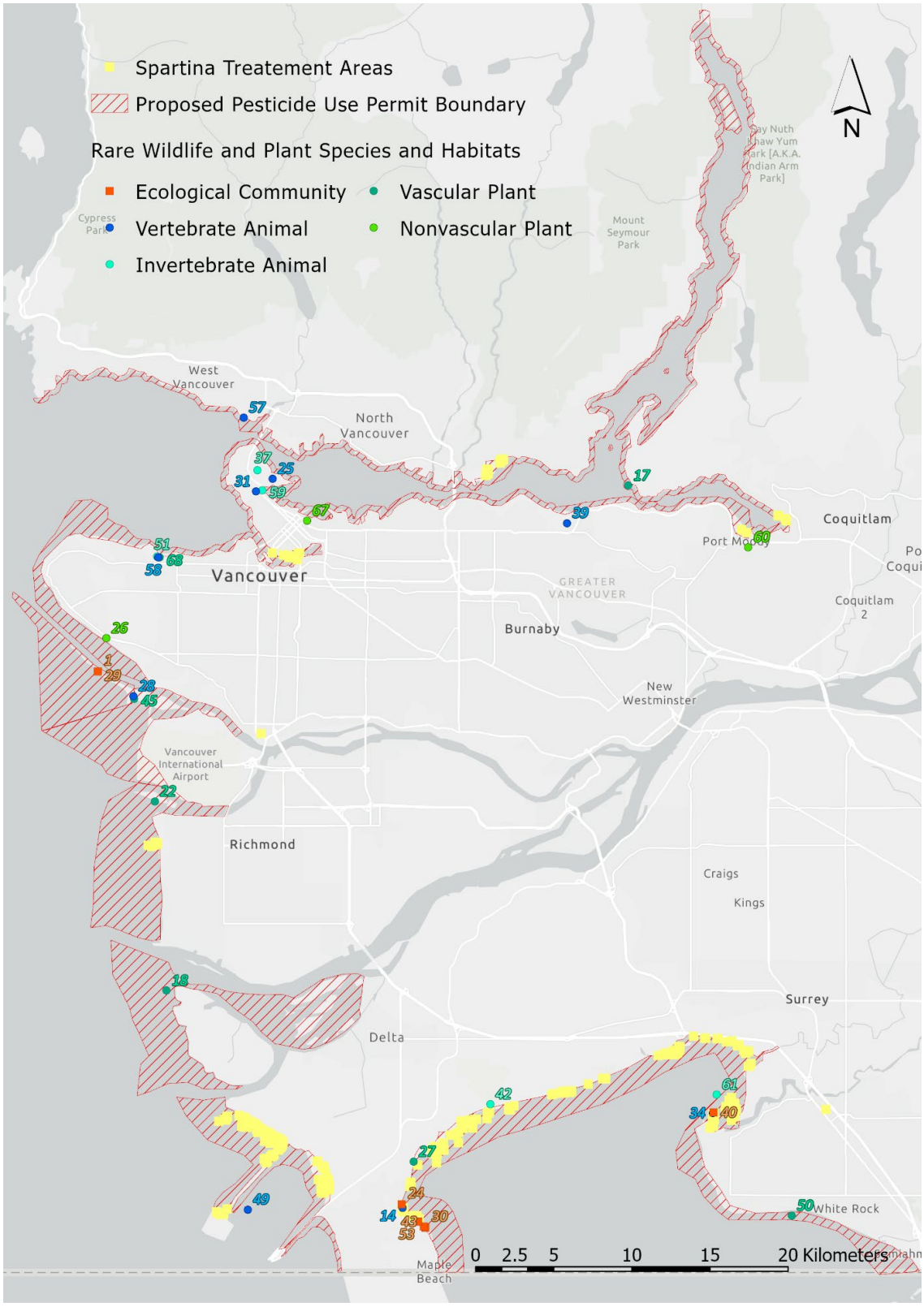
APPENDIX 3B – RECORDED INCIDENCES OF RARE AND ENDANGERED SPECIES IN THE LOWER MAINLAND (C.D.C)



B.C. *Spartina* Treatment Plan

ID	NAME	TYPE
1	Large-headed Sedge Herbaceous Vegetation	Ecological Community
14	Green Heron	Vertebrate Animal
17	Washington Springbeauty	Vascular Plant
18	Vancouver Island Beggarticks	Vascular Plant
22	Vancouver Island Beggarticks	Vascular Plant
24	Large-headed Sedge Herbaceous Vegetation	Ecological Community
25	Great Blue Heron, Fannini Subspecies	Vertebrate Animal
26	Roell's Brotherella	Non-Vascular Plant
27	Vancouver Island Beggarticks	Vascular Plant
28	Painted Turtle - Pacific Coast Population	Vertebrate Animal
29	Dune Wildrye - Beach Pea	Ecological Community
30	Large-headed Sedge Herbaceous Vegetation	Ecological Community
31	Painted Turtle - Pacific Coast Population	Vertebrate Animal
34	Green Heron	Vertebrate Animal
37	Blue Dasher	Invertebrate Animal
39	Great Blue Heron, Fannini Subspecies	Vertebrate Animal
40	Dune Wildrye - Beach Pea	Ecological Community
42	Audouin's Night-stalking Tiger Beetle	Invertebrate Animal
43	Northern Wormwood - Red Fescue / Grey Rock-moss	Ecological Community
45	Vancouver Island Beggarticks	Vascular Plant
49	Double-crested Cormorant	Vertebrate Animal
50	Near Navarretia	Vascular Plant
51	Autumn Meadowhawk	Invertebrate Animal
53	Dune Wildrye - Beach Pea	Ecological Community
57	Green Heron	Vertebrate Animal
58	Green Heron	Vertebrate Animal
59	Johnson's Hairstreak	Invertebrate Animal
60	Roell's Brotherella	Non-Vascular Plant
61	Audouin's Night-stalking Tiger Beetle	Invertebrate Animal
67	Roell's Brotherella	Non-Vascular Plant
68	Vancouver Island Beggarticks	Vascular Plant

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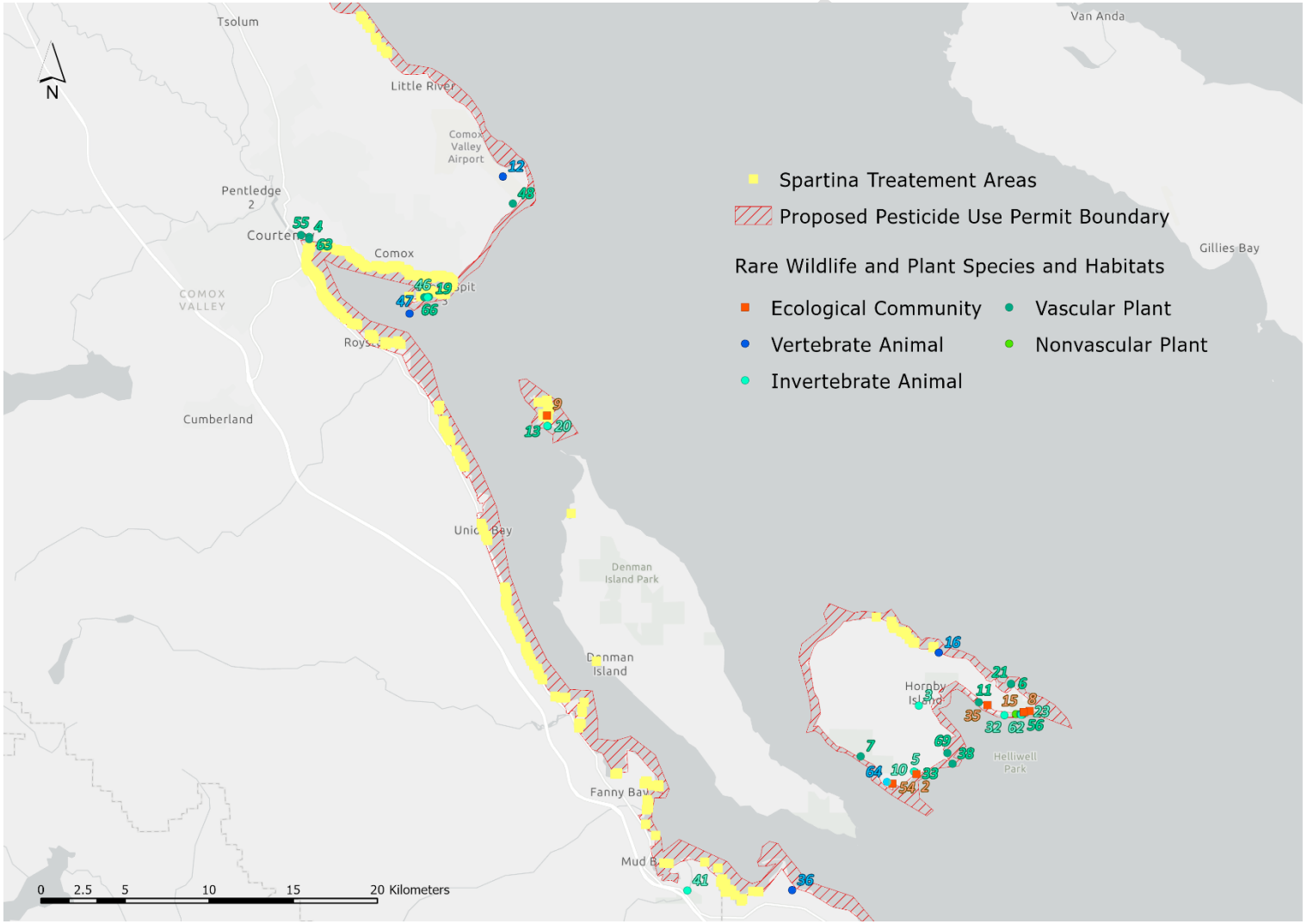
APPENDIX 3C – RECORDED INCIDENCE OF RARE AND ENDANGERED SPECIES ON THE EAST COAST OF VANCOUVER ISLAND (C.D.C)



B.C. *Spartina* Treatment Plan

ID	NAME	TYPE
2	Garry oak / California brome	Ecological Community
3	Common Woodnymph, Incana Subspecies	Invertebrate Animal
4	Edith's Checkerspot, Taylori Subspecies	Invertebrate Animal
4	Henderson's Checker-mallow	Vascular Plant
6	Nuttall's Quillwort	Vascular Plant
7	Coastal Wood Fern	Vascular Plant
8	Trembling Aspen / Pacific Crab Apple / Slough Sedge	Ecological Community
9	Northern Wormwood - Red Fescue / Grey Rock-moss	Ecological Community
10	Propertius Duskywing	Invertebrate Animal
11	Coastal Wood Fern	Vascular Plant
12	Great Blue Heron, Fannini Subspecies	Vertebrate Animal
13	Yellow Sand-verbena	Vascular Plant
15	Douglas-fir / Alaska Oniongrass	Ecological Community
16	Great Blue Heron, Fannini Subspecies	Vertebrate Animal
19	Black Knotweed	Vascular Plant
20	Sand-verbena Moth	Invertebrate Animal
21	Fragrant Popcornflower	Vascular Plant
23	Dun Skipper	Invertebrate Animal
32	Propertius Duskywing	Invertebrate Animal
33	Coastal Wood Fern	Vascular Plant
35	Garry oak / California brome	Ecological Community
36	Great Blue Heron, Fannini Subspecies	Vertebrate Animal
38	White-top Aster	Vascular Plant
41	Threaded Vertigo	Invertebrate Animal
44	Yellow Sand-verbena	Vascular Plant
46	Sand-verbena Moth	Invertebrate Animal
47	Brant	Vertebrate Animal
48	Yellow Montane Violet	Vascular Plant
52	Nuttall's Quillwort	Vascular Plant
54	Trembling Aspen / Pacific Crab Apple / Slough Sedge	Ecological Community
55	Chamisso's Montia	Vascular Plant
56	Coast Microseris	Vascular Plant
62	Edith's Checkerspot, Taylori Subspecies	Invertebrate Animal
63	Vancouver Island Beggarticks	Vascular Plant
64	Western Screech-owl, Kennicottii Subspecies	Vertebrate Animal
65	Banded Cord-moss	Non-Vascular Plant
66	Henderson's Checker-mallow	Vascular Plant
69	Macoun's Meadow-foam	Vascular Plant

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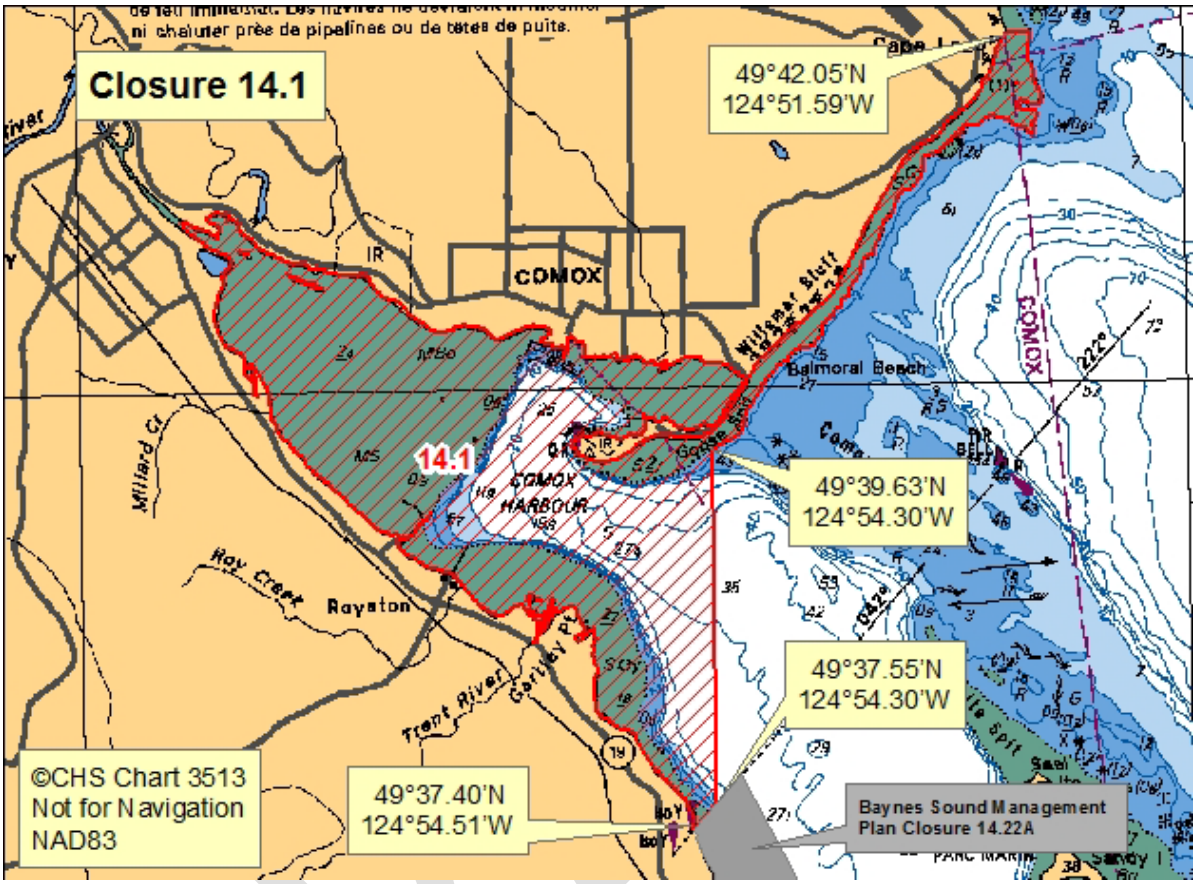
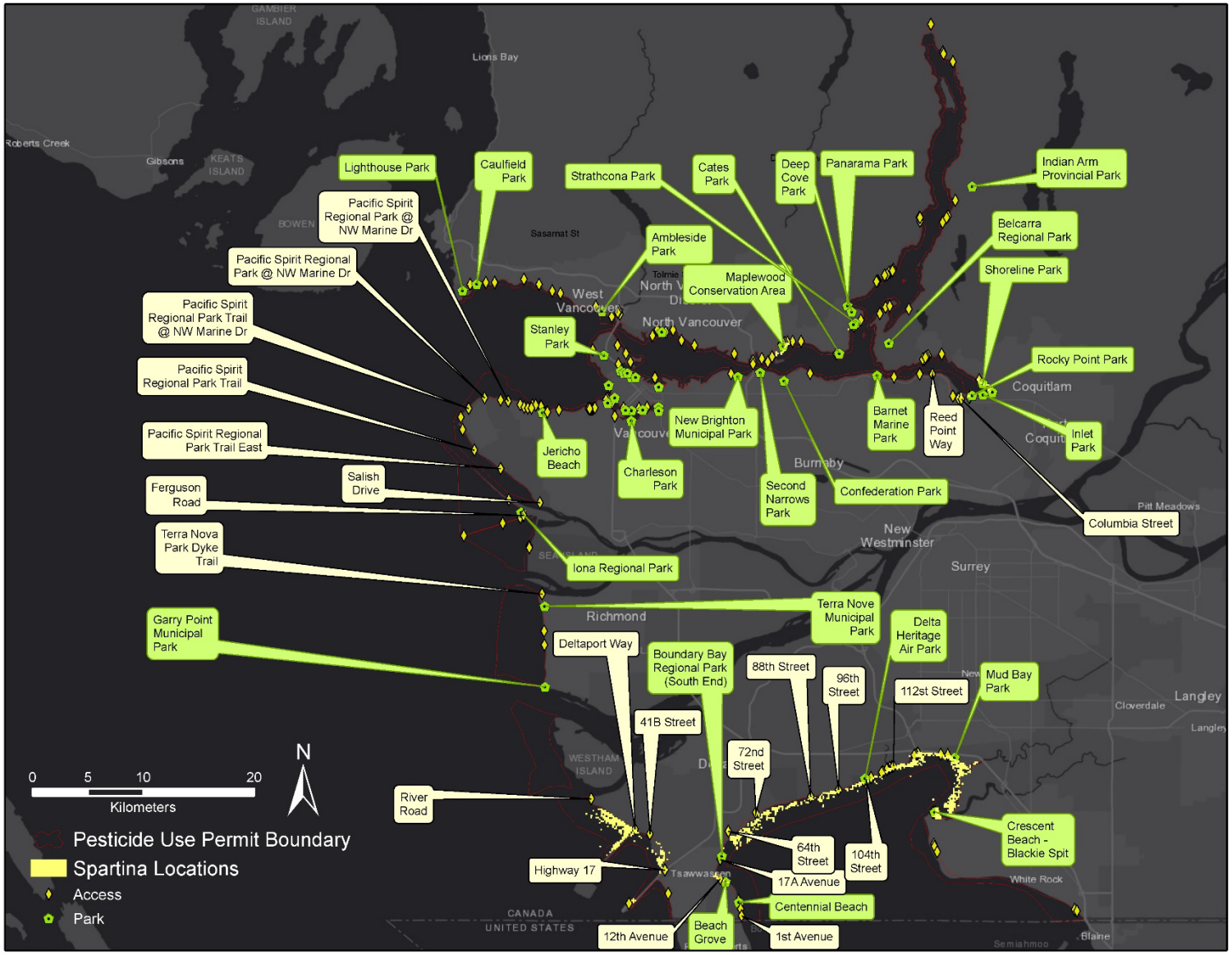
APPENDIX 4 – SHELLFISH HARVEST SANITARY CLOSURES IN THE COMOX HARBOUR3



"The waters and intertidal foreshore of Comox Harbour lying inside a line drawn from the point on land at the range markers at 49°37.40' north latitude and 124°54.51' west longitude, south of Gartley Point, thence seaward northeasterly to a point in water at 49°37.55' north latitude and 124°54.30' west longitude, thence due north towards the road entrance gate to HMCS Quadra on Goose Spit to a point in water at 49°39.63' north latitude and 124°54.30' west longitude, thence extending northeasterly along the low water mark to the first prominent point of land at the south end of Cape Lazo at 49°42.05' north latitude and 124°51.59' west longitude. [NAD83]"

[3] [Map retrieved from: http://www.pac.dfo-mpo.gc.ca/fm-gp/contamination/sani/area-secteur-14/14.1-eng.html]

APPENDIX 5A – PUBLIC ACCESS AND PARKS IN THE LOWER MAINLAND AROUND THE PROPOSED PUP BOUNDARY



APPENDIX 5B – PUBLIC ACCESS AND PARKS ON THE EAST COAST OF VANCOUVER ISLAND NEAR THE PUP BOUNDARY

B.C. Intertidal Perennial Pepperweed Treatment Plan

ADDENDUM – Perennial Pepperweed Intertidal Treatment Plan

BACKGROUND

Perennial pepperweed (*Lepidium latifolium*) is an invasive perennial, peppergrass with stout rhizomes. This species is a candidate for provincial eradication because it poses significant risks to BC and current presence is limited. It reproduces by seed and root fragments and spreads by a variety of vectors, including ocean currents. Perennial pepperweed can occur in a variety of habitats but prefers moist soil in freshwater or tidal riparian areas. This plant can reduce crop yields, available forage, and plant biodiversity, and can significantly impact sensitive intertidal plant communities.

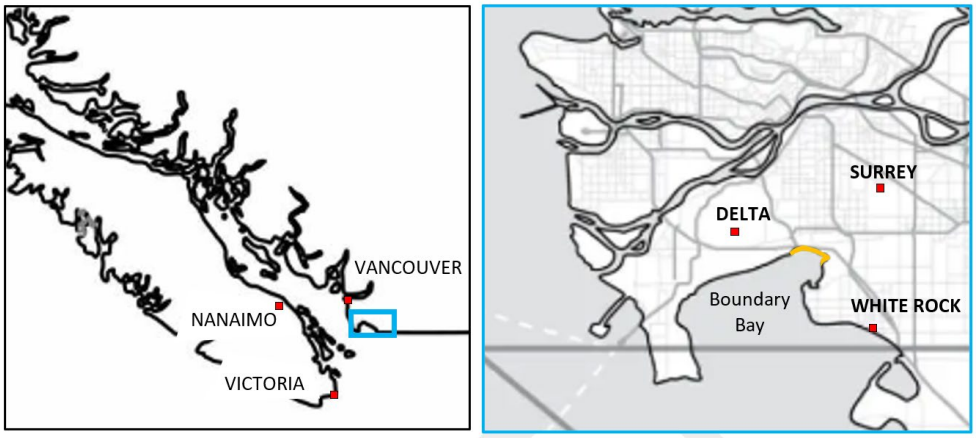
Perennial pepperweed was detected in the intertidal areas of Boundary Bay in 2023, one of only two populations known in the Lower Mainland and the only intertidal population known in B.C. The population was treated annually in 2023 and 2024 using a combination of mechanical and chemical treatment methods, determined by proximity to the high-water mark. Those occurrences treated chemically have declined in area and density. Impacted areas in the Pesticide Free Zone were controlled using manual digging methods, these occurrences have continued to expand. Including these limited Perennial pepperweed occurrences in the Spartina Pesticide Use Permit (PUP) will ensure that the progress towards healthy intertidal ecosystems, made under past PUPs, will be protected and continued.

PERENNIAL PEPPERWEED OVERVIEW

Table 1. Perennial pepperweed Intertidal Ecology and Status in BC, Dec. 31, 2024.

Ecology	*Lepidium latifolium* (perennial pepperweed)
Location in BC	Boundary Bay (east portion only)
Tidal Range	High marsh to mid-intertidal;
Growth Pattern	Grows in tufts and expands via rhizomes
Impacted Area (ha)	1.14
Distribution	Several well - spaced patches or clumps of species and several sporadically occurring individuals or clumps of species

Figure 1. General intertidal locations where Perennial pepperweed is found in B.C.



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B.C. Intertidal Perennial Pepperweed Treatment Plan

TREATMENT METHODS & TIMING

The treatment methods and timing have been selected by applying the principles of integrated pest management to identify the most effective methods that will result in a healthier, more diverse intertidal ecosystem following treatment. Herbicide treatment will be used as the primary means of control for intertidal occurrences of Perennial pepperweed (*Lepidium latifolium*), which is found in predominantly the upper intertidal among native vegetation. Herbicide treatment is more precise than digging and the salt marsh begins recolonizing with native plants faster than after shading or digging control methods.

The herbicide and surfactant selections; application methods, rates and quantities; and training are identical to those described in the Spartina Treatment Plan (see Table 2). The Perennial pepperweed occurrences total 1.14 ha and are so limited that treatments can occur without increasing the herbicide and surfactant requirements already listed for *Spartina* spp.

Table 3. Management Tool Cost, Timing and Location.

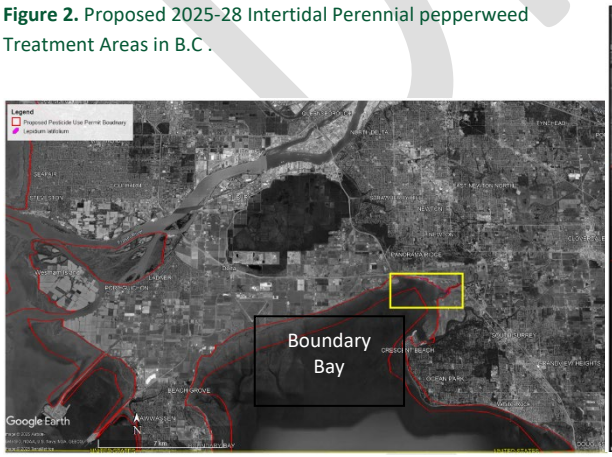
Management Tool	Target Species	Estimated Cost per Hectare	Timing	Location
Herbicide – backpack sprayer or hand pump sprayer	*Lepidium latifolium* (Perennial pepperweed)	$11,000 / ha	May – September Annually	Boundary Bay (east portion)

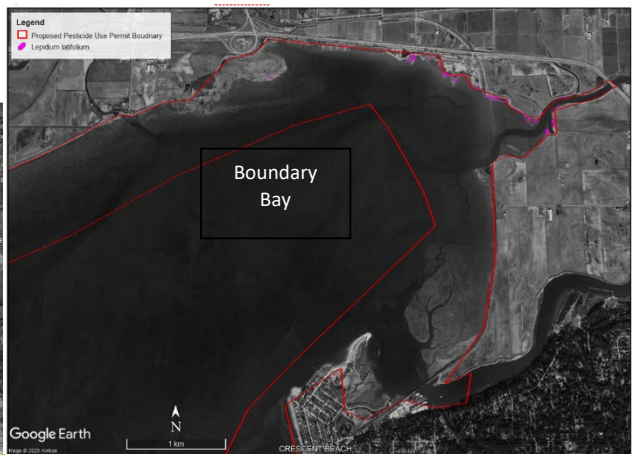
TREATMENT LOCATIONS

The specific location of Perennial pepperweed treatment sites will not be known until the mapping is completed in May 2025 and in May of each consecutive year, however the mapping in previous years provides a good indication of locations for treatment (see Figure 2). Based on previous years, treatment for Perennial pepperweed will occur in the Lower Mainland in the intertidal area of Boundary Bay. Most treatments will occur within 1200m of the surrounding dikes.

Final specific locations and timing will be dependent on input from local stakeholders including local governments, First Nations, local stewardship groups, landowners and the aquaculture industry.

Figure 2. Proposed 2025-28 Intertidal Perennial pepperweed Treatment Areas in B.C .





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B.C. Intertidal Perennial Pepperweed Treatment Plan

TIMING

Specific timing of the applications will be dependent on weather, low tides, location of plants in the tidal zone, applicator availability and plant development as outlined in (Table 3).

Table 3. Timing of Herbicide Treatments for Perennial pepperweed Plants.

Plant type/site	May	June to early July
Plants likely to go to seed	Treatment priority; at least two search and spray events should be done at sites that went to seed in the previous year	
All Plants	First treatment	Second treatment
All Plants	Plants will ideally be flowering at time of treatment to maximize detection and herbicide uptake into the plant	

All other aspects of the Perennial pepperweed Treatment Plan will be the same approach as described in the Spartina Treatment Plan, including but not limited to:

- Application methods
- Herbicide handling, spill prevention and spill response
- Containing and preventing invasive plant spread
- Invasive plant control in sensitive areas
- First Nations culturally significant areas
- Aquaculture activities
- Public recreation areas
- Monitoring
- Communication

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