

Delta's Invasive Species Strategy:

A framework



Executive summary

Invasive species have become the focus of many land managers and citizens because of the negative impacts exotic animals and plants have on biodiversity, natural areas, watercourses, private property, the economy and recreation. In response to these impacts and issues, the Corporation of Delta (Delta) has created an Invasive Species Management Strategy that describes what invasive species are and how they may be best managed in the municipality of Delta.

This strategy describes a management plan for invasive species in three sections:

1. Strategic management: prevention, mapping and inventory, and early detection, rapid response
2. Control and restoration: regulations, monitoring and replanting
3. Education & collaboration: roles and partners

It is the goal of this strategy to outline and implement specific invasive species management goals and objectives, operational procedures, and monitoring programs. By implementing strategy recommendations as well as continuing the proactive and aggressive approach Delta is currently taking to manage invasive animals and plants staff and residents may protect and conserve local biodiversity, the ecological viability of watercourses and natural areas, the recreational uses of Delta parks, and prevent damage to private property. It is expected that this strategy will be revised approximately every five years or as new information becomes available.

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1.0 Invasive Species

1.1 What are invasive species?

Invasive species (synonyms: alien, exotic, non-native, non-indigenous) are species that have been introduced, either intentionally, e.g. through horticulture, or accidentally to an area where they do not naturally occur. Once introduced invasive species aggressively grow and proliferate. Not all non-native species are invasive, but in almost all cases invasive species are non-native.

1.2 Why are invasive species a concern?

The issues and impacts associated with invasive species are extensive and can affect the ecological, economic, and social values of a community. Invasive species are now recognized as one of the greatest biological threats to Earth's environmental and economic well-being (McNeely *et al.* 2001).

Invasive species have an incredible ability to displace and reduce native populations of plants and animals. When native species become rare or extinct there are trickle down affects which can lead to impaired functioning of an ecosystem, e.g. poor crop yields, poor slope stability, the reduction in storm surge buffering, the proliferation of nuisance species, e.g. mosquitoes, and the loss of culturally important species, e.g. the barn owl, barn swallow.

Examples of specific issues and impacts caused by invasive species include:

- Some invasive animals out eat native species' prey or native animals themselves, e.g. bullfrogs will eat any living thing that can fit in their mouths – this includes native tree frogs, red-legged frogs, and other native frogs which tend to be smaller than a bullfrog. This type of behaviour can and has impacted native populations to the point where they become at risk.
- Invasive species can also introduce exotic diseases which native species have little immunity for, e.g. Red-eared slider turtles have introduced exotic diseases which have affected native turtle populations.
- Invasive plants, e.g. policemen's helmet, will compete with and displace native plants by monopolizing resources such as space, light, moisture, nutrients, and pollinators, which native plants require in order to grow. This can impact both natural and commercial areas negatively through increased costs of removing

infestations and loss of ecosystem services like pollination which assists agricultural operations.

- Non-native plants can breed with native plant species thereby reducing natural genetic variation. This is a particular concern for species-at-risk.
- Aquatic invasive plants and animals like curly leafed pondweed and common carp can choke waterways and cause poor water quality used for recreational, agricultural or commercial purposes.
- Reduction of recreational opportunities by producing impenetrable barriers, e.g. Himalayan blackberry (*Rubus discolor*) that are difficult to manage, and/or increasing liability as a result of increased risk to human health and safety, e.g. giant hogweed (*Heracleum mantegazzianum*). The sap of giant hogweed contains photosensitive chemicals that when exposed to the skin and sun can result in serious burns.
- Invasive species can infest agricultural lands. For example, in British Columbia, hundreds of thousands of hectares of crop and rangeland become infested each year, reducing forage potential and crop yields by an average of 10-15%; although for some species the toll is much greater (C. Rankin & Assoc. 2004).
- In Canada, as of 2010, the annual cost of invasive species is estimated to be as much as \$20 billion to the forest sector, \$7 billion for aquatic invasive species in the Great Lakes and \$2.2 billion for invasive plants alone in the agricultural sector. The cost of invasive species' impact on recreation, fisheries, tourism, and infrastructure has never been fully estimated but is expected to represent tens of billion dollars. In 2008, six invasive plant species were estimated to negatively impact BC by \$65 million. Damages are expected to increase to \$129 million by 2020 due to further spread (Frid *et al.* 2009 as cited in Invasive Species Strategy Version 10 2012). Economic impacts were measured in terms of increased management costs to control the spread of invasive plants and loss of resource productivity (Invasive Species Strategy Version 10 2012).

Further, in the future, climate change will likely increase the rate of invasive species establishment thereby increasing the cost of land management in addition to negatively impacting native plant communities.

1.3 Rationale for action in Delta

Environment

The Fraser River delta is a biodiversity hotspot and Delta is located at its estuarine edge. With abundant upland, nearshore and foreshore habitat, Delta is an important stopover for waterfowl and provides rich habitat for juvenile fish which support commercial and recreational fisheries. The wetland habitat available in and around the Fraser River is the largest single unit of wetland habitat in BC (Demarchi 1996) and was designated as a Ramsar Wetland of International Importance in September 2012.

The south coast of British Columbia is a hotspot of biodiversity with over 260 species provincially and federally listed as threatened or endangered. Species-at-risk are identified through federal and provincial assessment processes. In Canada, species-at-risk are managed under the Species at Risk Act (SARA). There is no species at risk regulation in BC but a memorandum of understanding exists between Canada and BC to protect species-at-risk using the SARA framework in BC.

Local governments do not have explicit responsibilities for the conservation of wildlife and habitats. However, they must ensure they do not violate provincial and federal legislation that protects wildlife and habitat, and they must consider due diligence for actions and decisions that may facilitate violations by other parties with respect to wildlife, habitat and species-at-risk. Local governments are responsible for many actions that can impact species-at-risk, wildlife, and habitat.

SARA came into force in 2004 and since then 520 animals and plants and have been listed on Schedule 1 (endangered, threatened or special concern) of the Act. A number of species and ecosystems at risk occur in Delta. Some of these species include: Pacific Water Shrew, Barn Owl, Oregon Forest Snail, Peregrine Falcon, Great Blue Heron, Streambank Lupine, Little Brown Myotis, Red Legged Frog, Barn Swallow and Short Eared Owl.

Economic

Invasive species present an economic threat to public and private property as well as agricultural and commercial businesses because once an invasive species becomes established its can be difficult and expensive to manage its impacts. For example, European starlings are now established and are a major nuisance to Delta blueberry farmers. Gypsy moths could potentially attack both blueberry and nursery farms but have not become established due to strategic and regimented management actions carried out by the Province of British Columbia. The European chafer beetle is

colonizing the lawns of North Delta homes creating a new expensive nuisance for homeowners. It is important to recognize infestations early and to take prompt action so that costs may be avoided and/or mitigated.

Delta is vulnerable to the introduction of new exotic species as it is a gateway community to the Asia-Pacific market. Delta Port, Westshore Terminals, BC Ferries and various rail and truck traffic present multiple pathways for the introduction of both invasive animals and plants. Vulnerability can be managed through the education of staff, businesses, and the public as well as coordinating operations between the municipal, provincial, federal and private enterprises.

Social

A significant portion of Delta's identity and character are associated with economic and community activities that involve farming, fishing and recreating along the Fraser River, Boundary Bay, in nearby wetlands and forests. Economics and traditions have changed over time but most Deltans continue to value the landscape directly through recreational and commercial activities. Invasive species have impacted some of these activities but most impacts are at a level that can be managed successfully.

Delta's Official Community Plan (OCP) includes objectives and policies that support the development of an invasive species strategy. These policies are:

- 2.4.1 Enhance the knowledge of Delta's environmental assets through physical and biological resource inventories.
- 2.4.4 As funding permits, develop natural areas management plans for significant habitat types and geographic areas.
- 2.4.39 Promote community environmental stewardship and identify ways to encourage private land stewardship.
- 2.4.40 Promote community involvement and increased awareness of environmental issues among all sectors and the public.
- 2.6.32 Implement best management practices for routine and regular maintenance activities in parks, including removal of invasive species, limited pesticide use and planting of native species.

1.4 Strategy goals and objectives

The Corporation of Delta's Invasive Species Management Strategy (the Strategy) has been created in response to the spread of invasive species in Delta and their associated impacts. The Strategy focuses on the management and removal of invasive plants and animals within Delta utilizing prevention, early detection, and rapid response (EDRR) techniques (Appendix A) where:

- Invasive species may be found in low densities and the potential for eradication is practical.
- Sites exist where invasive species are present and present a health or safety risk, e.g. Giant Hogweed on Roberts Bank.
- Sites where invasive species may impact species at risk, ecosystems at risk, and sensitive areas such as steep slopes or natural area-agricultural interfaces, or areas with high environmental value such as riparian areas.
- Sites with a high degree of community value and community interest, e.g. Cougar Creek and Watershed Park.
- Other sites where management or removal of invasive species are required or regulated.

Management of an invasive species infestation is most successful and economically viable when action is taken soon after discovering the infestation. As time, e.g. growing seasons, progresses between identification and action invasive species root systems, seed banks and/or progeny become more plentiful and create barriers to eradication. Therefore early detection and rapid response is crucial for invasive species management. Early detection requires regular monitoring of areas in Delta that provide ideal living conditions for invasive species. Such sites include riparian areas along creeks and ditches, dikes, boulevards, roads, railway corridors and public property adjacent to private yards.

Once an invasive species infestation is detected and interpreted (for local status), rapid response may be taken to ensure there is minimal spread of the plant or animal. Spread may be limited via removal, herbicide/pesticide application or seed clipping. Early detection of small or recent introductions have the highest potential for eradication and restoration. Complete eradication may be unattainable once invasive species become well-established like blackberry or European starlings. Early detection and rapid response is essential for mitigating the impacts of invasive species on local ecosystems.

The Strategy aims to facilitate the inventorying, removal, and management of invasive species in Delta on public and private property by Delta staff, citizens and volunteers. Other goals of the Strategy include the restoration of impacted habitat and communication between departments at the Corporation of Delta and the public. The Strategy is a living document and will be updated using adaptive management as new information and priorities emerge (Appendix B).

Goal 1: Identify what invasive species exist in Delta and where they may be found.

- Objective: create a complete dataset inventory and database
- Objective: compile an in-house GIS layer for Delta Map from inventory actions

Goal 2: Provide a clear and concise process-oriented framework to improve invasive species management decisions within Delta.

- Objective: outline departmental roles that will support consistent, effective, eradication, control and management strategies in a manner aligned with the principles of sustainability

Goal 3: Provide guidelines for invasive species management on public and private lands.

- Objective: develop guidance documents and regulations for Delta that integrates ecological and social factors into planning and management decisions made by Community Planning and Development, Engineering, Parks Recreation & Culture and Bylaws with respect to invasive species
- Objective: create online and print material for residents on how to best manage, remove and dispose of invasive plants and animals
- Objective: create restoration and preventative best management practices for staff and the public about invasive species

Goal 4: Outline education and collaboration opportunities.

- Objective: conduct an education campaign with an emphasis on preventing intentional and accidental introductions and spread of invasive species

2.0 Invasive species in Delta

2.1 Invasive animals

The term “invasive animals” includes invertebrates such as exotic insects and vertebrate species such as non-native frogs. There are a significant number of invasive animals that inhabit Delta. Some are well established like the American bullfrog or

European starling and some are new to Delta like European fire ants. In Delta the top seven invasive animals of concern are listed in Table 1 and Appendix D.

Table1. Common and scientific names of invasive animal species within Delta

Common Name	Scientific Name
European fire ant	<i>Myrmica rubra</i>
European chafer beetle	<i>Rhizotrogus majalis</i>
European gypsy moth	<i>Lymantria dispar</i>
Red eared slider turtle	<i>Trachemys scripta</i>
Common carp	<i>Cyprinus carpio</i>
Bull frog	<i>Lithobates catesbeianus</i>
Green frog	<i>Lithobates clamitans</i>

These species were selected based on their “newness” to Delta, impact to human health (e.g. European fire ant), potential impact to the economy, relative low abundances within the community, with the exception of carp, bull frog and green frog, which are well established in Delta, and the ability for staff and citizens to manage the spread of these species through routine work procedures and landscaping.

2.2 Invasive plants

The term “invasive plants” includes exotic vascular and non-vascular plants. The table below lists all invasive plants known to exist in Delta. The list is presented in order of priority for management purposes. The first 10 species represent Delta’s top invasive plants of concern and are the main focus of current inventory, control and management efforts. Information about each plant in the “Top 10” list and management techniques are described in Appendix C.

Table 2. Common and scientific names of invasive plants within Delta

Common Name	Scientific Name
Giant hogweed*	<i>Heracleum mantegazzianum</i>
Knotweeds*	<i>Polygonum polystachyum, Fallopia japonica, F. x bohemica, F. sachalenensis</i>
English cordgrass*	<i>Spartina anglica</i>
English Ivy	<i>Hedera helix (Helix hibernica)</i>
Canada thistle*	<i>Cirsium arvense</i>
Bull thistle*	<i>Cirsium vulgare</i>
Yellow flag iris	<i>Iris pseudacorus</i>
Scotch Broom	<i>Cytisus scoparius</i>
Purple loosestrife	<i>Lythrum salicaria</i>
English holly	<i>Ilex aquifolium</i>
Laurel species	<i>Daphne laureola, Prunus laurocerasus, Prunus laurocerasus</i>
Yellow lamium (yellow archangel)	<i>Lamium galeobdolon</i>
Common periwinkle	<i>Vinca minor</i>
Policeman's Helmet	<i>Impatiens glandulifera</i>
Common Tansy	<i>Tanacetum vulgare</i>
Diffuse knapweed	<i>Centaurea diffusa</i>
Gorse	<i>Ulex europaeus</i>
Himalayan blackberry	<i>Rubus armeniacus (Rubus discolor)</i>
Cutleaf blackberry	<i>Rubus laciniatus</i>
Reed canary grass	<i>Phalaris arundinacea</i>

* management plans already exist for these species and may be found in Appendix E.

2.3 Existing Management Initiatives

The focus of the Corporation of Delta's invasive species management has been primarily on invasive plants. This is due to Delta's historical ties to farming and the 30 + year summer invasive plant management team program. Recently, in the last five years, the control and management of new invasive animals as well as new invasive plants on private and public property has gained attention in the media and amongst practitioners in Delta and the lower mainland.

The control of invasive animals has mostly occurred on private property where nuisance pests have caused damage to gardens and turf grass, e.g. European fire ant and European chafer beetle. In response to these pests the Corporation of Delta provides guidance to residents on how best to manage invasive animals on the corporate website delta.ca.

Other invasive animals such as carp, bull frogs, green frogs and red-eared slider turtles tend to affect public assets like native fish populations in ponds, ditches and creeks. In response to these impacts the Corporation of Delta works with the public and professionals from the private and public sector to mitigate these invasive animals' impacts.

Delta operates a seasonal Invasive Plant Management Program from late May to August on public lands. For 14 weeks the three person crew mechanically removes Canada and bull thistle, giant hogweed, English ivy, holly, *Spartina*, scotch broom and other invasives as time permits. Every four years the team inventories Delta's public lands for invasive plants.

3.0 Strategic Management

This section addresses specific types of invasive species management.

3.1 Prevention

Prevention is the most effective way to mitigate the negative impacts of invasive species. Preventative action includes the use of policies, best management practices and education to prevent the transportation/transplantation of invasive species, avoid the use of invasive species and/or promote the suitable disposal of invasive species. Preventative management actions combined with regular monitoring are particularly important, as species not currently considered invasive may be so in the future, especially considering climate change (Page and Lilley 2008).

The first steps in prevention are:

- Reduce the sale of invasive species (through education campaign)
- Promote behavioural change among residents to choose native species over invasive species
- Restrict the use of invasive species and promote native species use during the development review process
- Provide clear instructions for the proper disposal of invasive species

DELTA ACTION ITEMS

- **Gauge community awareness and knowledge about invasive species**
- **Develop an education campaign on invasive species**
- **Create a “do not” plant/spread/release list**
- **Provide instructions for proper disposal of invasive species for the public and staff**

3.2 Mapping & Inventory

Mapping the distribution of invasive species assists practitioners to understand the nature and extent of an infestation. Invasive animals have not been well mapped or inventoried in Delta due to their mobility, common presence throughout Delta, e.g. common carp, or their “newness” to Delta, e.g. European Chafer Beetle and European Fire Ant.

A baseline inventory of invasive plants along the southern Delta dike system was conducted in 2009 and 2011. In 2010, the prominent natural areas and ravines in Delta were also inventoried. In 2015 the inventory was repeated. A map of these inventories may be found in Appendix E.

All data collected followed the Invasive Alien Plant Partnership (IAPP) data collection standard methods and was entered into the (IAPP) database. Some of these standards include UTM coordinates (zone, easting and northing), site creation date, jurisdiction, biogeoclimatic class, survey date, survey agency, invasive plant, estimated area (ha) distribution, density, and survey type.

DELTA ACTION ITEMS

- **Create an invasive plant GIS layer on Delta Map**
- **Complete an invasive animal GIS layer on Delta Map**
- **Conduct a complete inventory of invasive plants within the Corporation of Delta every four years**
- **Map invasive animals as they are found**

3.3 Control & Containment

To reduce the expansion of invasive species effort to control and contain invasive species infestations must take place. Expansion is inhibited by targeting the outer edge of invasive species ranges and/or limiting them to a specific area and then working to remove the core of the infestation (Page and Lilley 2008). Control and containment is

considered a long-term management action directed at invasive species that are expanding versus recent introductions or emerging species.

Control and containment techniques are dependent on the species, location, time of year etc. Often several different control techniques are used at a time to effectively manage a species infestation. In most cases, work is conducted during the growing and flowering seasons when plants are highly visible and seed development has not yet occurred so management activities do not facilitate dispersal. Sites with established monocultures may have reduced ecological values and are candidates for broad-scale removal techniques or herbicide use (where suitable).

Regular vegetation maintenance activities along ditch banks and roadways can potentially spread or introduce invasive plants. This can be done by unknowingly spreading invasive plant fragments from one site to another via equipment, removing native vegetation (and therefore creating space for invasives to colonize) and improper disposal of invasive plant material.

For invasive animals, control and containment techniques are specific to the life cycle of the pest and weather. Most control action may take place in the spring during larval/egg stages when pests are most vulnerable. Other control methods include landscaping techniques which make habitat less favourable to the invasive animal and best management practices for professionals to follow when conducting salvages as part of in-stream or riparian works etc.

DELTA ACTION ITEMS

- **Work with stewardship groups on invasive plant removal site selections**
- **Support local stewardship group removal events through debris pick-up**
- **Support local stewardship group removal events through event advertising and volunteer recruitment**
- **Train Delta staff, specifically those involved with vegetation management on invasive plant ID and management techniques**
- **Provide best management plans for common invasive animals found in Delta**
- **Provide control and containment information for invasive species on Delta's website**

3.4 Restoration

Once invasive species have been removed from a site, ecological restoration may be required. Ecological restoration is an intentional activity that restores or accelerates the recovery of a damaged ecosystem back to a state that is characteristic of the natural

area (or pre-existing conditions as in the case of a lawn) and function. There are many steps involved in restoring a site. The first step typically requires the creation of a restoration plan which may be formal or informal and aims to address ecological deficiencies. A plan can reflect the history of the site, local hydrology, erosion issues, invasive species, soil health and re-vegetation of disturbed areas.

Restoration techniques will vary from site to site reflecting the site's environmental conditions, use, and aesthetic value. Techniques will range from passive (e.g. natural colonization) to active (e.g. planting and maintenance). Restoration efforts may include introducing or sculpting physical features to promote succession, soil amendments, seeding with native grass, forb (herbaceous flowering plant that is not a grass, sedge or rush) or shrub mixes and planting live-cuttings (e.g. willow whips).

DELTA ACTION ITEMS

- **Create restoration plans for planting events**
- **Make restoration ideas and options available online for the public**
- **Support local stewardship group planting events through plant purchases**
- **Support local stewardship groups through event advertising and volunteer recruitment**
- **Support municipal restoration efforts**

3.5 Regulations

Section 8 of the Community Charter grants a municipality the authority to regulate, e.g. develop bylaws, prohibit and/or impose requirements in relation to the protection of the natural environment, trees and animals. The definition of "animal" under the Charter means any member of the animal kingdom, other than a human being. Amongst local governments these sections have been used to create bylaws to regulate the spread of invasive plants and ensure public safety in the context of dogs and exotic animals. Most municipalities have not created bylaws to manage the movement or spread of invasive pests such as insects, fish or birds. The Community Charter *Spheres of Concurrent Jurisdiction – Environment and Wildlife Regulation* (Section 2) gives municipalities the right to develop bylaws to prohibit the sale of invasive plants and to develop policies and plans to control and/or eradicate invasive species. Forty-seven terrestrial and eight aquatic plant species are considered invasive under the Regulations. To date, few municipalities have adopted bylaws dealing with the sale of noxious weeds. One exception is the City of Coquitlam, which enacted a bylaw in 2010 prohibiting residents from growing or allowing giant hogweed (*Heracleum mantegazzianum*) to grow on their properties

Delta first recognized invasive plants were a problem about 80 years ago. Delta's "Noxious Weeds Destruction Bylaw, 1930, No. 141" was created "for preventing the growth of noxious weeds and for providing for the destruction of noxious weeds in the

Municipality of Delta”. Policy, regulation and legislation are all valuable tools that can help manage and control invasive species. There are several pieces of federal and provincial legislation that address invasive species. These regulations are included in Appendix GF.

In 2012, the Delta Property Enhancement Bylaw No. 7055, 2012 was updated. As part of the update, a “Noxious Weeds” section was included. Bylaw officers can now inspect properties that have infestations of invasive plants. The definition of a weed in the bylaw is as follows:

includes weeds designated as noxious by the Weed Control Act Weed Control Regulation as amended or replaced from time to time and includes blackberry bushes, morning glory, and English ivy.

In 2004, a BC Inter-Ministry Invasive Species Working Group (IMISWG) was formed in order to provide policy direction, coordination and collaborative delivery of provincial invasive species programs for the province of BC (<https://www.for.gov.bc.ca/HRA/invasive-species/index.htm>). The BC provincial and regional noxious weeds lists were updated in 2013.

DELTA ACTION ITEMS

- **Revise and update Delta’s Noxious Weed Bylaw to reflect current provincial regulations and species of concern**
- **Assist bylaw staff with interpretation of the Delta Property Enhancement Bylaw as it relates to invasive plants**
- **Review Delta’s soil deposit permitting process for opportunities to educate about invasive species**

3.6 Monitoring

Monitoring is the repeated collection of measurements so that change may be observed over time. The results of monitoring can provide an idea of the success of invasive species management projects and guide maintenance activities. Monitoring is required to enhance the quality of planning, management and development decisions related to invasive species management.

DELTA ACTION ITEMS

- **Report on monitoring and program efforts every year**

4.0 Education & Collaboration

Education and outreach is an important aspect of this framework. The goal of education campaigns associated with the framework is to raise residents' and businesses' awareness of the potential risks of invasive species, the benefits of alternative species and how to properly dispose of invasives.

DELTA ACTION ITEMS

- **Work with Metro Vancouver to identify suitable options for the disposal of invasive plants**
- **Include information about invasive species at special events**
- **Develop and host educational seminars on invasive species**
- **Collaborate with groups like the Invasive Species Council of Metro Vancouver, the Invasive Species Council of British Columbia and volunteer organizations who focus on the management of invasive species**
- **Support municipal use of native plants**
- **Develop online and print support material**

4.1 Stewardship & Outreach Education

Stewardship is strong in Delta and staff continues to work on building these important relationships within the municipality. Stewardship groups include local beekeepers, naturalists, birders, gardening clubs and stream keepers. Staff work closely with these groups to facilitate and support their efforts. An example of two community groups currently participating in invasive plants removals are the Cougar Creek Stream Keepers in North Delta who work in the Delta Nature Reserve and Watershed Park, and Southpointe Academy who supports ivy removal in south Delta. Delta also works with corporate groups interested in invasive plant removals as one-off events.

DELTA ACTION ITEMS

- **Support local NGO and institutional efforts to manage invasive species**
- **Collaborate with key partners to educate the public and support behavioural change amongst Delta residents and business owners**
- **Develop an environmental stewardship model and program**

4.2 Partnerships

Partnerships are key to effective management. Delta already has strong relationships with several key partners with respect to invasive plant management. For example, Climate Action & Environment staff:

- Is a board director on the Invasive Species Council of Metro Vancouver
- Is a member of the BC *Spartina* working group
- Is an active participant on the Invasive Species Council of British Columbia's local government working group
- Is an active participant in the European Fire Ant local government working group

DELTA ACTION ITEMS

- **Continue to maintain and strengthen partnerships with federal agencies, provincial ministries, neighbouring communities, academic institutions, utilities and railways and the media**

4.3 Departmental roles & responsibilities

Staff within Climate Action & Environment, Parks Recreation and Culture and Engineering work together to coordinate the removal, remediation and disposal of invasive species. By targeting specific invasive species in a priority action approach resources can be utilized efficiently. Departmental roles can be found in Appendix G.

DELTA ACTION ITEMS

- **Create an invasive species working group for staff at the Corporation of Delta. The group would assist with the interdepartmental coordination of efforts and include staff from Climate Action & Environment, Parks Recreation & Culture, Engineering, Engineering Operations, Bylaws and Community Planning & Development as required**

5.0 Recommendations & Next Steps

Below is a table of key action items and recommended next steps with respect to invasive species management for the next five years for Delta.

This table can act as stand-alone attachment to this strategy and be updated as needed.

Table 2: Five year action plan for Delta’s Invasive Species Strategy

Year	Recommended Action
1	<ul style="list-style-type: none"> • Create an invasive species GIS layer on Delta Map • Map invasive animals as they are found • Revise and update Delta’s Noxious Weed Bylaw • Update invasive species information on Delta’s corporate website • Gauge community awareness about invasive species through outreach • Create an invasive plant working group within the Corporation of Delta. The group would meet quarterly with representation from CA&E, PRC, PRC Ops, ENG, ENG OPS, Bylaws and Planning departments • Create an environmental stewardship program and model • Support local NGO efforts on planning invasive plant removal site locations and restoration efforts
2	<ul style="list-style-type: none"> • Develop an education campaign based on outreach results • Create a “do not” plant/spread/release list • Support local stewardship groups through plant purchases or plant debris pick-up • Support local stewardship group removal events through event advertising and volunteer recruitment • Work with Metro Vancouver to communicate proper disposal of specific invasive plant species via the Vancouver Landfill • Provide instructions for proper disposal of invasive species for the public and staff • Complete an invasive animal GIS layer on Deltamap • Train specific Delta staff on invasive species ID and management techniques • Develop and host educational seminars on invasive species
3	<ul style="list-style-type: none"> • Review Delta’s soil deposit bylaw and other bylaws or permit applications for opportunities to educate about invasive species • Collaborate with key partners to educate the public and support behavioural change amongst Delta residents and business owners with respect to invasive species management and control

4	<ul style="list-style-type: none"> • Continue to strengthen partnerships with federal agencies, provincial ministries, NGOs, neighbours, academic institutions, utilities and railways and the media • Work with local industry and retailers on education and information sharing • Develop online and print invasive species material for public consumption
5	<ul style="list-style-type: none"> • Conduct a complete inventory of invasive plants within the Corporation of Delta and repeat every four years • Include restoration ideas and options for the public on Delta's corporate website

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Appendix A – Early Detection and Rapid Response (EDRR) summary



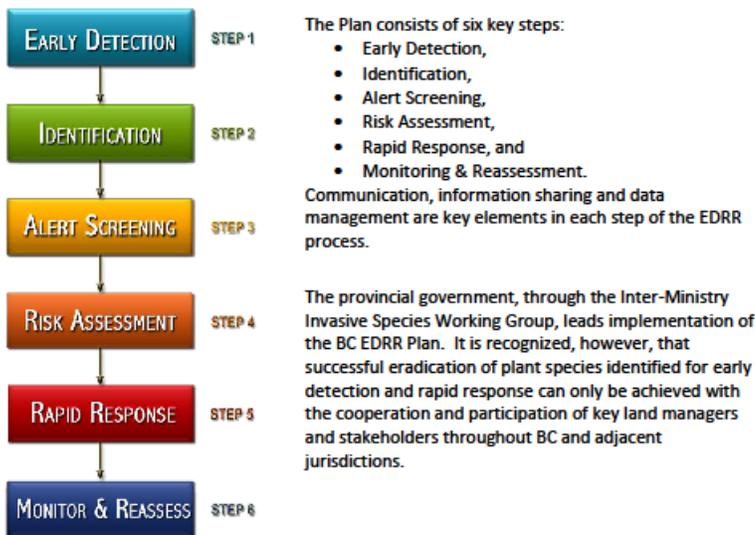
What is Early Detection Rapid Response?

Early Detection Rapid Response (EDRR) is a proactive approach to managing invasive species that prevents establishment in the first place.

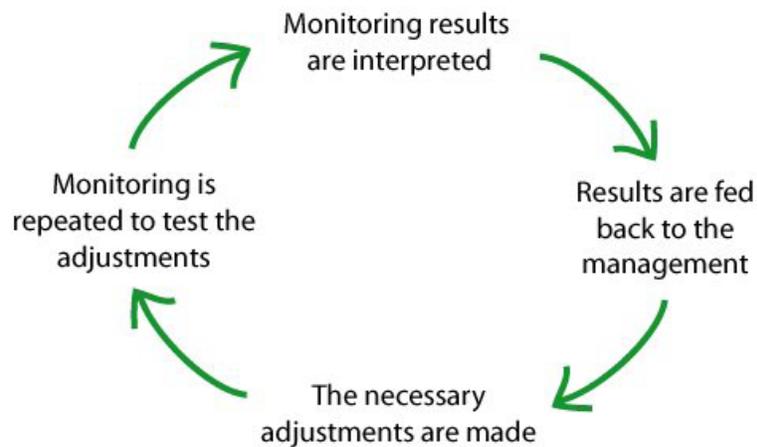
Early detection of newly arrived invasive species, followed by a well-coordinated rapid response, will increase the likelihood of eradication or containment of new invasions. EDRR has proven to be the most cost-effective means of controlling the expansion of invasive species in North America.

BC EDRR activities are guided by the BC Invasive Plant EDRR Plan, which provides detailed direction on the decisions and actions required to identify, assess, and respond to new plant species incursions anywhere in British Columbia.

The Plan establishes a province-wide structured response protocol that includes screening, risk assessment and decision-making processes to determine the appropriate rapid response to new incursions. It also provides a structure for effective communication of early detection rapid response activities and clarifies roles and responsibilities for stakeholders involved in each step of the BC EDRR Plan.



Appendix B – Adaptive Management



Adaptive Management diagram (source: www.forestbiodiversityinbc.ca)

Adaptive management is a continuous process for improving management policies and decisions based on the successes and failures of past projects and management actions (Page and Lilley 2008). With an adaptive management model, land managers are able to gauge ecosystem responses to chosen management strategies and use these results to assess progress towards objectives and adjust future actions to meet desired outcomes. Two key conditions must exist for adaptive management to be fully functional. The first is that alternative management options must exist (Page and Lilley 2008). The second is a baseline dataset must exist and a monitoring process to measure the status of invasive species and overall ecosystem health must be incorporated into management actions.

Appendix C – Top 13 Plant Species

Common Name	Latin Name	Description	Threat	Known Habitat/Location in Delta	Current Management
Giant hogweed	<i>Heracleum mantegazzianum</i>	Numerous small white flower clusters in an umbrella-shaped head. Stout, hollow green stems covered in purple spots. Mature plants can reach 5m.	Highly competitive and ability to co-exist with other aggressive invasive plants. Stem hairs and leaves contain a clear, highly toxic sap that can cause burns, blisters and scarring to skin if contact is made.	Riparian areas; Roberts Bank dike.	inventoried in 2007 and removed every spring since 2010
Knotweeds	<i>Polygonum spp.</i>	Small white-green flowers growing in plume-like clusters. Hollow stems stand upright, bamboo-like with reddish-brown speckles. Leaves are heart/triangular shaped.	Increases soil erosion potential. High infestation rates due to root breakage and downstream floatage to form new infestations.	Stream banks, along roads, fences, rights-of-ways, waste sites, wooded areas, and disturbed sites. Along River road and Ferry Road.	no current management, mapped in 2009 within weed control program boundaries
English cordgrass	<i>Spartina anglica</i>	Found as a single plant or clone. Bright green leaf blades growing at 45-90 degree angles. Flower heads resemble wheat.	Out-competes native marsh plants. Spreads across intertidal mudflats and forms vast "Spartina meadows"	Intertidal salt marshes and mudflats. Boundary Bay and Roberts Bank.	Delta sits on the BC <i>Spartina</i> working group and mapping and manual removals take place every summer

English ivy	<i>Hedera helix</i>	Young leaves bright and glossy and changes to a darker green as it matures. Horizontally spreading shoots near base of plant.	Can completely cover trees adding tremendous weight threatening the death of the tree and increased susceptibility to blow-over	Throughout Delta including natural areas and parks.	volunteer led stewardship in Watershed park and Delta Nature Reserve, some removal in 2010 at Ladner Harbour Park by Weed Control crew
Yellow lamium	<i>Lamium galeobdolon</i>	Trailing, evergreen perennial. Leaves are heart-shaped, silvery/grey markings on leaves. Unpleasant odor.	Aggressive and well-adapted. Successful seed dispersal through ants	Throughout Delta including natural areas and parks.	volunteer led stewardship in Watershed park and Delta Nature Reserve, some removal in 2010 at Ladner Harbour Park by Weed Control crew
Common periwinkle	<i>Vinca minor</i>	Perennial, evergreen vine with trailing stems. Shiny dark green leaves, blue/purple flowers. Can reach 2m in length.	Forms extensive mats along forest floor displacing native woody plant species.	Throughout Delta including natural areas and edges of parks.	volunteer led stewardship in Watershed park and Delta Nature Reserve
Yellow flag iris	<i>Iris pseudacorus</i>	Showy, yellow flowers, 3 sepals that curve backward, 3 petals pointing upwards. Mature plants can be 1.5m.	Seed dispersal through wind/water. Dense stands exclude native wetland species. Sold at nurseries	Ditches, marshes, streams	no current management, mapped in 2009 with weed control program boundaries

Canada thistle	<i>Cirsium arvense</i>	Purple, sometimes white flowers, spiny, dark-green oblong leaves growing directly from stem. Mature plants can be 0.3-2m high.	Infests crops, pastures, rangelands, roadsides and riverbanks. Spreads rapidly through horizontal roots. Can form dense patches of monocultures.	Along dikes, ditches, vacant land, railways corridors and farm field borders	manually removed through Delta's annual weed control program
Bull thistle	<i>Cirsium vulgare</i>	Large bright pink flows, deeply divided leaves. Mature plants can be 0.3-2m high.	Infests crops, pastures, rangelands, roadsides and riverbanks. Spreads rapidly through horizontal roots. Can form dense patches of monocultures.	Along dikes, ditches, vacant land, railways corridors and farm field borders	manually removed through Delta's annual weed control program
Purple loosestrife	<i>Lythrum salicaria</i>	Purple flowers in a dense terminal spike, branching root system. Mature plants can reach 3m.	Reproduces quickly, colonizes in wetland habitats.	Wet areas such as ditches, marshes and stream banks. Westham Island, River road, Arthur drive	no current management, mapped in 2009 within weed control program boundaries
English holly	<i>Ilex aquifolium</i>	Broadleaf evergreen shrub with reddish orange berries. Mature plants can be 18m.	Forms dense thickets and can suppress native tree growth. Out-competes native vegetation for water.	Forested areas, found throughout Delta including natural areas and parks.	volunteer led stewardship in Watershed park and Delta Nature Reserve, some removal in 2010 at Ladner Harbour Park by Weed Control crew
Policeman's helmet	<i>Impatiens glandulifera</i>	Showy pink flowers, hollow stems with long slender leaves. Mature plants can be 2m.	Prolific seed production, effective spread of seeds. Soil erosion from annual dies back, leaving bare soil.	Moist soils, edges of streams and wetlands. Cougar creek riparian area	no current management, mapped in 2009 within weed control program boundaries

Scotch broom	<i>Cytisus scoparius</i>	Evergreen shrub, bright yellow, pea-like flowers. Stems are woody. Flat, hairy seedpods. Mature plants can be 1-3m.	Competitor to conifer seedlings dense infestations, increases wildfire fuel loads, obstructs site lines on roads.	Along highways, roads, disturbed sites.	no current management, mapped in 2009 within weed control program boundaries
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Appendix D – Top Seven Invasive Animal Species

Common Name	Latin Name	Description	Threat	Known Habitat/Location in Delta	Current Management
European fire ant	<i>Myrmica rubra</i>	<p>Native to Europe and Asia it was first introduced to eastern North America in the 1900s. The ants were first recorded in B.C. in 2010, and have since been discovered in isolated locations throughout the Lower Mainland.</p> <p>Fire ants are small in size and red in colour. Their constricted "waist" has two segments (most native species have only one), and they have two backward-point spines on the middle body section, which are visible only with a magnifying glass. Their nests are built in soil under rocks, wood or other debris (nests are not large soil mounds). Nests are usually very abundant, with 10–12 nests in a 10" by 10" area.</p>	<p>The European fire ant is an aggressive, swarming ant that can deliver a painful sting when disturbed by people, pets and wildlife that wander into their territory. If a colony moves into a park, they may impact the recreational use of the park, and may also threaten native ants in the area.</p>	<p>North side of Annacis Island adjacent to Alex Fraser Bridge footings (directly east of 819 Cliveden Place)</p>	<p>The affected area is owned by the Ministry of Transportation who is not treating the site but placed signage there.</p>

European chafer beetle	<i>Rhizotrogus majalis</i>	The adult beetle is copper-coloured and approximately 1.5 cm long, with tufts of fine hair coming out of its underside and wing covers. The larvae (grubs) have a white body, black rear end, and copper-coloured legs and head. The larva is often curled up into a C-shape and is approximately 2 cm long stretched out.	The larva is the destructive life stage of this pest. It is a voracious consumer of grass roots. Lawns heavily damaged by chafer beetle larvae will be spongy, brown and loose. Peeling or digging the turf will reveal larvae feeding underneath (20 or more larvae per square foot of lawn is considered heavy infestation).	North Delta lawns and turf areas	Residents are urged to practice good turf management practices and use nematodes if the infestation persists.
European gypsy moth	<i>Lymantria dispar</i>	A strong flier, the male is brown, with a small body and well-developed wings. The female is flightless and is white with black markings on her wings. Female moths are much larger than males.	The Gypsy moth has a wide host range which includes native shade trees and ornamentals trees. Should the Gypsy moth become established, trees will be stripped of their leaves in midsummer. Such defoliation could undermine the intrinsic recreational/health and wildlife habitat values that these trees provide. Local parks could also be jeopardized.	Small forested pockets of south North Delta and Watershed Park.	The Province of BC regularly monitors and sometimes treats for gypsy moth.

Red eared slider turtle	<i>Trachemys scripta</i>	Their red “ear” patch, located just behind the eye, distinguishes them from other similarly sized turtles. The face and neck are marked with yellow stripes. The smooth, dark carapace (upper shell) of the Red-eared Slider commonly is decorated with darker lines and swirls, and patches of white, yellow or red. The plastron (shell covering the belly) is yellow, and can be marked with dark blotches. A medium-sized turtle, Sliders reach a maximum length of 28 cm.	Because Sliders eat many of the same foods as native turtles, biologists are concerned that these hungry newcomers could out-compete existing wetland inhabitants.	Most public ponds, e.g. Rotary Park, and some private property.	Little. Upon salvaging for salmonids and other species professionals will euthanize Red-eared sliders based on recommendations from the Province of British Columbia.
Common carp		The common carp can be up to half a metre long and 4kg with two large, whisker-like, sensory barbels on each side of the upper jaw. It has thick, large scales that cover the entire body and a long dorsal fin. Both dorsal and anal fins have a large serrated spine at the leading edge. Body colour ranges from grey to golden depending on diet.	Carp compete with native fish for food and have a voracious appetite, feeding on plants and aquatic invertebrates such as insects, worms and molluscs. When feeding, carp stir up the river or lake bottom and uproot plants, muddying the water and deteriorating weedy habitat. These traits combined make the Common Carp a threat	Most fresh water ponds, ditches and creeks.	Little. Upon salvaging for salmonids and other species professionals will euthanize common carp based on recommendations from the Province of British Columbia.

			to both native fish species and commercial and sport fisheries.		
Bull frog	<i>Lithobates catesbeianus</i>	<p>A very large, robust frog, green or brown in colour with large golden eyes. Adult female Bullfrogs may reach 20 centimetres in length (not including legs!) and 750 grams in weight. Male Bullfrogs are somewhat smaller. Both sexes have a large and distinct tympanum ('ear') just behind and below the eye. The tympanum is partly surrounded by a fold of skin that runs from the eye down to the shoulder. Males have a tympanum roughly twice the size of the eye, while females have a smaller tympanum that is about the same size as the eye. Males have yellow throats, often quite bright, while females have paler cream or white throats.</p>	<p>Adult Bullfrogs are highly predatory, consuming in addition to the conventional frog fare of insects and other small invertebrates, birds, small mammals, snakes, and other frogs (including smaller Bullfrogs). They will eat whatever they can fit into their large mouth.</p>	<p>Most fresh water ponds, ditches and creeks. Bull frogs are also found in Burns Bog and other fresh water wetlands.</p>	<p>Little. Upon salvaging for salmonids and other species professionals will euthanize bull frogs based on recommendations from the Province of British Columbia.</p>

Green frog	<i>Lithobates clamitans</i>	<p>These are raised folds of skin which extend from the head most of the way down the sides of the frog's back. Green Frogs can be up to 10 centimetres long from snout to rump; they can also be recognised by the large tympanum ("ear") behind each eye. Male frogs have tympana approximately twice the diameter of their eyes, while females have tympana about the same size as their eyes. Male Green Frogs have a yellow throat, which can be very bright during the breeding season.</p>	<p>The current consensus among biologists is that Green Frogs do not seem to have as much of an impact on native frog species as Bullfrogs do. Green Frogs are smaller and less aggressive than Bullfrogs. However, Green Frogs do compete with native frogs for food and habitat, and there is a risk that this extra pressure may be the final straw for some native populations. For this reason, we would like to keep a watchful eye on habitats invaded by Green Frogs.</p>	<p>Most fresh water ponds, ditches and creeks. Green frogs are also found in Burns Bog and other fresh water wetlands.</p>	<p>Little. Upon salvaging for salmonids and other species professionals will euthanize green frogs based on recommendations from the Province of British Columbia.</p>
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Appendix E – Existing Management Initiatives

Canada and Bull thistle (*Cirsium arvense* and *Cirsium vulgare*)

Delta operates a seasonal Invasive Plant Management Team on public land which includes the majority of dikes, slough banks and roadsides throughout Delta. It began in 1978 at the request of a delegation to Delta Municipal Council by members of the Delta Farmers' Institute (DFI). The program has evolved since the 1980's and staff now manage other invasive species as well as assist with riparian restoration and inventorying efforts.

The program is conducted under the provisions of the Provincial BC Weed Control Act and Delta's Noxious Weeds bylaw for the purpose of controlling noxious weeds, specifically Canada thistle (*Cirsium arvense*) and Bull thistle (*Cirsium vulgare*), in areas on and adjacent to agricultural lands. The program helps to maintain the health and vitality of agricultural lands in Delta.

Plants are removed mechanically on an annual basis and were mapped using GPS units in 2009, 2010, 2011 and 2015. The mapping data was uploaded into the Invasive Alien Plant Partnership database (IAPP) which is an invasive species database created and maintained by the BC Ministry of Forests, Lands and Natural Resource Operations.

Other invasive species that are mapped as part of the Invasive Plant Management Team and removed as time permits include:

- Scotch broom
- Tansy Ragwort
- Japanese knotweed
- Policeman's helmet
- Yellow-flag iris
- English Ivy
- Lamium
- English holly

Giant hogweed (*Heracleum mantegazzianum*)

Giant hogweed has been inventoried since 2007 and removal and treatment efforts have occurred each spring since 2010. The Agricultural Weed Control crew, Engineering Operations and specially trained contractors work to remove the plant.

Mechanical removal is used wherever possible but chemical stem injection and foliar application has also been applied where required.

Japanese Knotweed (*Fallopia japonica*)

Japanese knotweed is an invasive alien plant native to East Asia that was brought to North America as an ornamental plant in the late-1800's. Since then, it has escaped from private gardens and may be found within natural areas, along watercourses and in acidic soils. Japanese knotweed is difficult to control but can be successfully suppressed through the use of herbicide stem injection and/or herbicide leaf application, education and appropriate disposal. If allowed to grow unmanaged the plant can grow into dense monocultures which contribute to:

- Slope instability and increased erosion of stream banks.
- Over widening of stream/ditches which undercut existing roadways.
- Damage to asphalt, tarmac, sewerage and dike infrastructure.
- Degradation of environmental values like poor water quality and decline of native birds, insects and plants.

Japanese knotweed has been identified in a number of areas in Delta including along the base of the Ladner Harbour Bridge and along the fence on Ferry Road that marks the property line between the South Arm Marshes Wildlife Management Area (WMA) and Delta. In 2012, The BC Ministry of Forests, Lands and Natural Resource Operations hired a contractor (Invasive Species Council of Metro Vancouver) to treat the Japanese Knotweed on their property and asked Delta for their cooperation to treat the plants on Delta's property. Delta agreed and all sites were successfully treated by September 2012. This area and others continue to be monitored and treated on an annual basis.

Ivy, Lamium and Periwinkle (*Lamium galeobdolon* and *Vinca major*)

In Delta's parks, specifically Watershed Park, Delta Nature Reserve and Ladner Harbour Park, volunteers have been removing Ivy, Lamium and Periwinkle since 2004. Over 20 invasive plant pulls and/or plantings in 2011/2012 have taken place through volunteer efforts in the Delta Nature Reserve. These events focussed mainly on Ivy removal. In 2012, 85 m³ of Ivy was removed and volunteered time totaled 375 people hours. Ladner Harbour Park also had much work done in 2011/2012 with Ivy and

Lamium being removed. In 2014 approximately 200 people volunteered over 745 hours to remove over 60 m³ (about six dump trucks worth) of invasive plants.

English cordgrass (*Spartina anglica*)

English cordgrass species (*S. anglica*, *S. densiflora*, *S. patens* and *S. alterniflora*) are invasive marine plants that grow in intertidal salt marshes and mudflats. Left unchecked, *Spartina* can spread rapidly to form “*Spartina*” meadows which can negatively impact local shorelines and wildlife habitat. To manage the spread and *Spartina* eradication efforts, the British Columbia *Spartina* Working Group (BCSWG) was formed. The BCSWG consists of government and non-government agencies who work to identify, monitor and remove *Spartina* on the Fraser River Delta. The group also promotes education and outreach related to *Spartina* control efforts. Working with its American partners, the BCSWG shares a joint goal to eradicate all *Spartina* species by 2018 along the coasts of BC, Washington, Oregon and California. In 2013, large clones were treated with herbicide in Boundary Bay. In 2014 and 2015 large clones (> 1m) were treated in Boundary Bay and Roberts Bank with herbicides.

Purple loosestrife (*Lythrum salicaria*)

Purple loosestrife is native to Europe, Asia, northwest Africa, and southeastern Australia. It is a tall (up to 3 m) perennial wetland herb with a square, woody stem, opposite, dark green, lance-shaped leaves and purple-magenta flower spikes which appear from July through October. Left unmanaged purple loosestrife will outcompete wetland plants transforming the landscape from a wetland to dry upland habitat.

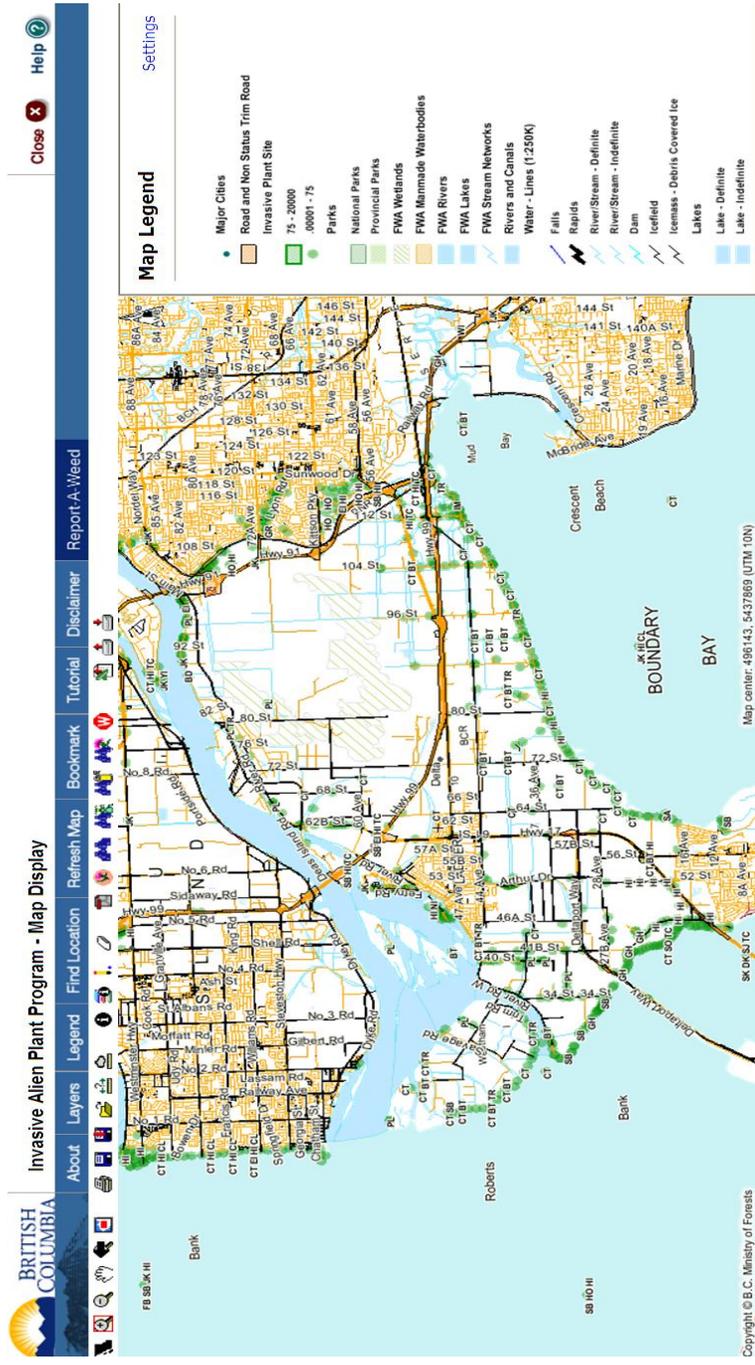
Currently Delta does not manage for purple loosestrife in its ditches but the invasive plant is managed by other organizations within the community of Delta. For example, Metro Vancouver manages purple loosestrife in Deas Regional Park and Ducks Unlimited has managed the weed in the Roberts Banks Wildlife Management Area. Both organizations use the Galerucella beetle (*Galerucella californiensis* or *G. pusilla*) to manage purple loosestrife infestations. These beetles will hold on for several years feeding on the plant.

Adult beetles overwinter in the leaf litter and emerge in early spring synchronizing with host plant's life cycle. Adults feed on young plant tissue causing a characteristic "shothole" defoliation pattern. Females lay eggs in batches of two to ten on leaves and stems from May to July. First instar larvae feed concealed within leaf or flower buds; later instars feed openly on all above ground plant parts. Larval feeding strips the photosynthetic tissue off individual leaves creating a "window-pane" effect by leaving the upper epidermis intact. Mature larvae pupate in the litter beneath the host plant. At high densities (greater than 2-3 larvae per centimeter of shoot), entire purple loosestrife

populations can be defoliated. Adults are mobile and possess good host finding abilities. They spread several miles from their original release sites in a few years. Peak dispersal of overwintered beetles occurs during the first few weeks of spring. New generation beetles have dispersal flights shortly after emergence and are able to locate patches of host plants as far away as one kilometer.

G. californiensis and *G. pusilla* are considered host-specific to purple loosestrife (*Lythrum salicaria*). Before introduction to North America, approximately 50 native plants, including some close relatives of purple loosestrife, were tested for susceptibility to these beetles. Only winged loosestrife (*Lythrum alatum*) was a potential host, and under field conditions in Europe, it was determined that if given a choice, *G. californiensis* and *G. pusilla* avoided the North American native. Winged loosestrife is endemic to wetland areas in central and eastern United States and Ontario and not British Columbia. (Source: <http://www.biocontrol.entomology.cornell.edu/weedfeed/Galerucella.php>)

Appendix F – Inventory Map



Appendix G – Regulations and Legislation

Federal Legislation, Polices and Guidelines

Weed Control Act

http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_96487_01

Forest and Range Protection Act

http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_02069_01

Integrated Pest Management Act

http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_03058_01

Community Charter

http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/03026_00

Provincial Noxious Weed List

<http://www.agf.gov.bc.ca/cropprot/noxious.htm>

Oil and Gas Activities Act

http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_08036_01

Plant Protection Act

<http://www.agf.gov.bc.ca/ministry/legsum/PPRO.stm>

Water Act

http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_96483_01

Wildlife Act

http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_96488_01

Local Legislation, Polices and Guidelines

Corporation of Delta Noxious Weeds Destruction Bylaw

<https://delta.civicweb.net/Documents/DocumentList.aspx?ID=33414>

Appendix H - Roles of the Corporation of Delta and its various departments

Department/Division	Role
Climate Action & Environment (CA&E)	Overall responsibility for managing and implementing the invasive species strategy; support other department's invasive species management efforts as necessary, review landscape and restoration plans, represent Delta on the Invasive Species Council of Metro Vancouver (ISCMV) board, sit on the BC <i>Spartina</i> Working group and coordinates Delta's efforts with respect to the program, provide support to stewardship groups in their invasive species removal efforts, facilitates invasive plant management in publicly-owned parks and natural areas; facilitates invasive plant management on private lands through education and outreach; revises and creates policy and bylaws regarding invasive plants such as updating Delta's Noxious Weeds bylaw; co-manages the summer Weed Control program with Engineering Operations, monitors or collates monitoring and mapping efforts; develops policies and strategic plans; integrates invasive plant management into policies and initiatives including the OCP.
Parks, Recreation and Culture	Work with CA&E to manage and coordinate invasive species management on public lands in parks. Assist with volunteer recruitment and logistics.
Parks Operations	Work with CA&E to identify invasive species and assist with associated removal and restoration efforts on public lands. Specific actions may include facilitating herbicide application efforts, removal and disposal of invasive plant and grubbing.
Community Planning and Development	Prevent the spread and establishment of invasive species by landscape plan reviews and the execution of development permits and demolition permits. Incorporate preventative invasive species management into policies and initiatives like the OCP.
Bylaws	Prevent the spread and establishment of invasive species by enforcing Delta's bylaws as appropriate.

Department/Division	Role
Engineering	Work with CA&E to develop the invasive species GIS layer on DeltaMap
Engineering Operations	Co-manage the summer Invasive Plant Management Team program with CA&E; use best management practices for soil management and revegetation during construction; incorporate invasive species management in transportation and storm water plans/construction projects, work with CA&E to train staff in invasive plant identification and develop procedures to reduce the spread of invasive plants through vegetation and ditch maintenance activities.