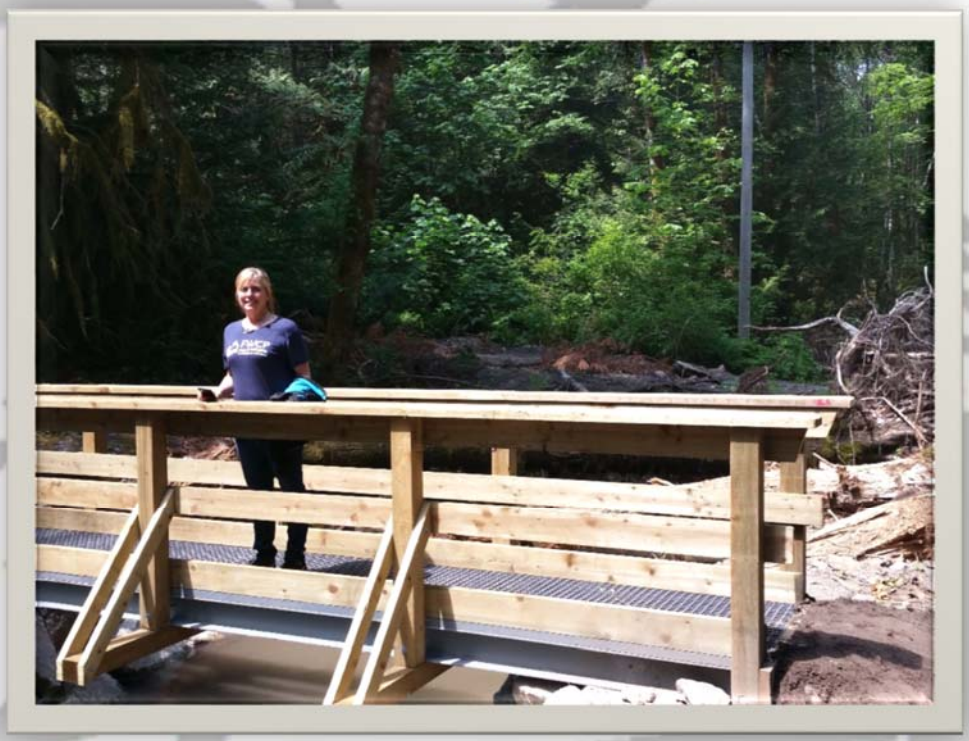
Kiwi Connector Channel Project – Year 2
COA-F19-F-2761
YEAR END FINAL REPORT



Prepared by:
Edith Tobe, RPBio, Executive Director
Squamish River Watershed Society
Box 1791, Squamish, BC, V8B 0B3

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Executive Summary

The Cheakamus River is well known for its abundant populations of salmon, trout and char. The lower reaches of this river lie within Paradise Valley, a highly productive area that has a broad floodplain and numerous side channels. Much of this habitat was disconnected from the river by dikes, but restoration efforts over the last 30 years have revitalized the floodplain and helped to restore salmon runs in this area.

The project site, the "Kiwi Connector Channel Year 2", is located within the Dave Marshall Salmon Reserve on the properties managed by School District #44's Cheakamus Center which is recognized as one of the premier outdoor education facilities in Canada and on Squamish Nation lands at IR 11. There are fewer higher profile area to showcase efforts to restore coastal watersheds. Previous restoration projects on these properties have been designed not just to provide off-channel habitat for salmonids but to also fit within the educational programming at the Cheakamus Centre. The Cheakamus Centre brings hundreds of students each year to experience this unique area on educational field trips. Similarly, Squamish Nation has a long legacy of restoring and improving habitat for salmonids and being stewards of the land. In partnership with Squamish Nation and the Cheakamus Centre, the SRWS, DFO along with BC Hydro have been successful at improving environmental values in this area.

This project expands on the works initiated in 2017/2018. The Kiwi Connector Channel Year 2 project includes the construction of a new channel that connects into Kiwi Channel South and will flow across Paradise Valley road via a new culvert alignment. The project also includes upgrading the existing culvert crossing across Paradise Valley Road that flows into Emerald Forest Creek, repairing bridge crossings (two), and placement of boulder clusters and large woody debris (LWD) in the newly constructed stream. On the east side of Paradise Valley Road work will continue with the Gorbuscha Channel, also with two new bridge replacements and cleaning out any sediment buildup to improve overall downstream flows. The weirs that are controlling the flow will also be cleaned and upgraded to better perform their function.

Beyond the fish habitat benefits from this project, we anticipate several other tangible benefits to the Cheakamus Centre. The first phase of the project (2017/2018 fiscal) has included upgrades to previously constructed infrastructure on the property, including intakes, wooden flow control structures, culverts and bridges. The second phase, this proposal, will now involve constructing the new 600 m extension of Kiwi Connector channel on the east side of Paradise Valley that will reconnect back into Far Point Channel.

New habitat created included 1,800 square metres along the Kiwi Connector Channel and over 10,000 square metres of improved habitat with the new culvert crossings along Paradise Valley Road and upgrades to the Gorbuscha Channel (not to mention over 10 km of downstream habitat within the Evans Creek re-watering project). Four new bridge crossings; 900 riparian plants; two new culvert crossings of Paradise Valley Road; improved trail access; and improved overall water flow.

The final outcomes were the creation of the new 4,000 m2 Kiwi Connector Channel that now provides spawning, rearing, and overwintering habitat for the local species of salmonids. The installation of the twin culverts under Paradise Valley Road has also now opening up and revitalized of over 10,000 m2 of available habitat for fish throughout the Dave Marshall Salmon reserve and the Evans Creek rewatering project.

Restoration efforts within the Cheakamus River watershed are accomplished by the work of many partners, including Squamish First Nation, Squamish River Watershed Society, School District #44, BC Hydro, DFO and others. This project has utilized the knowledge and expertise within all of these groups in order to deliver a project that will have long term benefits for the community.

The Kiwi Connector Channel Year 2 project aligns with high priority action activities for habitat-based restoration actions specific to the improvement of habitat for salmonids including Chinook, coho, chum, pink, and steelhead stocks as outlined in the Action Table of the “Cheakamus River Watershed Action Plan” (BC Hydro 2017). Specifically, this project aligns with the Cheakamus Salmonid Action Plan priority actions to maintain existing constructed habitat enhancements for all salmonids and improve existing side channels and off-channel areas for all salmonids.

Contents

1.0 Introduction and Project Description

The project is the second year of a two year project proposal in which additional water from the Far Point intake (upgraded in 2016) was delivered into the first section of Kiwi Connector channel that was completed in the 2017/2018 field season and extended down through Emerald Forest Creek and down into Moody's Channel. A portion of the funds were used downstream to improve the flows through Evans Creek and provide slope stability along the riparian zone.

While the habitat produced will be beneficial to all species of salmonids the project was specifically designed with providing habitat, reaches for spawning, and overwintering rearing habitat for all life cycles of coho salmon. The project included works on School District #44 (as part of the Cheakamus Centre, in partnership with Nature Conservancy of Canada) and on Cheekye (IR #11) in partnership with Squamish Nation.

The success of the project was based on the partnerships between the government agencies, Squamish Nation, and the project partners and on June 20th, 2018 a special event was held in recognition of the support and work that went into the construction of the two years of restoration that resulted in the construction of the new channel. The channel was opened as part of the ceremonies, some riparian shrubs were planted in the area, and Tenderfoot Hatchery released several thousand coho fry once the sediment settled out. A video clip of the day can be seen at: https://youtu.be/NEYh0sAVC0o.

New habitat created includes 1,800 square metres along the Kiwi Connector Channel and over 10,000 square metres of improved habitat with the new culvert crossings along Paradise Valley Road and upgrades to the Gorbuscha Channel (not to mention over 10 km of downstream habitat within the Evans Creek re-watering project). Four new bridge crossings; 400 riparian plants; two new culvert crossings of Paradise Valley Road; improved trail access; and improved overall water flow.

2.0 Goals and Objectives

The proposed habitat project involved expanding upon existing fish habitat work within the Cheakamus River floodplain. In partnership with Fisheries and Oceans Canada and Squamish Nation the SRWS had established the following objectives:

- Extend Kiwi Connector Channel south of Kiwi Channel South down towards Moody's Channel;
- Gorbuscha Channel Complex upgrade (including replacement of two bridge crossings, cleaning out silt and debris, and removal of wooden box structure with replacement of more efficient weir).
- Twin culvert crossings across Paradise Valley Road to connect Kiwi Connector into Emerald Forest Creek.
- Riparian planting of over 900 native trees and shrubs.

The Kiwi Connector Channel project aligns with high priority action activities for habitat-based restoration actions specific to the improvement of habitat for salmonids including Chinook, coho, chum, pink, and steelhead stocks as outlined in the Action Table of the “Cheakamus River Watershed Action Plan” (BC Hydro 2017). Specifically, this project aligns with the Cheakamus Salmonid Action Plan priority actions to maintain existing constructed habitat enhancements for all salmonids and improve existing side channels and off-channel areas for all salmonids.

3.0 Study Area

The salmon habitat restoration sites are located on the west bank of the Cheakamus River downstream of the Paradise Valley Road Bailey Bridge. The project is within the lands managed by the Cheakamus Centre, School District 44 (North Vancouver) designated as District Lots 1245 and 1244 within the New Westminster Land District as well, at the southern end, lands managed by Squamish Nation as part of IR 11. Maps covering the site are Natural Resources Canada National Topographic System 92G/14 and GeoData British Columbia Terrain Resource Information Management 92G.085 (see map/drawing at end of report).

This portion of the Cheakamus River floodplain is within the “Dave Marshall Salmon Reserve” and contains an extensive network of restored fish habitats that have been constructed over the past thirty years. The area is separated from the main river by dikes, which provide a degree of protection to the restored habitats during significant floods.

4.0 Methods

A qualified environmental practitioner (QEP) was on site to supervise the activities and provide direction and oversight to the contractor, John Hunter and Company and Atwell Contracting. Most of the work was undertaken using 200 and 300 series excavators, front end loader, and trucks which allowed the site to be cleared, the channel constructed, placement of rock and boulder clusters as well as placement of large and coarse woody debris. Large rock trucks were used to transport the larger material and transport the gravel that was placed along the channel to provide spawning habitat.

The twin culverts were installed in two sections to allow passage of cars along Paradise Valley Road and the installation was constructed as per specifications provided by the District of Squamish. Gravel and aggregate were trucked into the sties to provide spawning gravels within the streams. New bridge decking was used to replace the old wooden structures. Most of the larger bridge upgrades and replacements were undertaken with manual labour and on-site construction.

Planting was completed by June 2018 with a total of over 900 riparian plants established throughout the site.

The works for this project commenced in May 2017 and continued right through to the end of November 30, 2018.

5.0 Results and Outcomes

The final outcomes were the creation of the new 4,000 m^2 Kiwi Connector Channel that now provides spawning, rearing, and overwintering habitat for the local species of salmonids. The installation of the twin culverts under Paradise Valley Road has also now opening up and revitalized of over 10,000 m^2 of available habitat for fish throughout the Dave Marshall Salmon reserve and the Evans Creek rewatering project. Additional outcomes included upgrades and new channel construction downstream along Evans Creek to improve downstream flows. Added benefits of the project included bridge replacement and upgrades as part of the operations of the Cheakamus Centre to improve safety in and around the watercourses for visitors and students. Community support has also been a positive outcome of this project with Squamish Nation, the Nature Conservancy of Canada (who has land covenants on the property at the Cheakamus Centre), as well as the broader community have participated either in riparian planting or monitoring and visiting the site. The success of the project was based on strong collaboration between the property owners, Cheakamus Centre / School District #44 and Squamish Nation.

The channel construction spanned two years and had several set backs due to inclement weather conditions in the fall of 2017 that resulted in some of the channel becoming completely infilled and requiring additional excavation. The breakdown over the two-year period of the total habitat created is as follows:

2017/2018

- 162 linear metres of channel construction of the Kiwi Connector channel from Paradise Valley Road east towards confluence with Emerald Forest Creek (not connected until 2018);
- 1,000 linear meters of channel construction from Kiwi North Channel south towards Paradise Valley Road (not connected);
- Installation of twin 1.2 m diameter / 20 m length culverts
- Placement of 450 riparian plants
- Total area of habitat created along Kiwi Connector Channel was 2,905 m^2.

2018/2019

- 350 linear metres of new channel needing cleaning out and reconfiguration of Kiwi Connector Channel;
- Cleaning out of twin culverts across Paradise Valley Road from sediment deposition;
- 155 new channel construction along Kiwi Connector Channel to provide connection to Kiwi North;
- Installation of new pedestrian bridge along Kiwi Connector Channel;
- Construction of new pedestrian trail (approximately 150 m in length);
- 350 linear metres of new channel construction along Evans Creek floodplain;
- Installation of 1.2 m diameter 10 m length culvert along access road along Evans Creek floodplain
- Placement of 450 riparian plants
- Total area of habitat created along Kiwi Connector: 1,095m^2; Evans Ck: 875 m^2 which has provided access to over 10,000 m^2 of habitat downstream.

As noted in the previous section, a total of 900 native riparian trees and shrubs were placed alongside the newly constructed channel.

Riparian Planting List:

Common Name	Latin Name	# of pots
Sword Fern	*Polystichum munitum*	600
Salmonberry	*Rubus spectabilis*	100
Thimbleberry	*Rubus parviflorus*	100
Nootka Rose	*Rosa nutkana*	50
Western Red Cedar	*Thuja plicata*	50

6.0 Discussion

The project proceeded without too many issues. In the fall of 2017, during late October and early November there was an unprecedented regional storm that hit just after the twin culverts had been installed under Paradise Valley Road and resulted in gravel infilling the culverts and some washouts upstream along the newly constructed channel (none of which affected Paradise Valley Road). This resulted in delays as the area needed to dry out substantially before any heavy equipment could once again access the site. However, once work resumed in early 2018 the construction proceeded without any obstacles and continued through until November 2018.

7.0 Recommendations

The opportunity to continue to expand the off-channel habitat along the Dave Marshall Salmon Reserve over 30 years after it was initiated is a testimony to the commitment and vision of the original concept. The support of the Cheakamus Centre and Squamish Nation to this project along with the on-going commitment and expertise by Fisheries and Oceans Canada have provided a recipe for success. Funding support from Fish and Wildlife Compensation Program have allowed this project to continue and be improved upon. The SRWS has been glad to assist with the administration of this project and provide on-going monitoring and scientific support. However, there needs to be ongoing strategies for the decades ahead to ensure the habitat continues to function as intended. At this time it may be worthwhile for staff from DFO, Cheakamus Centre, and Squamish Nation to develop a long-term strategic plan and discuss potential long-term commitments from BC Hydro and Fish and Wildlife Compensation Program to fund on-going upgrades and operations of this important habitat. It is difficult to place a dollar value on the amount of restoration works, staff time, and in-kind support that have gone into this project just as it is difficult to place a dollar value on the benefits this habitat provides not just to fish and wildlife but to the community and students. However, it is important to recognize the ongoing value of this type of project and the habitat that is generated.

The SRWS will continue to monitor the site in the coming year to ensure the system is functioning and planned. A follow-up monitoring report will be prepared in the summer of 2019.

8.0 Acknowledgement

We would like to thank Fisheries and Oceans Canada, our project partners and Fish and Wildlife Compensation Program for funding and supporting this project.

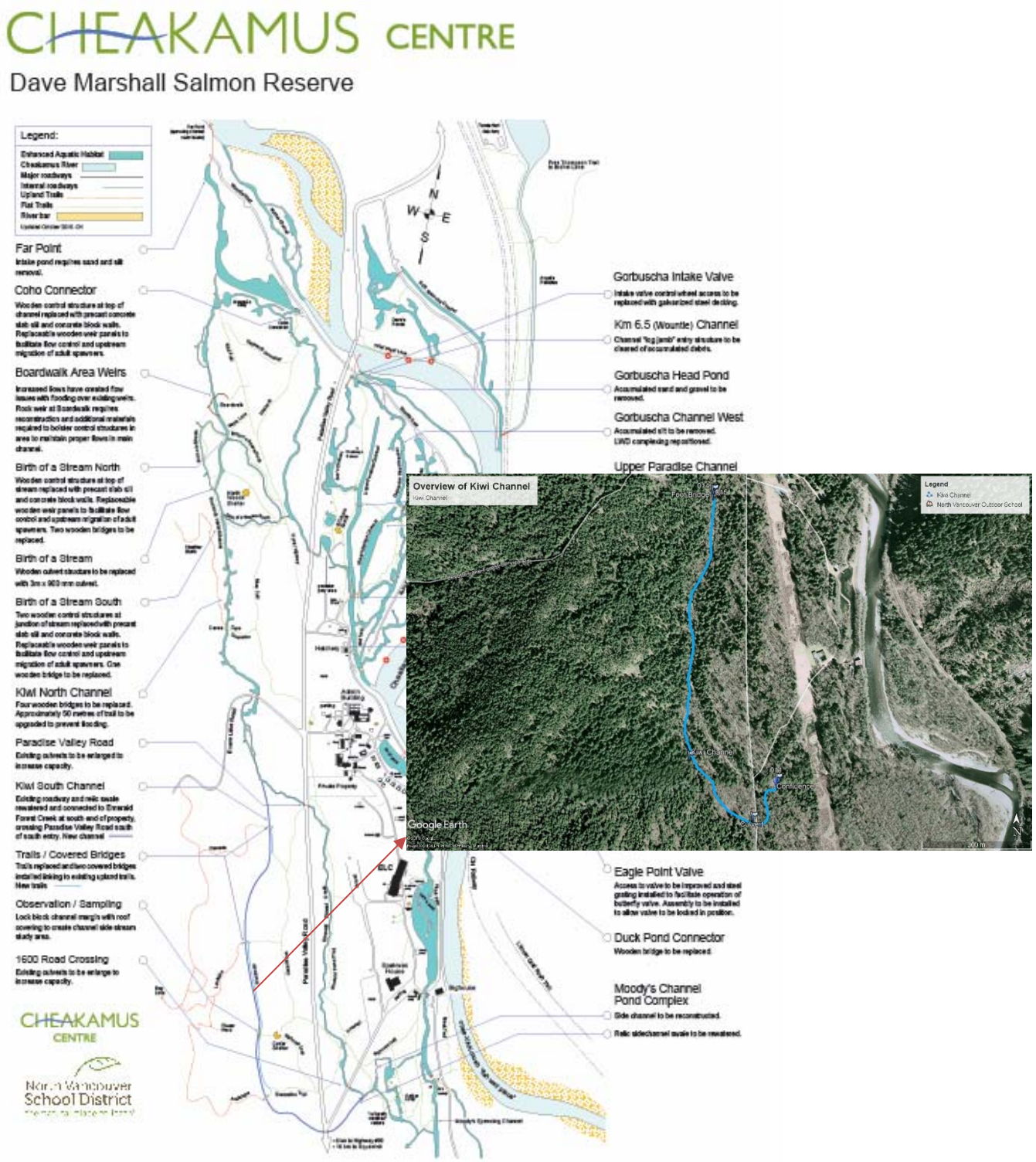
We would also like to take this time to thank:

- Cheakamus Centre and School District #44
- Randall Lewis, Joyce Williams, and Squamish Nation
- Dave Nanson, Al Johnson and other Fisheries and Oceans Canada for all of their assistance
- Tenderfoot Hatchery
- Nature Conservancy of Canada
- John Hunter & Company and Atwell Contracting

9.0 References

- BC Hydro. Cheakamus River Watershed Action Plan. November 2017.
- Department of Fisheries, Canada 1957. *A report on the fisheries problems related to the power development of the Cheakamus River system*. Vancouver B.C. 39p. + appendices.
- Melville, M. and D. McCubbing. 2000. *Assessment of the 2000 Juvenile Salmon Migration from the Cheakamus River, using Rotary Screw Traps (draft)*. Prepared for BC Hydro, Burnaby. 36 p. + appendices
- Northwest Hydraulic Consultants. 2001. *Analysis of channel morphology and sediment transport characteristics of the Cheakamus River*. Prepared for BC Hydro, Burnaby. 40p. + appendices.

10.0 Site Map


CHEAKAMUS CENTRE
Dave Marshall Salmon Reserve
Legend:
Enhanced Aquatic Habitat
Cheakamus River
Major roadways
Internal roadways
Upland Trails
Flat Trails
River bar
Far Point
Intake pond requires sand and silt removal.
Coho Connector
Wooden control structure at top of channel replaced with precast concrete slab sill and concrete block walls. Replaceable wooden weir panels to facilitate flow control and upstream migration of adult spawners.
Boardwalk Area Weirs
Increased flows have created flow issues with flooding over existing weirs. Rock weir at Boardwalk requires reconstruction and additional materials required to bolster control structures in area to maintain proper flows in main channel.
Birth of a Stream North
Wooden control structure at top of stream replaced with precast slab sill and concrete block walls. Replaceable wooden weir panels to facilitate flow control and upstream migration of adult spawners. Two wooden bridges to be replaced.
Birth of a Stream
Wooden culvert structure to be replaced with 3m x 900 mm culvert.
Birth of a Stream South
Two wooden control structures at junction of stream replaced with precast slab sill and concrete block walls. Replaceable wooden weir panels to facilitate flow control and upstream migration of adult spawners. One wooden bridge to be replaced.
Kiwi North Channel
Four wooden bridges to be replaced. Approximately 50 metres of trail to be upgraded to prevent flooding.
Paradise Valley Road
Existing culverts to be enlarged to increase capacity.
Kiwi South Channel
Existing roadway and relic swale reshaped and connected to Emerald Forest Creek at south end of property, crossing Paradise Valley Road south of south entry. New channel
Trails / Covered Bridges
Trails replaced and two covered bridges installed linking to existing upland trails. New trails
Observation / Sampling
Lock block channel margin with roof covering to create channel side stream study area.
1600 Road Crossing
Existing culverts to be enlarge to increase capacity.
Gorbuscha Intake Valve
Intake valve control wheel access to be replaced with galvanized steel decking.
Km 6.5 (Wountie) Channel
Channel "log jamb" entry structure to be cleared of accumulated debris.
Gorbuscha Head Pond
Accumulated sand and gravel to be removed.
Gorbuscha Channel West
Accumulated silt to be removed. LWD complexing repositioned.
Upper Paradise Channel
Overview of Kiwi Channel
Kiwi Channel
Legend
Kiwi Channel
North Vancouver Outdoor School
Google Earth
Eagle Point Valve
Access to valve to be improved and steel grating installed to facilitate operation of butterfly valve. Assembly to be installed to allow valve to be locked in position.
Duck Pond Connector
Wooden bridge to be replaced.
Moody's Channel Pond Complex
Side channel to be reconstructed.
Relic sidechannel swale to be reestablished.
CHEAKAMUS CENTRE
North Vancouver School District

11.0 Photos

April 27, 2018 – photos taken at various locations along the newly constructed Kiwi Channel

May 6, 2018- riparian plants placed along the newly constructed stream bank

June 20, 2018 – photos from the north end of the Kiwi Connector channel

Introduction to project partners and team just prior to opening up channel

Getting ready to open channel: above: waiting with anticipation along new bridge; below: Joyce Williams daughter assists the machine operator (Rick Hunter) in opening the channel

Joyce and her daughter plant a red cedar along the new channel

Tenderfoot Hatchery staff release coho fry into newly watered channel

August 1, 2018 – photos from downstream along Evans Creek where additional works were completed to improve downstream flows (along with culvert connection across logging access road on IR #11)