Restoring Ecological Function in the Campbell River Estuary FWCP Project COA-F19-F-2725 – Final Report

Figure 1: Cheryl, a Greenways Conservation Team volunteer pulling purple loosestrife, Aug 2018

Prepared for: Fish and Wildlife Compensation Program

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Greenways Land Trust

Executive Summary

In 2018/19, *Restoring Ecological Function in the Campbell River Estuary* completed its third year focusing on providing tangible and measurable conservation benefits to the ecology of the Campbell River estuary, particularly targeting restoration of diverse wetland habitats through invasive species management.

This project is currently majority funded by the City of Campbell River, the Fish and Wildlife Compensation Program, and Environment and Climate Change Canada, with significant in-kind and financial support from Wei Wai Kum First Nation, Greenways Land Trust, the Nature Conservancy of Canada, and TD Friends of the Environment Foundation.

The Campbell River estuary is an iconic sensitive ecosystem that is currently recovering from over a century of degradation through industrial use. The estuary provides habitat to many wildlife species, including great blue herons, bald eagles, waterfowl, and four species of Pacific salmon, including the iconic "Tyee" chinook. It also still contains remnants of amazingly diverse wildflower meadows in upper intertidal marsh habitat. Healthy estuarine ecosystems are key to supporting this rich biodiversity. While most industrial uses have now ceased in the estuary, the ecological scars from decades of impacts are still healing. The disturbance caused by activities such as log milling and log storage offered an unparalleled opportunity for invasive species to spread, and they are one of the impacts that remain to be addressed for the estuary to recover its ecological integrity.

Invasive species were first noted in the Campbell River estuary in an inventory completed for the Management Plan for Baikie Island Reserve in 2002. Unfortunately, yellow flag iris treatments did not start in the estuary until 2012, and in the intervening 10 years, this species invaded several hectares of sensitive marsh habitat all around the estuary.

Invasive species management is a priority 1 action of the Campbell River Watershed Action Plan's Wetland and Riparian Ecosystem chapter, under action item CBR.WAR.HB.31.01 – Implement Wetland and Riparian Restoration Projects; and a priority 2 action of the Campbell River Watershed Action Plan's Rivers, Lakes and Reservoirs Ecosystem chapter, under action item CBR.RLR.HB.11.06 – Implement habitat restoration, enhancement measures – Campbell River Watershed.

Greenways Land Trust has been working to manage invasive species in the estuary for over 5 years, with intensive progress being made with the *Restoring Ecological Function in the Campbell River Estuary* since 2016. In 2018/19, 4,570 kg of yellow flag iris was removed; 570 kg of purple loosestrife; and 540 kg of Scotch broom and Himalayan blackberry was sent to landfill. Treatments of broom and blackberry on 8.7 hectares of upland habitat were carried out, with disposal taking place on site. One infestation of Japanese knotweed was treated within the estuary, with another 11 infestations being monitored after potentially being eradicated. Two new knotweed infestations were found in areas where they are unable to be treated due to restrictions on herbicide use. Greenways facilitated over 100 volunteers and 250 volunteers hours towards carrying out action on invasive species in the Campbell River Estuary over 13 events in 2018/19.

Our recommendation is to continue the intensive invasive species management in the estuary for the benefit of the estuary's wildlife and its biodiversity in general, and we are pleased to have been conditionally granted FWCP funding for year 4 of the project in 2019/20.

Table of Contents

List of Figures

List of Tables

Introduction

In 2018/19, *Restoring Ecological Function in the Campbell River Estuary* completed its third year focusing on providing tangible and measurable conservation benefits to the ecology of the Campbell River estuary, particularly targeting restoration of diverse wetland habitats through invasive species management.

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Invasive species were first noted in the Campbell River estuary in an inventory completed for the Management Plan for Baikie Island Reserve in 2002. At that time, it was recommended that "immediate management efforts should be taken against yellow-flag iris before it establishes larger populations, as it is currently restricted to small, scattered clumps (District of Campbell River and Nature Conservancy of Canada, 2002)." Unfortunately, yellow-flag iris treatments did not start in the estuary until 2012, and in the intervening 10 years, this species invaded several hectares of sensitive marsh habitat all around the estuary. We are urgently trying to get this invasive species under control to prevent further infestation, and the majority of funding requested of FWCP will be allocated to yellow-flag iris treatment.

The Campbell River estuary is an iconic sensitive ecosystem that is currently recovering from over a century of degradation through industrial use. The estuary provides habitat to many wildlife species, including great blue herons, bald eagles, waterfowl, and four species of Pacific salmon, including the iconic "Tyee" chinook. It also still contains remnants of amazingly diverse wildflower meadows in upper intertidal marsh habitat. Healthy estuarine ecosystems are key to supporting this rich biodiversity. While most industrial uses have now ceased in the estuary, the ecological scars from decades of impacts are still healing. The disturbance caused by activities such as log milling and log storage offered an unparalleled opportunity for invasive species to spread, and they are one of the impacts that remain to be addressed for the estuary to recover its ecological integrity.

This project builds on over 15 years of restoration projects by many agencies to restore ecological function in the estuary. The City of Campbell River estimates that over $1 million has already been spent on restoring the estuary, and the City continues to fund ongoing restoration of its Baikie Island Nature Reserve, which is currently managed by Greenways Land Trust under an annual maintenance contract. The Nature Conservancy of Canada holds a conservation covenant on the Baikie Island Nature Reserve. The estuary is a proposed provincial Wildlife Management Area, and negotiations are ongoing to enact the designation.

Invasive species are impacting the ecosystem functioning of the entire estuary, particularly the provincially red-listed Henderson's checker-mallow-Tufted Hairgrass marsh ecological community, and habitat for the Vancouver Island beggarticks, a species of Special Concern under the Species at Risk Act found in marsh habitat (BC Species and Ecosystems Explorer, 2018). Mitigating threats from invasive species is a management objective under the recently adopted SARA Management Plan for the Vancouver Island Beggarticks in British Columbia (Environment Canada, 2015). One of the greatest threats to the functioning of the Campbell River estuary is the impacts of invasive species in both natural and created wetland habitats. The goal of this project is to reduce the area of invasive species

infestation and eventually eradicate all invasive species from sensitive habitats in the estuary over the long term. This project focuses on protecting the investments already made in the Campbell River estuary and restoring the estuary to a well-functioning, productive, and ecologically diverse wetland which supports numerous wildlife species.

Greenways Land Trust is keen to continue to address the threat of invasive species in order to restore the rare ecological communities present in the estuary and ensure their continued ecological health, and continue to work towards the goal in the Campbell River Estuary Management Plan of "establishing a mix of rehabilitated, revegetated and natural upland, shoreline setbacks and foreshore that will support improved fish and wildlife habitat" (Penfold, 2002). As a locally-based environmental non-governmental organization, Greenways can work with all of the landowners in the estuary to restore and enhance the estuary's ecological functions. Greenways has a long-term interest in restoring our estuary and we are committed to eradicating all invasives from the estuary over time.

Greenways Land Trust

Established in 1996, the mission of Greenways Land Trust is to restore, sustain and protect natural areas and critical habitats, particularly ecological and recreational greenways, for the benefit of our community. Our volunteer board is active in championing environmental projects and collaborating with partners.

Greenways has been actively involved with management of invasive species in the Campbell River, including developing and implementing programs to control Japanese knotweed, Himalayan blackberry, purple loosestrife and yellow flag iris with our partners. Greenways has an excellent track record in facilitating volunteering and stewardship among community members and school students. Volunteers contributed over 5,000 hours towards our community stewardship projects in 2017/18.

Goals and Objectives and Linkage of FWCP Action Plans and specific Action(s)

One of the greatest threats to the functioning of the Campbell River estuary is the impacts of invasive species in both natural and created wetland habitats. The goal of this project is to contribute towards reducing the area of invasive species infestation and preventing their spread. Our eventual goal is to eradicate all invasive plants from sensitive habitats in the estuary over the long term. This project focuses on protecting the investments already made in the Campbell River estuary and restoring the estuary to a well-functioning, productive, and ecologically diverse wetland which supports numerous wildlife species.

The project approach focuses on continuing invasive species management programs already undertaken by Greenways Land Trust, the City of Campbell River and the Nature Conservancy of Canada. We have been excited to work in partnership with the new Wei Wai Kum Guardians program in 2018 and anticipate continuing our partnership in 2019.

Activities include physical removal of yellow flag iris (Iris pseudacorus) and purple loosestrife (Lythrum salicaria) and replanting or reseeding areas as appropriate, using donor seeds and plants from elsewhere in the estuary wherever possible. Infestations of Japanese knotweed (Fallopia japonica) that are 1m above the high water mark will be treated chemically, which is best practice for chemical treatments to avoid impacts on non-target species. Areas where previous invasive species removals have already taken place continue to be monitored and removal of invasive regrowth, and replanting and reseeding with native species from donor sites elsewhere in the estuary have taken place where necessary.

FWCP Action Plan Alignment:

Primary Action:

Coastal Watershed Action Plan: Campbell River Watershed Action Plan
Ecosystem Chapter: Wetland and Riparian
Action Type: Habitat-based Actions
Priority Action Short Description: CBR.WAR.HB.31.01 Implement Wetland and Riparian Restoration Projects – P1

This project manages invasive plant species in the Campbell River Estuary, which has been identified as a high priority restoration activity by both estuary stakeholders and through recent assessment and mapping (Campbell River Estuary Vegetation Community Mapping and Assessment, Mimulus Biological Consultants, 2017). This project directly address Priority Action CBR.WAR.HB.31.01 which states "Implement wetland and riparian restoration projects that are identified as high priorities through inventory, mapping or assessment...This can include managing invasive plants as needed."

Secondary Action:

Coastal Watershed Action Plan: Campbell River Watershed Action Plan
Ecosystem Chapter: Rivers, Lakes and Reservoirs
Action Type: Habitat-based Actions
Priority Action Short Description: CBR.RLR.HB.11.06 Implement habitat restoration, enhancement measures – Campbell River Watershed – P2

Estuarine habitat restoration is a priority 2 action for anadromous and resident salmonids. Removal of invasive species and restoration of native vegetation, especially intertidal and riparian species, will provide habitats and prey productivity to the ecosystem which is essential for rearing juvenile salmonids, as well as improving substrate stability and reducing erosion.

Study Area

The study area is the Campbell River Estuary from the highway bridges and Highway 19 to Discovery Passage at Tyee Spit.

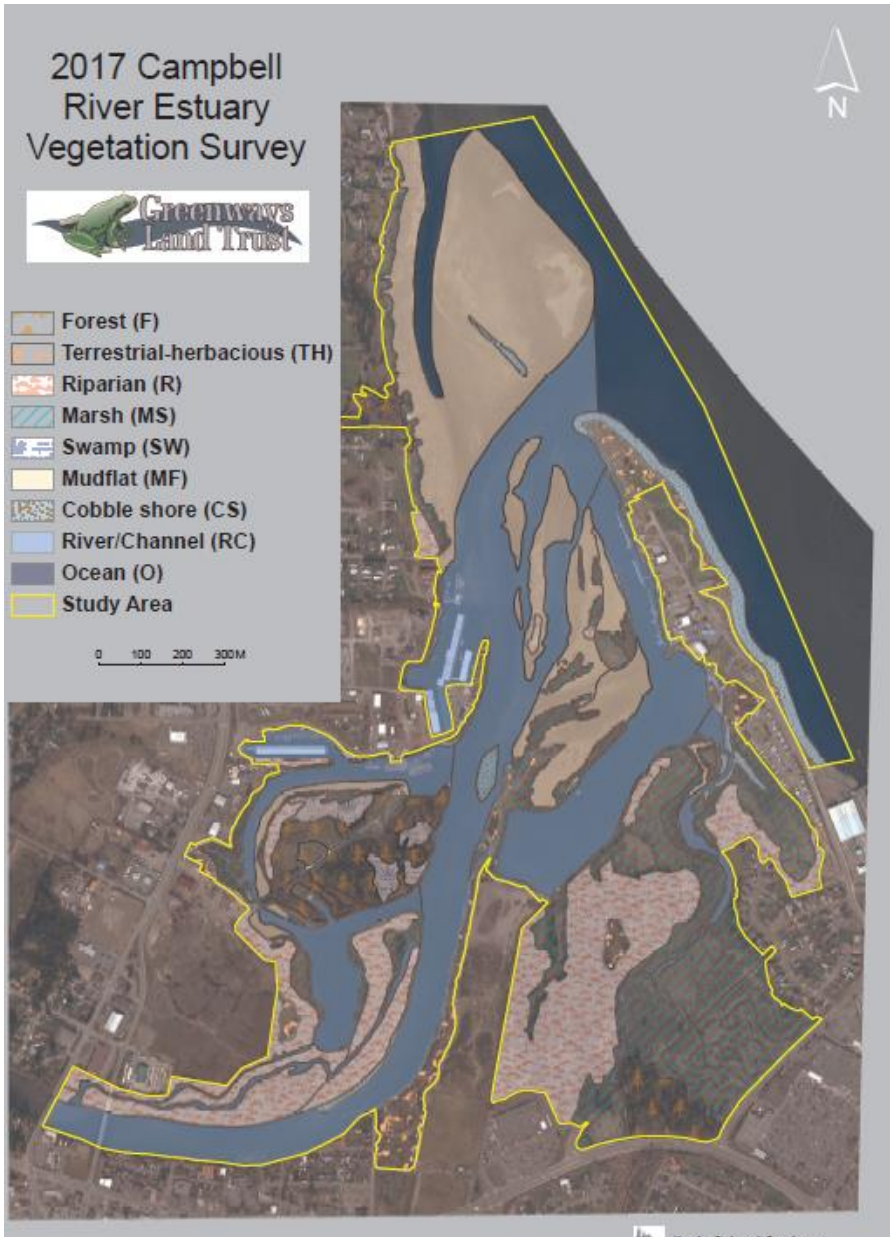

Figure 2: Study Area - Campbell River Estuary

Methods

Invasive species removal and treatments followed best practices to ensure that efficient and effective control measures were undertaken and long-term impacts were maximized.

For all species, isolated and outlying populations were prioritized for treatment to prevent continued spread. Contractors inspected the polygons (by boat where necessary) where invasive species were identified during vegetation mapping in 2017 (Campbell River Estuary Vegetation Community Mapping and Assessment, Mimulus Biological Consultants, 2017) while these species were in flower or otherwise visible on the landscape, and marked for treatment as necessary. Once treatment of outlying populations had taken place, contractors and volunteers continued on to treat existing dense infestations in easily accessible areas, including through a pilot of the benthic barrier technique for yellow flag iris.

The following species-specific treatment techniques were used:

Table 1: Major invasive species in the Campbell River Estuary and their treatment

Species	**Treatment technique**
Yellow flag iris	Hand-picking flowers and seedpods to prevent infestation/re-infestation of suitable habitat; digging of rhizomes with disposal at the landfill. New in summer 2018 – pilot of the benthic barrier (light exclusion) technique.
Purple loosestrife	Hand-pulling entire plants prior to seed formation, disposal at the landfill. Biocontrol is available and persists in non-tidal areas from introductions approx. a decade ago (e.g. Nunns Creek estuary). Attempts were made in 2017 and 2018 to purchase biocontrol, but this was unsuccessful. In 2019 we will try collecting from existing non-tidal population and spreading into tidal areas (n.b. according to Dan Buffet at Ducks Unlimited (2018), the biocontrol cannot overwinter in tidal areas)
Knotweed species	Chemical treatments via qualified contractor, only possible if infestation is greater than 1m above high water mark. No treatments currently possible below 1m.
Scotch broom	Cutting plant at just below soil surface, best if carried out during flowering. No cutting while seeds are on the plant to prevent spread during removal. Disposal can be either at the landfill, or to leave the plant waste in-situ where possible (sometimes this is not possible due to the site aesthetics or simply volume of plant waste).
Himalayan blackberry	Cutting to prevent spread, and digging out rhizomes to eradicate. Disposal at the landfill, or where possible, in waste piles on site that are monitored for regrowth (generally regrowth from cut material will not occur unless the node tips are in contact with soil).

It was planned for areas where significant disturbance has occurred from invasive species treatments to be seeded with seed collected from native species elsewhere in the estuary to assist in diverse natural

regeneration and suppression of invasive species regrowth. Unfortunately, due to unseasonable fall storms in mid-September, many of the seeds we were going to collect had already dispersed into the surrounding environment. Most of the disturbed wetland areas have had significant natural regeneration, but we will continue to attempt to collect and spread seeds from elsewhere in the estuary to ensure as much biodiversity as possible within naturally regenerated areas in future years.

Treatment data was recorded in the provincial Invasive Alien Plant Program (IAPP) database to ensure that all stakeholders were aware of the works. Records were kept including maps of areas treated, weight of invasive species removed, chemical formulation and volume applied (if any). Treated areas will continued to be monitored in future years.

Results and Outcomes

Year 3 (2018/19) of the program saw significant new capacity added for invasives species management in the Campbell River estuary through both the addition of FWCP funding, and developing a partnership with the newly established Wei Wai Kum Coastal Guardians program. The Wei Wai Kum Guardians have been very active in invasive species management in Year 3, including removing over 300 kg of purple loosestrife and cutting over 4 hectares (by hand!) of Scotch broom from reserve lands. Also new this year is the piloting of the benthic barrier technique developed at Thompson Rivers University with Dr. Catherine Tarasoff for controlling yellow flag iris. We eagerly await next spring to see if the barriers will stay in place through both the storm season and the king tides.

Figure 3: Benthic barrier pilot, July 2018

Contractors inspected the polygons where invasive species were identified during vegetation mapping in 2017 (Campbell River Estuary Vegetation Community Mapping and Assessment, Mimulus Biological Consultants) while these species were in flower or otherwise visible on the landscape, and treated as necessary to ensure that all isolated populations are being treated.

Table 2: Impact 2018/19 of Invasive Species treatments

Invasive Species	**Impact 2018/19**
Yellow flag iris	4,570 kg of plant removed, including 400kg of flowers and seedpods, from 7.0 ha of wetland habitat
Purple loosestrife	570 kg removed from 7.9 ha of wetland habitat
Scotch broom and Himalayan blackberry	540 kg sent to landfill and treatments from over 8.7 hectares of upland habitat within the estuary were disposed of on site.
Knotweed species	One treatment within the estuary at an industrial property. Continued monitoring of 11 sites presumably eradicated. 2 new infestations found in untreatable areas (One in the Campbell River in front of Campbell River Lodge, the other near the double footbridges on the NCC trail).

Figure 4: Rayyan, one of our summer students, installing the fencing to mark the benthic barriers, July 2018

Treatment data has been recorded in the provincial Invasive Alien Plant Program (IAPP) database to ensure that all stakeholders are aware of the works during this winter.

Discussion

The Campbell River estuary is an iconic sensitive ecosystem that is currently recovering from over a century of degradation through industrial use. The estuary provides habitat to many wildlife species, including great blue herons, bald eagles, waterfowl, and four species of Pacific salmon, including the iconic "Tyee" chinook. It also still contains remnants of amazingly diverse wildflower meadows in upper intertidal marsh habitat. Healthy estuarine ecosystems are key to supporting this rich biodiversity.

While most industrial uses have now ceased in the estuary, the ecological scars from decades of impacts are still healing. The disturbance caused by activities such as log milling and log storage offered an unparalleled opportunity for invasive species to spread, and they are one of the impacts that remain to be addressed for the estuary to recover its ecological integrity. The goal of this project is to reduce the area of invasive species infestation and eventually eradicate all invasive species from sensitive habitats in the estuary over the long term.

Figure 5: YFI contractors carrying out Yellow flag iris removal, July 2018

Invasive species are impacting the ecosystem functioning of the entire estuary, particularly the provincially red-listed Henderson's checker-mallow-Tufted Hairgrass marsh ecological community, and habitat for the Vancouver Island beggarticks, a species of Special Concern under the Species at Risk Act found in marsh habitat (BC Species and Ecosystems Explorer, 2018). Mitigating threats from invasive species is a management objective under the recently adopted SARA Management Plan for the Vancouver Island Beggarticks in British Columbia (Environment Canada, 2015). One of the greatest threats to the functioning of the Campbell River estuary is the impacts of invasive species in both natural and created wetland habitats. This project focuses on protecting the investments already made in the Campbell River estuary and restoring the estuary to a well-functioning, productive, and ecologically diverse wetland which supports numerous wildlife species.

In Year 3 of the project, invasive species removal and treatments continued to follow best practices to ensure that efficient and effective control measures were undertaken and long-term impacts were maximized. For all species, isolated and outlying populations were prioritized for treatment. However, most of these populations have now been treated, and Year 4 will focus on treating re-growth in isolated areas, and starting to focus on more dense infestations. It was particularly rewarding this year to be able to support the new Wei Wai Kum Coastal Guardians program take action on invasive species within the Campbell River estuary, particularly on Wei Wai Kum reserve lands.

Management of invasive species in the format that Greenways champions provides a limited risk profile. While manual removal of invasive species can also disturb valuable native species, the long-term impact of allowing infestations to grow will negate the effects of trying to protect native species rather than continuing with invasive species treatments. Infestations located on the Baikie Island Nature Reserve will continue to be monitored and treated if necessary using annual maintenance funds provided by the City of Campbell River. If additional funding cannot be obtained in future years to continue to treat other areas, those areas will be monitored and regrowth suppressed using volunteer labour, although no new areas will be able to be treated. Removing yellow-flag iris rhizomes is slow but effective for controlling the plant. Most areas where we have removed rhizomes in the past only need minimal maintenance for continued control. The benthic barrier technique, as piloted this year, may increase efficiency of treatment by reducing labour cost.

Most invasive species treatments are well-understood and accepted by the general community. Greenways has an excellent reputation in our community and Greenways is incredibly proud to have recently won "Non-Profit of the Year 2017" at the Campbell River Chamber of Commerce Awards.

One invasive species treatment that may carry some risk is the chemical treatment of Japanese knotweed within the Pesticide Free Zone, if permitted by regulators. If this activity is approved, we will proceed with caution and only where all stakeholders are supportive, particularly First Nations.

Community Engagement, Education and Outreach

Greenways Land Trust is committed to engaging with our community and providing education and outreach to continue to build an environmental ethic within our community. Every year, we carry out several community events focused on invasive species education and getting community members out on site assisting with management.

Table 3: Invasive Species Community Events 2018/19

Date	**Invasive Species Community Events**
Mar. 24, 2018	Campbell River Seedy Saturday – Greenways booth featuring invasive species info
May 28, 2018	YFI flowers and seedpods with Stewardship Leaders and Stream to Sea class (18 volunteers, 36 hrs)
Jun. 7, 2018	Blackberry cutting and watering new Doug fir trees (5 volunteers, 7.5 hrs)
Jun. 13, 2018	YFI seedpods with 2 school groups (32 volunteers, 64 hrs)
Jun. 24, 2018	Campbell River Farmer's Market – Greenways booth featuring invasive species info
Jun. 28, 2018	YFI seedpods with Greenway Conservation Team [GCT] (3 volunteers, 6 volunteer hrs)
July 22, 2018	Campbell River Farmer's Market – Greenways booth featuring invasive species info
July 26, 2018	Purple loosestrife pull with GCT & Nature Conservancy (7 volunteers, 10.5 hrs)
Aug. 5 & 9, 2018	Purple loosestrife pull with GCT (5 volunteers, 7 hrs)
Sept. 23, 2018	Haig-Brown Festival – Greenways booth featuring invasive species info
Oct. 28, 2018	TD Tree Days – clearing blackberry and re-planting with native species (390 trees planted, 39 volunteers, 120 hrs)
Nov. 7, 2018	Clearing blackberry on Myrt Thompson trail with GCT (3 volunteers, 4.5 hrs)

Project Communications

In 2018, Greenways did not publish any press releases relating to invasive species management in the Campbell River Estuary. We did have one email newsletter article (currently 900 subscribers), and three Facebook posts (currently 874 followers) that we sent out to our people and in which FWCP is credited:

Purple Loosestrife Pull and Lunch (537 people reached):
https://www.facebook.com/events/453056931787723/

Yellow Flag Iris Day 2018 (572 people reached): https://www.facebook.com/events/198208877674122/

Funder's thank-you post (572 people reached):
https://www.facebook.com/events/198208877674122/permalink/198219474339729/

E-newsletter article, Yellow Flag Iris: https://mailchi.mp/29a2d863f9ef/mpdbwjfqfb-1342973

Recommendations

Greenways recommends the continuation of the intensive invasive species management program in the Campbell River estuary to benefit the biodiversity of the entire estuary. Much progress is being made, and we believe that our goal of eradication of many of these species from the estuary is possible in time.

Acknowledgements

Greenways Land Trust would like to acknowledge the financial support of the Fish and Wildlife Compensation Program, Environment and Climate Change Canada's National Wetlands Conservation Fund, the City of Campbell River, and TD Friends of the Environment Foundation for the project's 2018/19 financial year.

In addition, Greenways would like to acknowledge the support of our dozens of volunteers, the Wei Wai Kum First Nation, the Nature Conservancy of Canada, A'tlegay Fisheries Society, Fisheries and Oceans Canada, and the Fanny Bay Enhancement Society towards our work in the estuary this year. Thank you.

Figure 6: Greenways Annual Broom Bash 2018 along the Myrt Thompson trail, May 2018

Figure 7: Greenways Conservation Team and the Timberline Stream to Sea class picking yellow flag iris flowers, May 2018

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