



**FRASER VALLEY
WATERSHEDS
COALITION**
Healthy Watersheds, Healthy Communities

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**STAVE RIVER WATERSHED – RESTORING SALMON SPAWNING,
REARING AND OVERWINTERING HABITAT**



Photo courtesy of Jim Taylor- Stave Valley Salmonid Enhancement Society



FWCP No: 16.SFN.01
Prepared for Fish & Wildlife Compensation Program

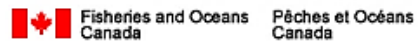
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STAVE RIVER WATERSHED -RESTORING SALMON SPAWNING, REARING AND OVERWINTERING HABITAT

The Fraser Valley Watersheds Coalition would like to thank all project funders, partners and the community. With their contributions, projects like these are much more successful and benefit our wildlife, watersheds and communities.

For additional information about this document or project details please contact the Fraser Valley Watersheds Coalition, or visit our website: www.fwvc.ca.

PROJECT ACKNOWLEDGEMENT



Stave Valley Salmonid Enhancement Society

EXECUTIVE SUMMARY

Off-channel habitats are vital in maintaining the ecological integrity of river systems in British Columbia. Natural off-channel habitats include beaver ponds, wetlands, alcoves, floodplains, side channels and tributaries (Blackwell et. al 1999). The Lower Stave River has been regarded as one of the most productive salmon habitats in the province and supports the second largest chum salmon population in the Fraser River watershed. The presence of the Ruskin dam restricts the range of habitat that the anadromous salmon can use, and currently only the lower 3 km section of the Stave River provide habitat for these spawning salmon. To ensure the Lower Stave remains a highly productive system, monitoring and periodic restoration of in-stream and off-channel habitat quality and quantity is necessary.

The Stave River Watershed – Restoring Salmon Spawning, Rearing and Overwintering Project is a collaborative effort to enhance, restore and promote shared conservation values in the Stave River watershed. It is a continuation of projects that have occurred in the Lower Stave River region to improve the overall salmon habitat in the area. This project resulted in the restoration of the following amount of habitats:

- 48,200 m² rearing instream habitat
- 750 m² spawning instream habitat
- Installation of an intake and repair of another intake to repair flows to off-channel habitats
- Planted 20,299 native plants for an area totalling 3,902 m² of habitat.

Fish & Wildlife Compensation Program (FWCP) contributed **\$48,466** and with other financial and partner in-kind contributions of **\$169,399.50** the total project value of this project **\$217,865.50**

This report summarizes the results of work completed between April 1, 2015 and March 31, 2016 under the financial contribution of Fish & Wildlife Compensation Program and Recreational Fisheries Conservation Partnership Program. Additional in-kind support for this project was received by Department of Fisheries and Oceans Canada, Stave Valley Salmonid Enhancement Society, Athene Ecological, University of the Fraser Valley, Ducks Unlimited Canada, Kwantlen First Nation, the local community members, the Fraser Valley Watersheds Coalition, and the Fraser Valley Regional District.

Thanks to the momentum of on-the-ground restoration activities, the strength in partnerships and sponsorships, and overall importance of this project, further restoration efforts and long-term management plans are being developed to continue building upon the success and ensure long-term ecological integrity is maintained.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	3
TABLE OF CONTENTS	4
1.0 INTRODUCTION	5
2.0 RATIONALE	6
3.0 GOALS AND OBJECTIVES	6
4.0 STUDY AREA	7
5.0 WORKPLAN	8
6.0 METHODS AND OUTCOMES	9
6.1 SITE # 1	9
6.2 SITE # 2	10
6.3 SITE # 3	11
6.4 SITE # 4	13
6.5 SUMMARY OF WORKS COMPLETED	14
7.0 DISCUSSION	15
8.0 RECOMMENDATIONS	16
9.0 ACKNOWLEDGEMENTS	16
10.0 REFERENCES	17
11.0 LIST OF APPENDICES	18
APPENDIX 1. PROJECT PHOTO-DOCUMENTATION	19
APPENDIX 2. CONFIRMATION OF RECOGNITION AND OUTREACH	25
APPENDIX 3. PROJECT AS BUILT DIAGRAM	34

1.0 INTRODUCTION

Off-channel habitats are vital in maintaining the ecological integrity of river systems in British Columbia. Natural off-channel habitats include beaver ponds, wetlands, alcoves, floodplains, side channels and tributaries (Blackwell et. al 1999). The Lower Stave River is regarded as one of the most productive salmon habitats in British Columbia. The area between the Ruskin Power Station and the Fraser River is highly braided with numerous gravel bars and side channels. This section of river supports the second largest chum salmon population in the Fraser River watershed (after the Harrison River). Over 500,000 chum salmon and thousands of Coho and Chinook salmon have been recorded spawning within these gravelled channels (Bailey et al 2005).

However, the presence of the Ruskin Dam, developed between 1910-1930, restricts the range of habitat that the salmon can use; consequently, only the lower 3 km section of the Stave River provide habitat for spawning salmon. The Ruskin Power Station, located immediately upstream of this section also has a significant ongoing influence on gravel recruitment, sedimentation and erosion processes in the Lower Stave River (Bailey et al 2005). To mitigate the hydro-electrical development impacts and to help support a robust recreational fishery, numerous major habitat maintenance projects have been conducted by Fisheries and Oceans Canada (DFO) and BC Hydro from 1990 until present day. In particular, to ensure the Lower Stave remains a highly productive system, DFO and partners have been working to improve the availability and functionality of salmon habitat within this stretch, work that has included routine monitoring and periodic restoration of in-stream and off-channel habitat.

In addition, to the restricted lower floodplain and controlled flows related to the Ruskin Dam and hydro-electrical output, other challenges limit the availability and viability of suitable salmon habitat. These include invasive species encroachment including the invasive reed canary grass, *Phalaris arundinacea*, and Himalayan blackberry, *Rubus armeniacus*. Habitat simplification and modification of the chemical composition of the waterway causing a reduction in available dissolved oxygen and increased water temperatures. As well as the presence of invasive predators like the large-mouth bass, and barriers to fish passage restricting access into these critical estuary habitats.

2.0 RATIONALE

The purpose of this project was to increase viable off-channel habitats to support rearing, overwintering and spawning salmon, wildlife and overall biodiversity. Restoration efforts included creation of additional off-channel habitat to provide year-round sustained flows, spawning gravel augmentation and overall habitat complexing using bioengineering techniques and replanting, and replacement and improvements of flow intake structures. The goal of this project is to ensure that the long-term resiliency and ecological integrity of this area is maintained into the future.

3.0 GOALS AND OBJECTIVES

There were eight main objectives associated with this project.

- Repair Site 1 intake.
- Repair Site 4 intake and Thompson Creek
- Restore and enhance a minimum of 1,200 m² of salmon habitat through excavation of existing and new tidal channels.
- Create a minimum of 250 m² of spawning habitat.
- Place large wood over a minimum of 400 m² of habitat benefiting coho salmon
- Complete instream habitat complexing through bioengineering techniques and LWD placement.
- Revegetate the restoration sites to encompass an estimated 300 m² of habitat.
- Report the archaeological and Species-at-Risk (Western Painted Turtle) assessments.

4.0 STUDY AREA

The associated projects are located in the Stave River Watershed within the municipal boundaries of the District of Mission, Silverdale community, and Fraser Valley Regional District (Figure 1). The Stave River flows south-southwest from the Hayward Lake reservoir and joins the Fraser River. Four main restoration project sites were identified for restoration activities over the next several years (2014-forward). Restoration and associated assessment works completed under the 16.SFN.01 project occurred at all Project Sites: 1, 2, 3 and 4.

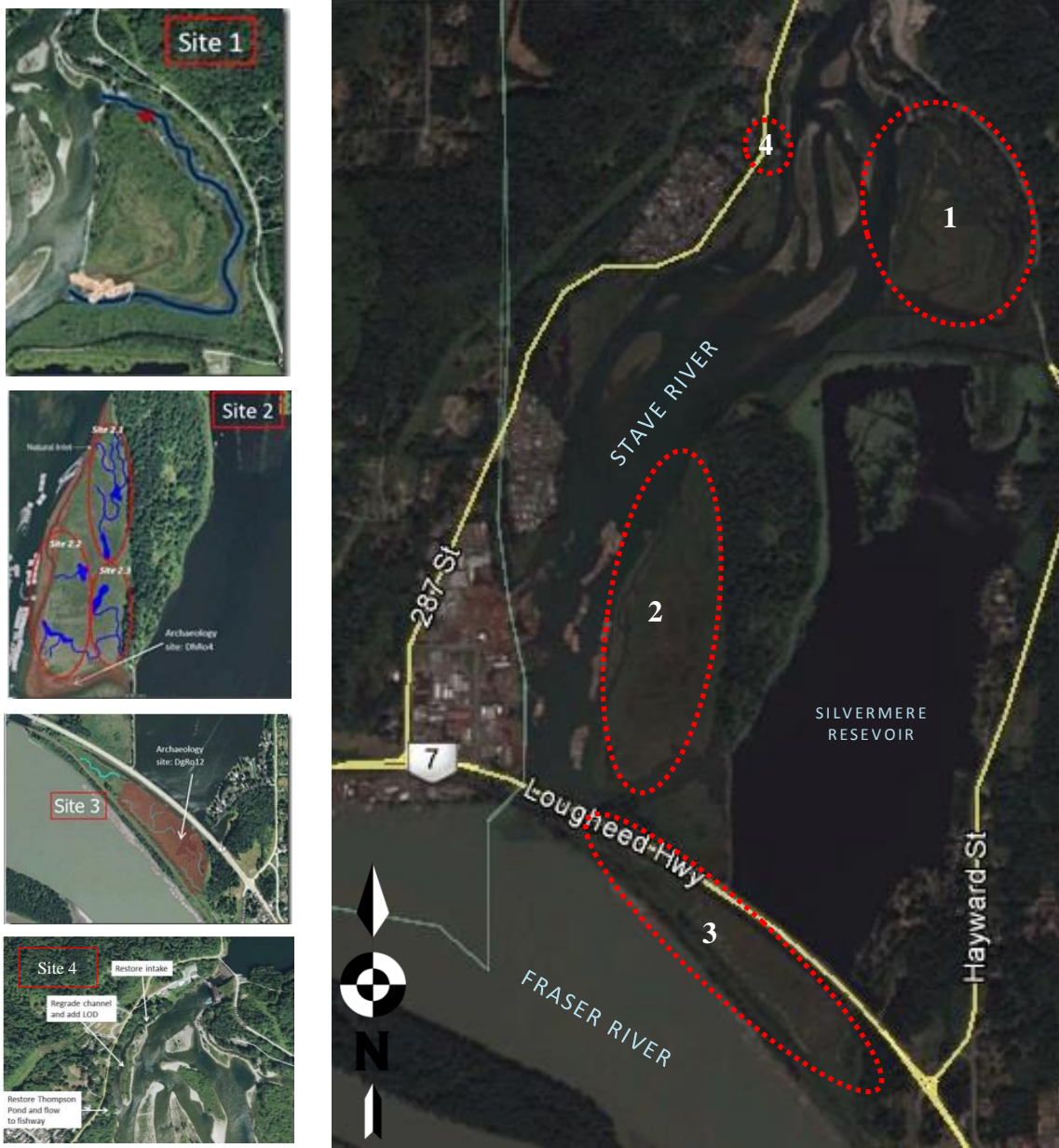


Figure 1. Locations of Restoration Project Sites within the Lower Stave Rivers Images © Google Earth.

5.0 WORK PLAN

Following a similar method that has been successful in past projects, project partners and their specific roles and responsibilities were allocated and are listed below.

Status	Task	Detail
Completed	Vegetation & SARA species Survey. Bio-inventory for existing vegetation Site 2.	This has been completed for Western Painted Turtles, Screech owls and vegetation. Contracted to Raincoast Applied Ecology (veg) and Athene Ecological (SAR). Due to the sensitive nature reports are not publicly available.
Completed	Preliminary design of works	Design of works and partner collaboration included consultation with Kwantlen First Nation, Ministry of Transportation and Infrastructure, Ducks Unlimited Canada, Stave Valley Salmonid Enhancement Society, Fisheries and Oceans Canada and the community.
Completed	Onsite discussion with partners.	Onsite discussion with partners, field site visits, determine in-situ field conditions.
Completed	Archaeological Impact assessment	Archaeological Impact assessment and onsite monitoring during restoration activities has begun – led by Seyem Qwantlen First Nation and Cordillera Archaeology. Due to the sensitive nature reports are not publicly available.
Completed	BC Hydro Ruskin Operations Scheduling	Has been completed to enable successful in-stream restoration. Will continue to schedule and coordinate to ensure replanting is successful.
Completed	Contractor Awarded	Awarded Contractors to operate machinery at Stave Site.
Completed	Construction/Habitat Restoration	Instream construction and restoration of new groundwater tidal channels and side channels, ponds, enhancement at confluence of Stave and Thompson Creek, Ruskin Island and lower site.
Completed	Site Re-vegetation	Replanted Site 4 (Thompson has been replanted, with some bioengineering and a protective soil berm has been created). Site 3 riparian plants have been replanted, much more required.
Completed	Final Report Writing	Completed March 31, 2016.

6.0 METHODS & OUTCOMES

6.1 SITE # 1- RUSKIN ISLAND



The challenge associated with Site # 1 (see Figure 1) was the need to improve sustained flows into the recently constructed off-channel habitat in Ruskin Island. Recent beaver activity and fluctuating Stave River flows had limited the volume of water passing through the existing culvert into the channel and limited the viability of the habitat, and its connectivity back to the Stave River downstream.

In addition, the previous placement of the intake created a blind-back-channel pond. The replacement of the intake enabled direct flows, eliminating this pond, and increasing the overall water quality for that habitat. The priority was to replace the upstream intake with a larger intake to provide greater flow volumes and improve the off-channel habitat conditions. The work was completed in the 2015 In-stream Fisheries Works Window under the direct supervision of DFO.

Using an excavator the old intake was removed and replaced with a 914 mm diameter Boss 2000 corrugated, high-density polyethylene pipe. The pipe connected the flows from the back-channel along the Site 1 Ruskin Island to those within the islands off-channel habitat. (See Appendix 1. Project Photo-Documentation)

The outcomes associated with this site:

- Replacement of Site # 1 intake

6.2 SITE # 2 – KWANTLEN FIRST NATION IR3 ISLAND



The need for salmon habitat restoration at this site reflects the profound encroachment from invasive reed canary grass (*Phalaris arundinacea*) creating a monoculture, engulfing the natural sedges and aquatic vegetation. The grass has formed dense mats that alter the physical and chemical composition of the existing channels. Through its decomposition, it reduces the availability of oxygen for salmonid species and has filled-in historical

channels at this site. In addition, some encroachment from Himalayan Blackberry (*Rubus armeniacus*) along the riparian areas and toe of western-edge hillslope was also observed.

Site # 2 (see Figure 1) was the original habitat targeted for restoration activities. It is owned by Kwantlen First Nation and is situated within a known archaeological hot-spot, requiring the completion of archaeological and species-at-risk assessments. However, Kwantlen First Nation had not finalized their land management plans before the 2015 Instream Fisheries works window and thus, only the archaeological assessment, species-at-risk inventory, and Vegetation assessment memo, work was completed. The archaeological assessment identified significant cultural features that will need to be protected during future restoration activities at this site. It also identified numerous opportunities for restoration in low-lying areas and within historic and existing channels that would be consistent with the conceptual restoration plan. Considerations for existing nesting western painted turtles will be required, especially at access routes for mobilizing heavy machinery and equipment. In addition, a blue-listed taxon in BC, false-pimpernel *Lindernia dubia* var. *anagallidea*, was found on the tidal mudflats along the west shore of Site #2.

An additional component and a key mandate of how the FVWC operates, was to engage and inform the community about the benefits of these projects and the importance of this habitat. As such, two students from the University of the Fraser Valley biology department assisted in the archaeological assessments and gave a summary presentation about their experience and this project to their class. (See Appendix 1. Project Photo-Documentation).

The outcomes associated with this site:

- Archaeological impact assessment Report
- Western Painted Turtle Surveying Report
- Vegetation and Plant Community Assessment Memo
- Engaging students in the project.

6.3 SITE # 3 – LOWER STAVE TIDAL ESTUARY



The most pressing challenge at Site # 3 is the significant encroachment from invasive reed canary grass (*Phalaris arundinacea*), coupled with restricted salmon overwintering habitat that required regrading and an overall lack of habitat diversity.

Majority of the restoration activities were completed at Site # 3 (see Figure 1). During the 2015 Instream Fisheries Works window, under the direct supervision of DFO, up to two large

200-series excavators were used to add habitat complexity to the lower Stave River tidal estuary. Excavators were able to access the site using the Ducks Unlimited access route, located off St. Augstines Way. Works occurred on both Ducks Unlimited property and Kwantlen First Nation property. It involved re-grading the existing north slough to encourage natural flows following the Fraser freshet regime, including the contouring of the channel to allow natural draw-downs of the deeper water in the eastern edge of the property which had brown bullhead and other invasive fish and aquatic species present; side-casting spoil piles to create micro-habitat complexity; excavation and extension of the southern groundwater channel with the addition of spawning gravels to support spawning salmon; and the placement of large wood throughout the channels. (See Appendix 1. Project Photo-Documentation and Appendix 3. Project As-Builts Diagram).

The site was then replanted in the fall of 2015 and spring 2016 with the help from community volunteers, UFV students and FVWC staff. The plants selected for this site needed to be appropriate species that can tolerate high Fraser freshet levels (inundation) for long periods of time, seasonal drying during the summer months, herbivory from beaver and small mammals, some salt influx, a heavy clay substrate, and can compete against invasive reed canary encroachment. While also supporting appropriate estuary plant communities, riparian communities, leaf litter drop and species important for waterfowl use, Table 1. Planting occurred along the new spawning channel, and along the southern-most groundwater channel. Although significant replanting was completed, this site will require much more planting to balance the instream restoration with the aquatic and riparian plantings.

Table 1. Species planted at Site # 3

Common Name	Latin Nam	Size	Quantity
Aquatics and estuary plant species			
Dense sedge	<i>Carex densa</i>	Plug	1,728
Sawbreak sedge	<i>Carex stipata</i>	Plug	936
Common Rush	<i>Juncus effuses</i>	Plug	648
		1 gal	55
Slough sedge	<i>Carex obnupta</i>	Plug	1,296
		1 gal	55
Spike rush	<i>Eleocharis palustris</i>	Plug	360
Hard-stemmed bulrush	<i>Scirpus acufus</i>	Plug	360
Soft-stemmed bulrush	<i>Scirpus viridis</i>	Plug	360
		1 gal	40
Martins sedge	<i>Carex Martensii</i>	1 gal	55
Tall mannagrass	<i>Glyceria elata</i>	1 gal	519
Spreading rush	<i>Juncus patens</i>	Plug	1,355
Tapered rush	<i>Juncus acuminatus</i>	Plug	144
Subtotal			7,911
Riparian shrub and tree species			
Sweet gale	<i>Myrica gale</i>	1 gal	220
		2 gal	60
Hardhack	<i>Spirea douglasii</i>	1 gal	224
		2 gal	300
Pacific willow	<i>Salix lusindra</i>	1 gal	100
Black Hawthorne	<i>Crataegus douglasii</i>	2 gal	60
Twinberry	<i>Lonicera involcrata</i>	2 gal	434
Pacific ninebark	<i>Physocarpus capitatus</i>	2 gal	80
Red osier dogwood	<i>Cornus sericea</i>	2 gal	230
Red alder	<i>Alnus rubra</i>	2 gal	40
Pacific crab apple	<i>Malus fusca</i>	5 gal	10
Black cottonwood	<i>Populus trichocarpa</i>	1 gal	40
Paper birch	<i>Betula papyrifera</i>	2 gal	20
		5 gal	20
Willow and Cottonwood whips	<i>Salix sp.</i>	Whip	10,300
subtotal			12,138
TOTAL			20,049

The outcomes associated with this site:

- Creation of 48,000 m² of overwintering and rearing salmon habitat
- Creation of 750 m² of spawning salmon habitat
- Placement of 400 m² of large wood
- A total of 20,049 native species planted
- Approximately 3,867 m² of habitat bioengineering and replanting
- Installation of 1- 4' x 6' acknowledgement sign and 1-20" x32" information sign
- Engaging students in the project.

6.4 SITE # 4- THOMPSON CREEK AND OFF-CHANNEL HABITAT



Site # 4 is situated on the west bank of the Stave River. It was added to the project scope in May 2015. The challenges at this project site included the de-watering of the refuge pond and fishway, adjoining Thompson Creek due to a beaver tunnelling through the bank into the Stave River. The intake and upper slough immediately upstream of Thompson Creek was buried during a spill event during the 2014 winter, and there have been significant angler and

recreational impacts to Thompson Creek, resulting in the lack of riparian and sloughing of the existing channel.

The works occurred in the 2015 Instream Fisheries works window under the direct supervision of DFO. As this project site is situated within known archaeological hot-spots, an archaeologist from Cordillera Archeology and a Kwantlen First Nation field technician monitored the works. An excavator was used to repair the intake at the northern – upper end of the slough-fishway, repair the tunnelling and de-watering from the beaver by using spoil to re-inforce the bank. The sediment that had filled the fishway was removed and the material was side-casted to create a protective berm along Thompson Creek as it joins the Stave River. This berm was then planted by FVWC field crew with native plant species, Table 2. Plant species were chosen for their ability to withstand season high-water and inundation, season droughts and act as a barrier discouraging damage and trampling from recreationalists.

Table 2. Species planted at Site # 3

Common Name	Latin Nam	Size	Quantity
Riparian shrub and tree species			
Black Hawthorne	<i>Crataegus douglasii</i>	2 gal	30
Nootka Rose	<i>Rosa nukatensis</i>	2 gal	100
		1 gal	80
Pacific Ninebark	<i>Physocarpus capitatus</i>	1 gal	40
TOTAL			250

The outcomes associated with this site:

- Restoring 175 m² of overwintering and rearing salmon habitat
- A total of 250 native species planted
- Approximately 35 m² of habitat replanted
- Installation of 1 1-20” x32” information sign

6.5 SUMMARY OF WORKS COMPLETED

Goals	Site # 1	Site # 2	Site # 3	Site # 4	Status
Repair Site 1 intake	Complete				Complete
Repair Site 4 intake				Complete	Complete
Restore and enhance a minimum of 1,200 m ² of salmon habitat.			48,000 m ²	175 m ²	Complete
Create a minimum of 250 m ² of spawning habitat.			750 m ²		Complete
Place large wood over a minimum of 400 m ² of habitat benefiting coho salmon.			400 m ²		Complete
Revegetate the restoration sites to encompass an estimated 300 m ² of habitat.			3867 m ² (20,049 plants)	35 m ² (250 plants)	Complete
Report the archaeological and Species-at-Risk (Western Painted Turtle) assessments.		Arch & SAR	Arch & SAR	Arch	Complete
Engage the Community- # Planting Volunteers		2	30		Complete
Engage the Community- signage			1-4'x6' and 1-20x32" signs installed	1-20x32" signs installed	Complete
Engage the Community- Social Media reach and presentations	For all Stave projects- 1 delegation to the FVRD RCAS, 2 presentations to UFV Geography Classes and FVWC public lecture series. An estimated 2,374 people were reached during this project.				Complete

7.0 DISCUSSION

The objectives of this project were to ultimately increase the quantity and quality of habitat for salmon and other native aquatic species in lower Stave River watershed. This was done across four different project sites and included constructing new, and enhancing and repairing existing, overwintering and rearing channels; augmenting salmon spawning gravels; re-grading and contouring channels to create additional aquatic habitat that fluctuates with the natural Fraser River freshet hydrological regime, assisting as a control mechanism for invasive species management; repairing and replacing intake structures to improve flows and to ensure fishways remain functional; creating complex habitats through the placement of large wood and spoil piles; and replanting of both aquatic estuary habitats and riparian habitats. In addition, this project has helped to increase knowledge about healthy watersheds and waterways through the community outreach activities.

The loss of off-channel habitats, particularly estuary habitats, from isolation, land altering practices and/or flow modifications, has significantly reduced and impacted returning adult salmon. This is especially true for the Stave River and all of the project sites. These sites, which connect to the Fraser River Delta RAMSAR wetland, are vital for not only salmon but also migratory birds (Ramsar Canada). Restoring and the planning for the future restoration activities was designed to improve salmon habitat, while ensuring SARA listed species including Western Painted Turtle, species at risk, rare plant communities, waterfowl habitat and archaeological, heritage cultural sites were (and will be) protected and if viable enhanced in the process.

It is anticipated that from the project sites that underwent restoration activities, the ecological connectivity, functionality and diversity of each area will be improved. This is by increasing food availability for salmon and waterfowl, changing movement of nutrients and water, and creating variations in the habitat that will offer long-term integrity for salmon habitat (Lapointe et al 2013). Restoration efforts incorporated built-in diversity designs to enhance the resilience of the area. Specifically, in-stream channel habitats were varied: deep, shallow, wide and narrow. Placement of large woody debris within and above the submerged water level provided in-stream complexing, which is particularly important for juvenile coho development. Replanting included a variety of native riparian and aquatic species to enhance functions of the system (Roni et al 2002). The riparian vegetation will have lasting benefits. Full results will take an estimated minimum of two to five years for stock to mature before results are observed, and up to twenty years before an in-tact functioning system may be observed. The benefits include providing shade to the channel, regulating water temperature on a micro-habitat level, increasing bank stability, particularly where deep rooted species were planted, increasing organic and detritus material into the system which creates suitable habitat for riparian and aquatic invertebrates and making the area less susceptible to invasive plant re-establishment.

The restoration work under this project has increased salmon overwintering and rearing habitat in the lower estuary, which is critical in the staging development for smolts; while using the natural landscape as a model for restoration efforts to create new channels and

support greater salmon habitat. It has also improved off-channel slow moving fishways from desiccation, created additional spawning habitats in this lower watershed. In addition, deeper refuge pools within the channels were completed to offer coho and chum over-wintering habitat and food. Already, preliminary monitoring by DFO as found salmonids using the new perimeter channel and adult chum and coho salmon were observed spawning in the new spawning channel. It is anticipated that the overall results of this project will be far reaching. Beyond the physical works, collaborative partnerships with DFO, Ducks Unlimited, Kwantlen First Nation, Stave Valley Salmonid Enhancement Society, District of Mission, BC MOTI and the Fraser Valley Regional District and many others were strengthened through this process.

8.0 RECOMMENDATIONS

Further actions recommended for this project include:

- Continued maintenance and monitoring of restoration site for its use by salmonids for spawning, rearing and overwintering (both adult use and juvenile use).
- Continued monitoring of restoration site for its use by wildlife
- Continued monitoring for the natural establishment of native vegetation and the guarding of large standing trees and shrubs to avoid mortality due to herbivory.
- Management of invasive species through treatment and physical control measures- particularly focussing on Reed Canary Grass.
- Additional restoration and enhancements activities including significant aquatic replanting, spawning gravel supplementation and off-channel creation within this project site and extending throughout the entire Stave River watershed.

9.0 ACKNOWLEDGEMENTS

Financial contributions for this project were received from:

- Fish Wildlife Compensation Program
- Recreational Fisheries Conservation Partnership Program

In-kind support and partners for this project are:

- Fisheries and Oceans Canada –Resource Restoration Unit & Community Advisor
- Fraser Valley Regional District
- District of Mission
- University of the Fraser Valley
- Stave Valley Salmonid Enhancement Society
- Ducks Unlimited Canada
- Kwantlen First Nation

- BC Ministry of Transportation and Infrastructure
- Neighbouring landowners, community and volunteers
- Fraser Valley Watersheds Coalition – members, volunteers and directors

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RAMSAR Canada – website access: <http://www.ramsar.org/wetland/canada>

11.0 LIST OF APPENDIXES

- Appendix 1. Project Photo-Documentation
- Appendix 2. Confirmation of recognition and outreach
- Appendix 3. Project As-Built Diagram

APPENDIX 1. PROJECT PHOTO DOCUMENTATION
SITE # 1 RUSKIN ISLAND



A. Air-photo of Ruskin Island showing location of intake replacement. **B.** New Boss 2000 intake installed north-view in the back-channel. **C.** Machine installing new intake and avoiding archaeological feature. **D.** New Boss 2000 intake installed south-view to newly constructed off-channel salmon habitat. C.



APPENDIX 1. PROJECT PHOTO DOCUMENTATION
SITE # 2 KWANTLEN FIRST NATION IR3 ISLAND



A UFV students participate in the archaeological assessment. They have found cultural features and the Kwantlen First Nation technician is describing how it may have been used in the past.



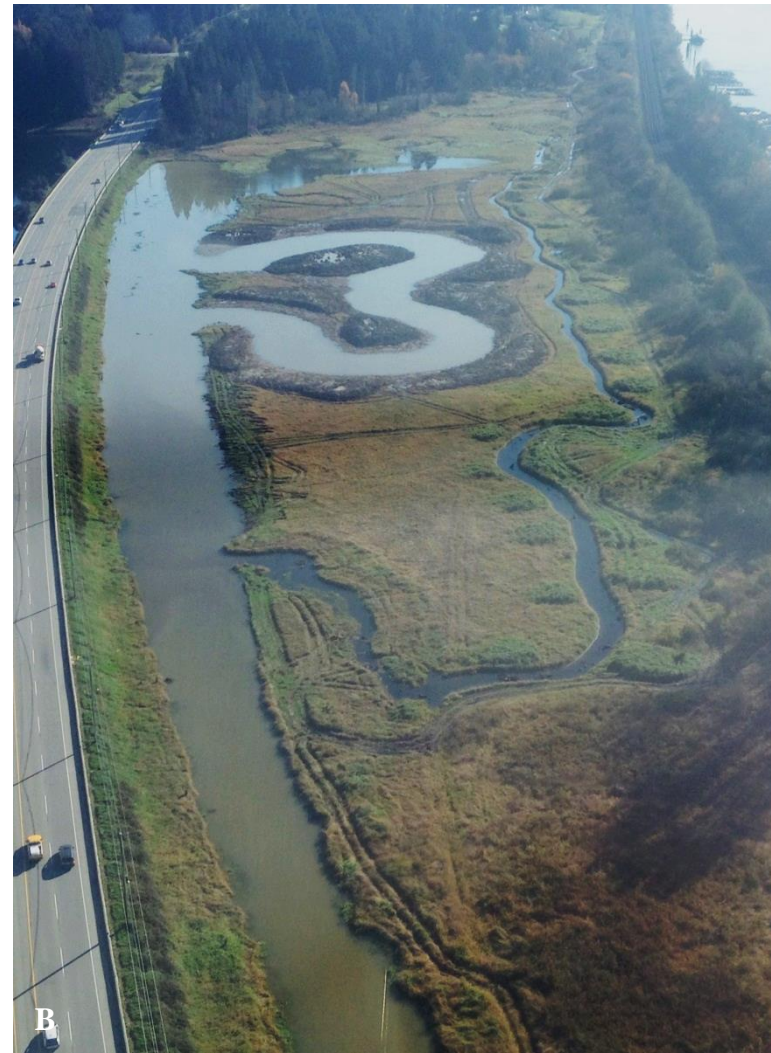
APPENDIX 1. PROJECT PHOTO DOCUMENTATION
SITE # 3 LOWER STAVE TIDAL ESTUARY



A. East-view along the groundwater channel with large wood placed throughout it. B. Long reach excavator is re-contouring the northern-most slough to support rearing salmon habitat. C. The excavator backfills a live palisade bioengineering trench. D. The excavator bucket assisted in moving the plants to where they should be planted. E. UFV students and the community help plant. F. The new spawning channel replanted and guarded to reduce damage from herbivory.



APPENDIX 1. PROJECT PHOTO DOCUMENTATION
SITE # 3 LOWER STAVE TIDAL ESTUARY



A. Air-photo of Site # 3 during in-stream restoration 2015 B. Air-photo of in-stream restoration efforts completed for 2015- prior to replanting.



APPENDIX 1. PROJECT PHOTO DOCUMENTATION
SITE # 4 THOMPSON CREEK AND OFF-CHANNEL HABITAT



A. Excavator digs out sediment from fishway. B. Fishway before restoration-completely de-watered, C. Fishway after restoration. D. Thompson creek channel and riparian damaged and dried out. E. During works, spoil was used to create a berm and riparian habitat along Thompson Creek. F. Replanted berm with signage informing people to care for this habitat.



APPENDIX 1. PROJECT PHOTO DOCUMENTATION
SIGNAGE



Stave River Watershed Restoring Wetlands & Salmon Habitat


**FRASER VALLEY
WATERSHEDS
COALITION**
Healthy Watersheds, Healthy Communities


FWCP
Fish & Wildlife
COOPERATION PROGRAM


Ducks Unlimited Canada


**Mission
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For more information contact www.fvwc.ca



**Fisheries and Oceans
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**Stave Valley Salmonid
Enhancement Society**


Fraser Valley Regional District


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Stave River Watershed Restoring Wetlands & Salmon Habitat



Air-photo of Stave River Estuary after restoration efforts - Fall 2015
For more information contact www.fvwc.ca

Freshwater estuaries, like this one located in the Stave River Watershed, provide important habitat for many species including salmon, waterfowl, raptors, amphibians and mammals. This site required restoration as the stream channels were encroached by invasive reed canary grass, and had barriers restricting salmon from using the habitat. This project included the restoration of existing channels, creation of new channels, refuge ponds and salmon spawning sites. Sections were also replanted with the help from community volunteers.

Left: excavator placing wood in the channel to create a complex stream habitat. Center: re-grading the habitat and adding wetland features. Right: FWWC and Community volunteers planting the restored site. (All photos taken in 2015)

Project Financial Contributions


FWCP
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COOPERATION PROGRAM


**Fisheries and Oceans
Canada**


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Project Partners and In-kind Contributions


Ducks Unlimited Canada



**Mission
ON THE FRASER**


**BRITISH
COLUMBIA**



**Ministry of
Transportation
and Infrastructure**


**Stave Valley Salmonid
Enhancement Society**


Fraser Valley Regional District






Stave River Watershed Restoring off-channel salmon habitat




Air photo of Thompson Creek after restoration efforts - Fall 2015
For more information contact www.fvwc.ca


Off-channel habitats, like this one located in the Stave River Watershed, provide important habitat for rearing and overwintering salmon. These habitats provide slow-water refuge for young salmon which enables them to grow and prepare for their migration to the ocean, as part of the salmon cycle. This stream is called Thompson Creek. It required restoration as it was damaged from high waters and seasonal drying out. It also lacked a riparian habitat and was encroached by invasive Himalayan blackberry. This project restored flows to the channel and replanted the streambank with native plant species.






Left: Excavator repairing Thompson Creek, 2015. Center: Adult coho swimming up Thompson Creek, 2011. Right: Thompson Creek ready for FWWC and community volunteers to replant the riparian habitat.


Project Financial Contributions



FWCP
Fish & Wildlife
COOPERATION PROGRAM



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APPENDIX 2. CONFIRMATION OF RECOGNITION AND OUTREACH

Along the Fraser: Saving a marsh for salmon fry



by Jack Emberly - Maple Ridge News

posted Jan 28, 2016 at 12:00 PM — updated Jan 28, 2016 at 1:54 PM

It's not an assault on fish habitat, but it looks like it from the road.

Mounds of freshly excavated dirt, the deep tracks of earth movers, vegetation uprooted in a marsh across the Lougheed Highway from Silvermere Lake, near Mission.

I've watched scoots dive for sunfish here under the critical eye of eagles perched in nearby cottonwoods, and noted the coming and going of river otters. I'd hoped it would be protected to overwinter salmon fry.

"That's our goal," says Natasha Cox, of the Fraser Valley Watersheds Coalition.

It's heading up a habitat restoration project in this strip of tidal wetland Cox estimates is "the length of 181 NHL rinks."



Along the Fraser Jack Emberly — Image Credit:

The marsh – which parallels the highway towards Silverdale – will be new juvenile salmon habitat. It begins about 300 meters up the side channel near the mouth of the productive Stave River. The river's three kilometres of gravel – from Ruskin Dam to the mouth – spawning ground for pink, and coho, and one of the biggest producers of chum (500,000) in B.C. Only the Harrison River hosts more.

But, adverse conditions here have prevented the overwintering of juvenile coho and chinook, and marshland is key in wild salmon renewal.

"This is a place where we could balance the needs of salmon and waterfowl," says Cox, "improve habitat not previously available."

A first step was to remove two weirs – rock barriers – someone had set in the side channel from the Stave. They restricted water movement and prevented salmon migration.

Excavation reconnected to the groundwater.

"That gave us consistent water levels and made dirty water cleaner and cooler to suit fry," says Cox.

"Getting the water chemistry right for juvenile salmon was the vital change we needed," added Jim Taylor, of the Stave Valley Salmon Enhancement Society, one of the groups in the FVWC Project. "It wasn't there because of masses of canary grass, a barrier to fish. It decomposes, consuming oxygen and increasing temperature. We had to excavate the channel, pull the grasses out to expose the natural feed bank, the sedges and rushes that we want here."

It will also discourage bass.

"Until now, any fry in here we're prey to large predators like bass and carp. What you'll see when we're finished is a habitat that's better suited to juvenile salmon."

A more diverse habitat will also benefit water fowl, says Al Jonsson of DFO's Restoration Unit.

"Water pepper is a natural plant for this area they like. We exposed it so it can grow, and added a little gravel too. There's potential for salmon to spawn here."

Other groups involved in the restoration that began in 2014 include Kwantlen First Nations, the B.C. Fish and Wildlife Compensation Program (money for the widening of Lougheed Hwy.), and Ducks Unlimited, which purchased the property.

The Stave Marsh restoration – just one of FWWC's projects – is good for declining commercial and recreational fisheries along the Fraser. Since 1997, it's helped communities restore watersheds impacted by Hydro dams like the one at Ruskin.

Taylor and wife, Terry, have helped save salmon habitat in the Mission area since the 1980s.

Jim Taylor, a school trustee, taught kids and teachers about salmon enhancement at the river's edge for years. With DFO help, he led classes of students – mine included – to set and pull gill nets in the fall, and mix eggs and milt in buckets. We transported fertilized eggs to George Donatelli's hatchery in Silverdale and one on Taylor's property, then celebrated by roasting marshmallows around camp fires and drinking hot chocolate.

The importance of wild salmon wasn't recognized by the former Conservative government, but that hasn't slowed the work of their local champions.

In 2013, Ducks Unlimited presented the Taylors a richly-deserved Community Conservation Award.

– By Jack Emberly, a retired teacher, local author and environmentalist.

Post Details

Reported stats may be delayed from what appears on posts X



Fraser Valley Watersheds Coalition added 10 new photos — with Rachel Drennan and Winter Moon.

Published by [Natashia Cox](#) [?] · October 2, 2015 ·

A fantastic start to replanting the stave tidal wetlands! Thank you to those who came out today! We will be there tomorrow too! 9:00am and it will be another great day. (We can definitely use some help with this site). For more information: <http://fvwc.ca/get-involved/>

This project is in partnership with BC Hydro FWCP, RFCPP, FWWC, DFO, Ducks Unlimited Canada, SVSES, FVRD, MOTI, UFV, Kwantlen First Nation and our community volunteers!



1,539 People Reached

39 Likes, Comments & Shares

28 Likes	10 On Post	18 On Shares
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1 Comments	0 On Post	1 On Shares
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10 Shares	9 On Post	1 On Shares
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172 Post Clicks

55 Photo Views	3 Link Clicks	114 Other Clicks ⓘ
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NEGATIVE FEEDBACK

1 Hide Post	0 Hide All Posts
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Fraser Valley Watersheds Coalition added 5 new photos.

Published by [Natashia Cox](#) [?] · July 22, 2015 ·

Our summer students are helping us as we prepare for Instream salmon habitat restoration. Stay tuned for more project updates!



180 People Reached

14 Likes, Comments & Shares

11 Likes	5 On Post	6 On Shares
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0 Comments	0 On Post	0 On Shares
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3 Shares	3 On Post	0 On Shares
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4 Post Clicks

4 Photo Views	0 Link Clicks	0 Other Clicks
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NEGATIVE FEEDBACK

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Fraser Valley Watersheds Coalition shared your photo.

Published by Natasha Cox [?] · February 10 · 🌐



Natasha Cox added a new photo to Mission Voice's timeline — in [Mission, British Columbia](#).

February 10 · 🌐

Many people over the last two years may have been wondering what was happening and why there were excavators in the wetland near the Stave River. The answer is the restoration and enhancement of salmon habitat and improved waterfowl habitat on this conservation wetland. This project, lead by Fraser Valley Watersheds Coalition , in partnership with Ducks Unlimited, Ministry of Transportation, stave Valley salmonid enhancement society, fisheries and oceans Canada, Kwantlen First Nation, BC Hydro Fish Wildlife Compensation Program and Recreational Fisheries Conservation Partnership Program all collaborated to improve this natural area. Although not yet complete, the works have been significant. We would like to say a BIG thank you to the volunteers who helped us, to our project funders and to our partners. Together we are working towards healthy watersheds and healthy communities!

(Photo credit Mr. Jim Taylor- stave Valley Salmonid Enhancement Society).

374 People Reached

11 Likes, Comments & Shares

10 Likes	10 On Post	0 On Shares
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1 Comments	1 On Post	0 On Shares
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0 Shares	0 On Post	0 On Shares
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68 Post Clicks

2 Photo Views	0 Link Clicks	66 Other Clicks 📱
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Fraser Valley Watersheds Coalition
Unit 1 43950 Cheam Avenue
Chilliwack BC V2- 1N6
604-855-8274
natashia@frwc.ca
www.frwc.ca

Good afternoon students,

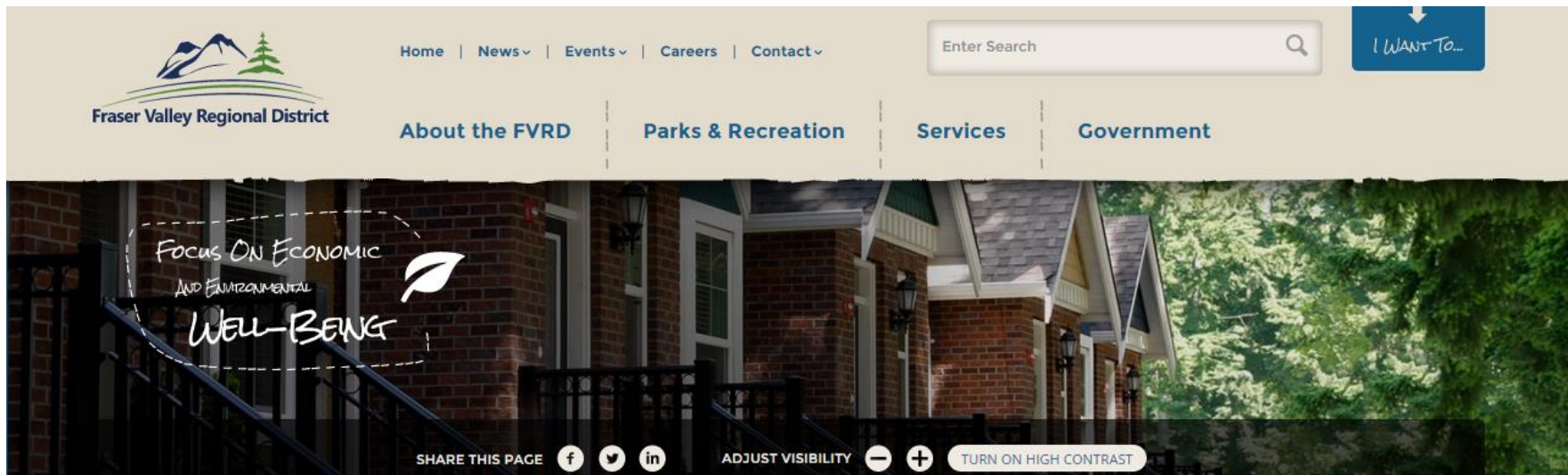
You have volunteered with us, the [Fraser Valley Watersheds Coalition](http://www.frwc.ca), to learn about the importance of interdisciplinary roles when restoring habitat. In particular, you learned about archaeological requirements and assessments at the planning stages of our large-scale salmon restoration project in the Stave River Watershed just west of Mission BC. You assisted in an archaeological assessment as it relates to designing restoration projects and gained an appreciation for the importance of project scoping, design work, conservation act, and contributed to in-field conversations about salmon, rare species and freshwater and tidal wetlands while designing goal specific biological and ecological projects.

Summary Information:

- As part of planning for projects proper assessments must be completed, including: archaeological assessments in areas of known cultural concentrations, bio-inventories for plants and animals and hydrology to ensure water levels and flows are adequate, among many others.
- Today you learned about archeology within the Lower Stave River site- owned by ~~Squamish~~ First Nation- and saw cracked hearthstones, flints and post features.
- Today you saw tidal estuaries (those lowlands) which are very important habitats for salmon to feed and grow large enough to swim out to the ocean. They are also very important for many other species.
- You saw the invasive plant species: Reed Canary grass, which forms dense mats and out-competes native vegetation; and learned some features that define an invasive species.
- Today you dug test pits to help with identifying areas we may need to avoid when we make our final stream design plans.
- This overall purpose of this project is to restore the tidal and freshwater estuaries and improve salmon habitat while ensuring other significant cultural and environmental features are protected.

Thank you for participating!
Natashia Cox
Project Manager
natashia@frwc.ca
604-855-8274

The Fraser Valley Watersheds Coalition is a registered charity working towards healthy watersheds and healthy communities across the Fraser Valley.



Watershed Program

The Fraser Valley is rich in natural resources that are responsible for the region’s high tourism, recreational, agricultural, and environmental values. The FVRD is working with Fisheries and Oceans Canada and the [Fraser Valley Watersheds Coalition](#) to form the Fraser Valley Watersheds Program. The goal of the Watersheds Program is to help improve the health and sustainability of watersheds throughout the Fraser Valley using watershed planning, enhancement and restoration projects, partnership building, and community stewardship, education, and awareness.

Recent projects include:

Chilliwack River Watershed Strategy (CRWS)

The purpose of this collaborative planning project is to provide a common understanding of watershed concerns and values to assist in decision-making that will promote the sustainability of the Chilliwack River Watershed. [Click here for the Chilliwack River Watershed Strategy.](#)

Cultus Lake Aquatic Stewardship Strategy (CLASS)

Lead by the Fraser Basin Council, [CLASS](#) is a group of interested residents, organizations, and agencies to work towards improving the health and sustainability of the Cultus Lake ecosystem.

Stoney Creek Riparian Enhancement and Stewardship

Working with the [City of Abbotsford](#), the Freshwater Fisheries Society of BC, the Abbotsford Soil Conservation Association, and others, we have helped to improve fish access, stewardship capacity, and riparian habitat conditions along Stoney Creek at Bateman Park (Abbotsford).

Off-Channel Habitat Complexing along Chilliwack River

We have been working towards restoring off-channel habitat within the Chilliwack River watershed, critical habitat for spawning and rearing salmon.

Lower Stave River Spawning Habitat Enhancement and Bank Stabilization

Partnering with [DFO](#) and [BC Hydro](#), we are helping to restore important salmon spawning habitat within the lower Stave River beneath the Ruskin Power Station (Mission).

Hammersley Pump Station Conceptual Design Upgrade

Many outdated pump stations along the Fraser are inadequate for drainage and for allowing fish passage. We are looking at developing different design options for the eventual upgrade of one key pumping station near Agassiz, the Hammersley Pump.

Hope and Camp Slough Enhancement

Working with DFO and the [City of Chilliwack](#), we are looking to improve water quality and stewardship within the slough habitats of northern Chilliwack.

For more information about the Watersheds Program, please contact the FVRD Watershed Planner, [Lance Lilley](#).

APPENDIX 3. PROJECT AS BUILTS DIAGRAM

