

October 9th, 2016
**Land Based Investment Strategy (LBIS):
Fish Passage Program Annual Report 2015-2016**

Background

Why restore fish passage?

The ability for fish and other aquatic organisms inhabiting streams to move freely (upstream and downstream) throughout their natural environment is an important component of healthy resilient natural aquatic ecosystems. Different fish species and life stages require a variety of habitats at different times of the year. Human-caused barriers such as road-stream crossings that block or delay fish movement can result in changes to fish communities and lost productive capacity. Healthy, resilient fish populations are necessary to maintain BC's fish species diversity and productivity that in turn supports our recreational, commercial, and indigenous food fisheries. In addition to the importance to our fisheries, maintaining access to a full range of habitats is necessary to ensure fish populations and other aquatic species have the best chance to adapt to changing aquatic conditions resulting from climate change.

Fish passage program

In 2007, the ADMs of the then Ministry of Forests and Range, and MOE – in cooperation with DFO and the Forest Industry (COFI and CFPA) – formed the Fish Passage Program. The inter-agency Fish Passage Technical Working Group (FPTWG) was established and developed the four-phase 'Fish Passage Strategic Approach' that guides delivery of the program by prioritizing problem road-stream crossings for remediation. The four phases are:

1. *Assessments* undertaken for all road crossings in watersheds that are strategically identified as a high priority for fish;
2. *Habitat confirmations* undertaken at crossings assessed to be the best candidates for remediation to determine actual habitat values to be gained;
3. *Site plans and designs* to determine the most effective structure to remediate priority crossings identified through the habitat confirmation phase;
4. *Remediation* projects that most often involve either (i) the purchasing and installation of new fish-friendly structures (e.g. culverts and bridges) or (ii) road crossing deactivations (e.g. for non-status roads) that restore fish passage.

Data and reports from each of the four-phases are to be uploaded in the Provincial Stream Crossing Information System (PSCIS).

BC's FPTWG has been working with BC Timber Sales, Ministry of Transportation and Infrastructure, Pacific Salmon Foundation (PSF) and DFO to prioritize and remediate problem road-stream crossings. Between 2008 and 2015 the Fish Passage Program has remediated over 150 road stream crossings resulting in fully restored access to over 750 kilometers of fish habitat.

The actual delivery of projects on-the-ground is primarily accomplished through agreement with BCTS; however district and regional staff may also lead delivery for some projects.

2015-2016 Budget

The Fish Passage Program budget totaled \$1,470,122 including:

- \$1,130,822 from LBIS, and
- \$339,300 from federal partnership funding - DFO's Recreation Fisheries Conservation Partnership Program (RFCPP) received by working with the Pacific Salmon Foundation (PSF) – all for remediation projects.

2015-2016 Accomplishments

Assessments

78 crossings assessed including 62 in Bulkley and 16 in Ingenika watersheds.

Habitat confirmations

9 crossings including 8 in Skeena and 1 in Stuart-Nechako.

Site plans and designs

4 crossings in Kootenays, Stuart-Nechako, and Okanagan-Columbia.

Remediations

10 crossings remediated (with 6 embedded culvert structures and 4 bridges) that reconnected 22.3 km of high or moderate quality fish habitat.

An unneeded small dam that was a barrier to fish passage was removed in partnership with a forest company.

4 project areas restored 1 km of habitat primarily by restoring large woody debris.

Attachment A1 and A2 provides an overall summary of the remediation projects, and a one-page summary of each of the projects.

Communications

Published two papers in ABCFP's BC Forest Professional magazine:

- 'Remediation of Fish Passage at Stream Crossings on BC's Forest Roads' (May-June 2015) – see Attachment B.
- 'Restoration of Fish Passage on Elbow Creek, Southwestern BC' (Jan-Feb 2016) – see pp. 10-11 in Attachment C.
- Delivered abstract and presentation on 'A Strategic Approach to Fish Passage in BC' to the 4th IUFRO International Conference on Forests and Water in a Changing Environment' in July 2015 – see Attachment D.

Other

- Maintained/updated PSCIS data base.
- FPTWG undertook quality assurance field trips for several of the remediated crossings.
- In partnership with PSF, applied for Federal DFO RFCPP Round 5 funding for 7 projects to be initiated in 2016-2017 [All 7 applications were subsequently approved by DFO in July 2016].

Attachment A1:
Executive Summary¹:
Fish Passage and Habitat Restoration Partnership Projects
2015/16

Partnership between

**BC Ministry of Forests, Lands and Natural Resource Operations'
Land Based Investment Strategy (LBIS)**

Inter-Agency Fish Passage Technical Working Group



**Fisheries and Oceans Canada's
Recreation Fisheries Conservation Partnership Program (RFCPP)**



Recreational Fisheries Conservation Partnership Program
Programme de partenariats relatifs à la conservation des
pêches récréatives

and the

Pacific Salmon Foundation



¹ Assembled by Terje Vold under contract with FLNR Resource Practices Branch and Fish Passage TWG

Acknowledgements

Inter-Agency Technical Working Group:

BC Ministry of Forests, Lands and Natural Resource Operations (FLNR)

- David Maloney (Chair), Resource Practices Branch
- Brian Chow, Engineering Branch
- Dave Hamilton, BC Timber Sales

BC Ministry of Environment

- Craig Mount, Knowledge Management Branch
- Richard Thompson, Ecosystems Branch
- Peter Tschaplinski, Ecosystems Branch

BC Ministry of Transportation and Infrastructure

- Sean Wong, Environmental Management Branch

Fisheries and Oceans Canada:

- Suzanne Thorpe, Ecosystem Management Branch

Pacific Salmon Foundation:

- Dianne Ramage, Salmon Recovery
- Timothy Sucic, Finance and Administration

Remediation Project Delivery:

Copper Creek – Skidegate Lake

- Larry Duke, Haida Gwaii District, FLNR
- Dave Hamilton, BC Timber Sales, FLNR

Clint Creek, Honna River, and Shelley Creek

- Larry Duke, Haida Gwaii District, FLNR

Plumbob Creek, and Linklater FSR – Purcell Creek

- Phil MacDonald, BC Timber Sales – Kootenays, FLNR
- Jasbir Naul, Engineering Branch - Southern Engineering Group, FLNR

Nass River – Brown Bear FSR, and Kispiox River – Helen FSR

- Stephen Hales, BC Timber Sales – Skeena, FLNR
- Alan Harrison, BC Timber Sales – Skeena, FLNR
- Gail Campbell, BC Timber Sales – Skeena, FLNR
- Howard DeBeck, Engineering Branch – Northern Engineering Group, FLNR

Cherry Creek – North Fork FSR

- Warren Yablonski, BC Timber Sales – Okanagan-Columbia, FLNR
- Jock McArthur, BC Timber Sales – Okanagan-Columbia, FLNR

Bench FSR

- Roland Doering, BC Timber Sales – Strait of Georgia, FLNR
- Dave Hamilton, BC Timber Sales – Strait of Georgia, FLNR

Summary of Remediation Projects 2015/16 in partnership with LBIS, RFCPP and PSF

| Project | Location | 2015/16 Costs² | Restoration | Habitat | Fish |
|----------------------------------|---------------------|----------------------------------|--|---|---|
| 1. Copper Creek – Skidegate Lake | Haida Gwaii | \$149,400 (Year 2 costs) | Spur 30 bridge NES2 embedded structure | 1,700 m gain 530 m gain | Coho and Sockeye Salmon |
| 2. Clint Creek | Haida Gwaii | \$107,200 ³ | Dam removal Habitat enhanced | 1,300 m gain 375 m enhanced | Coho and Chum Salmon, and Dolly Varden |
| 3. Honna River | Haida Gwaii | \$69,000 | Habitat enhanced | 325 m enhanced | Coho, Chum, Pink, and Steelhead Salmon, and Dolly Varden |
| 4. Shelley Creek | Haida Gwaii | \$83,400 | Habitat enhanced | 285 m enhanced | Coho and Chum Salmon, Cutthroat Trout and Dolly Varden |
| 5. Plumbob Creek | East Kootenays | \$198,500 | Bridge installed | 7,000 m gain | Cutthroat, Eastern Brook, and Bull Trout |
| 6. Linklater FSR- Purcell Creek | East Kootenays | \$195,600 | Bridge installed | 7,600 m gain | Cutthroat, Eastern Brook, and Bull Trout |
| 7. Nass River – Brown Bear FSR | Skeena | \$99,200 (Year 2 costs) | 2 Embedded structures | 350 m gain | Rainbow Trout |
| 8. Kispiox River – Helen FSR | Skeena | \$177,700 (Year 2 costs) | 2 Embedded structures | 2,300 m gain | Bull and Rainbow Trout |
| 9. Cherry Creek – North Fork FSR | Okanagan - Columbia | \$146,400 | Bridge installed | >500 m gain (up to 2500 m) | Rainbow and Bull Trout |
| 10. Bench FSR | Chilliwack | \$211,500 | Embedded structure Habitat restored | 1,000 m gain | Cutthroat and Rainbow Trout, and Coho Salmon, and Dolly Varden |
| Totals | | \$1,437,900⁴ | 10 crossing structures replaced: - 6 embedded structures - 4 bridges 1 dam removal 4 habitat enhancements | >22,280 m gain (up to 24,280 m) >985 m enhanced | -Coho, Sockeye, Chum, Pink Salmon -Steelhead -Dolly Varden -Cutthroat, Bull, Rainbow and Eastern Brook Trout |

The above table and ensuing one-pagers per project provides a summary of accomplishments 2015/16 from the partnership between FLNR’s LBIS Fish Passage program, DFO’s RFCPP program, and the Pacific Salmon Foundation with project delivery by FLNR district and BCTS staff. A Final Report for each project is available that provides more details.

² For projects showing Year 2 costs, Year 1 costs in 2014/15 included site plans and purchase of structures

³ Includes \$29,150 paid by Western Forest Products (WFP) for dam removal

⁴ Total costs = LBIS Fish Passage + RFCPP + in kind (BCTS + FLNR +PSF + Interagency Fish Passage Technical Working Group + WFP)

1. Copper Creek – Skidegate Lake Project



Photo: Top - NES 2 before and after; Bottom - Spur 30-1 before and after

Project Objective

The project objective was to replace two crossing structures (Spur 30-1 and NES2) that impeded fish passage with two fish-friendly crossing structures that provide for safe fish passage.

Project Results

The project objective was achieved with the installation of a bridge at Spur 30-1 and an embedded open bottom culvert at NES2 (also referred to as South Bay Mainline).

The Copper Creek project restored fish access to 1700 m of high value spawning and rearing habitat at Spur 30-1 for *Oncorhynchus kisutch* (Coho), and 530 m of high value spawning and rearing habitat at NES2 for *Oncorhynchus kisutch* (Coho) and *O. nerka* (Sockeye).

2. Clint Creek Project



Upper photo: Clint Creek dam before the project
Lower photo: Clint Creek dam removed due to the project

Project Objectives

The project objectives were:

1. To remove a small dam (weir) that is no longer needed and that impeded fish passage on Clint Creek in order to restore fish passage, and
2. To remediate key areas surrounding the lower 375 m of Clint Creek to improve and restore fish habitat quality through the installation of large woody debris (LWD) structures.

Project Results

The project objectives were achieved with the dam removal increasing access to at least 1,300 m of high and moderate value habitat for *Oncorhynchus kisutch* (Coho), *O. keta* (Chum), and *Salvelinus malma* (Dolly Varden); and 375 m of habitat restoration completed with installation of LWD structures.

3. Honna River Project



Photo: Honna River large woody debris structure #7

Project Objective

The project objective was to enhance fish habitat by installing large woody debris (LWD) that is lacking in the river and is limiting salmon production.

Project Results

The project objective was achieved with the installation of 9 LWD structures along 325 m of channel as prescribed in the report “2015 Instream Habitat Enhancement Prescriptions: Clint Creek, Shelly Creek, and Honna River” that was prepared as part of this project.

The project enhanced 325 m of high value fish habitat for *Oncorhynchus kisutch* (Coho), *O. keta* (Chum), *O. gorbuscha* (pink), *O. mykiss* (steelhead), *O. clarkia* (cutthroat) and *Salvelinus malma* (Dolly Varden).

4. Shelley Creek Project



Photo: Examples of large woody debris structures that were installed

Project Objective

The project objective was to enhance fish habitat by installing large woody debris (LWD) that is lacking in the creek and is limiting salmon production.

Project Results

The project objective was achieved with the installation of 12 LWD structures along 285 m of channel as prescribed in the report “2015 Instream Habitat Enhancement Prescriptions: Clint Creek, Shelly Creek, and Honna River” that was prepared as part of this project.

The project enhanced 285 m of high value fish habitat for *Oncorhynchus kisutch* (Coho), *O. keta* (Chum), *O. clarkia* (cutthroat) and *Salvelinus malma* (Dolly Varden).

5. Plumbob Creek Project



Photo: Plumbob Creek Crossing – before and after

Project Objective

The project objective was to restore fish passage by replacing an undersized, perched culvert on Plumbob Creek, which flows into the Koocanusa Reservoir. The culvert was located on the Teepee Forest Service Road (FSR) in the East Kootenay area of British Columbia (BC). The culvert was an impassable barrier for fish.

Project Results

The project objective was achieved with the installation of a clear span bridge. With the removal of the old culvert and installation of the bridge, the Plumbob Creek Fish Passage restoration project now provides fish access to 7,000 linear metres of upstream habitat for utilization by *Oncorhynchus clarkii lewisi* (Westslope Cutthroat Trout), *Salvelinus fontinalis* (Eastern Brook Trout), and *S. confluentus* (Bull trout).

Attachment A2: Fish Passage Remediation Projects 2015-2016 (continued)

6. Linklater FSR – Purcell Creek Project



Photo: Purcell Creek Crossing – before and after

Project Objective

The project objective was to restore fish passage by replacing two undersized, perched culverts on Purcell Creek, which flows into the Kootanusa Reservoir. The crossing is located on the Linklater FSR in the East Kootenay area of British Columbia (BC). The culverts were an impassable barrier for fish.

Project Results

The project objective was achieved with the installation of a clear span bridge. With the removal of the perched culverts and installation of the bridge, the Linklater FSR - Purcell Creek Fish Passage restoration project now provides fish access to 7,600 linear metres of upstream habitat for utilization by *Oncorhynchus clarkii lewisi* (Westslope Cutthroat Trout), *Salvelinus fontinalis* (Eastern Brook Trout), and possibly also *S. confluentus* (Bull trout).

7. Nass River – Brown Bear Forest Service Road Project



Photo: Axnegrelga Crk (Nass River tributary) Site 262 on Brown Bear FSR – before and after

Project Objective

The project objective was to replace two crossing structures (Site 262 and Site 264) that impeded fish passage with two fish-friendly crossing structures that provide for safe fish passage.

Project Results

The project objective was achieved with the installation of embedded open bottom culverts at both Sites 262 and 264.

The Nass River – Brown FSR project restored fish access to 350 m of high quality fish habitat for spawning, rearing and overwintering habitat use by *Oncorhynchus mykiss* (rainbow trout).

First Nations involvement: The Gitanyow Fisheries Authority was subcontracted to prepare the environmental management plan for the two culvert replacements.

8. Kispiox River – Helen Forest Service Road Project



Photo: Kispiox River tributary Site 6 on Helen FSR – before and after

Project Objective

The project objective was to replace two crossing structures (Site 5 and Site 6) that impeded fish passage with two fish-friendly crossing structures that provide for safe fish passage.

Project Results

The project objective was achieved with the installation of embedded open bottom culverts at both Sites 5 and 6. In tandem with the project, BCTS deactivated a crossing at Site 5b that increased fish access to above Site 5 to 1,300 m.

The Kispiox River – Helen FSR project restored fish access to 2,300 m (1,300 m for Site 5 and 1,000 m for Site 6) of high and moderate value habitat for *Salvelinus confluentus* (bull trout) and *Oncorhynchus mykiss* (rainbow trout).

First Nations involvement: The Gitanyow Fisheries Authority prepared the habitat confirmation report that led to this site being identified as a priority for remediation.

9. Cherry Creek – North Fork Forest Service Road



Photo: Tributary to Cherry Creek Crossing – before and after

Project Objective

The project objective was to restore fish passage by replacing an undersized, perched closed bottom culvert on an unnamed tributary of Cherry Creek. The culvert was located on the North Fork FSR in the Okanagan-Columbia area of BC. The culvert was an impassable barrier for fish.

Project Results

The project objective was achieved with the installation of a clear span bridge. With the removal of the perched culvert and installation of the bridge, the Cherry Creek – North Fork FSR Fish Passage restoration project now provides fish access to at least 500 linear metres of upstream habitat for utilization by *Salvelinus mykiss* (Rainbow trout) and *S. confluentus* (Bull trout). Based on TRIM data, there is the potential for up to 2500 metres of habitat gain.

10. Bench Forest Service Road Project



photo: Newly installed open bottom arch culvert that provides for safe fish passage

Project Objective

The project objective was to replace a corrugated metal pipe (CMP) on km 4 of the Bench Forest Service Road (FSR) that impedes fish passage with a fish-friendly structure.

Project Results

The project objective was achieved with the installation of an open bottom arch culvert that provides for safe fish passage. The project also addressed stream flooding of the FSR by raising the road, undertaking bank restoration, restoring thalweg, and restoring riparian area by re-routing the ATV trail to prevent future bank failure

The Chilliwack Bench project restored fish access to 1,000 m of high value habitat for *Oncorhynchus clarkii* (Cutthroat trout), and possibly *O.mykiss* (rainbow trout), *O. kisutch* (Coho), and *Salvelinus malma* (Dolly varden)

First Nations involvement: Seven Generations Environmental Services were hired to provide First Nations environmental monitoring for the project, and Chilliwack First Nations were hire for cultural heritage monitoring through Ts'elxwéyeqw Tribe Management Ltd.



Remediation of Fish Passage at Stream Crossings on BC's Forest Roads

ROAD CULVERTS INSTALLED AT STREAM CROSSINGS ARE KNOWN TO NEGATIVELY impact freshwater habitat for fish. In 2009, the BC Forest Practices Board (FPB) confirmed the scope of the problem with a report concluding that these closed-bottom structures pose a province-wide risk to connectivity of fish habitat. While culverts are necessary to manage water flow near resource roads, they often constrict the natural stream channel, increasing stream velocity and causing a range of channel changes that are detrimental to fish. Most importantly, fish attempting to migrate or reach their food supply are unable to access upstream habitat due to these constricted stream crossings. The impacts are also economic: though BC's fisheries sector generated \$2.2 billion in revenues and supported 13,900 jobs in 2011, revenues from salmon-related fisheries have declined since 2000, with loss of connected freshwater habitat considered a key contributing factor.

In 2007 the BC Government formed the Fish Passage Technical Working Group¹ (TWG) to address fish passage issues on forestry roads. An inter-agency group, the TWG includes members from the BC Ministries of Environment (MoE); Forests, Lands and Natural Resource Operations (FLNRO); and Transportation and Infrastructure (MoTI), BC Timber Sales (BCTS), and Fisheries and Oceans Canada (DFO). The TWG is funded mainly by the Land Based Investment Strategy (LBIS), as one of its key priorities is remediation of fish passage crossings with the goal of achieving maximum return on investment.

As of 2009, the TWG had identified an estimated 435,000 stream crossings province-wide, with 313,000 of those classified as potentially detrimental to fish habitat. A strategic approach was thus required to focus remediation on those crossings that would result in the greatest improvement to fish habitat.

First, large-scale mapping and modelling is applied to identify provincial watersheds that have high-value fish habitat. A four phase field approach to remediation is then applied within these high-value watersheds:

1. Fish passage assessment: Field assessments are conducted at all stream crossings in the watershed to determine which are barriers to fish passage.
2. Habitat confirmation: For those crossings identified in Phase 1, field assessments are used to determine the quantity and quality of fish habitat to be gained by remediation.
3. Design: The crossings identified in Phase 2 are ranked based on which would have the greatest benefit to fish habitat if remediated. Remediation site plans and designs are then developed in consultation with stakeholders.
4. Remediation: The design from Phase 3 is implemented.

Data from the large-scale analyses and all four remediation phases are available in the Provincial Stream Crossing Inventory System (PSCIS), including maps, photos, field notes, design drawings,

and costs. The current governance model funds remediation of fish passage problems only at crossings constructed prior to 1995. For roads constructed after 1995, only Phase 1 and 2 field assessments are covered, as forest practices legislation since then has assigned the obligation to maintain fish passage to forest and range tenure holders.

To date (2008-2015), the fish passage program has received \$17.8 million in funding. Although this funding varies considerably between years, on an annual basis approximately 5-10% is allocated to modelling and program support, 20-30% to performing site assessments (Phase 1), 5-10% to habitat confirmations (Phase 2), and 60-70% to site remediations (Phases 3 and 4). To date, >26,000 site assessments, >150 habitat confirmations, and 135 remediations have been completed, re-connecting approximately 750 km of fish habitat. While remediation costs can vary greatly - for example, when the cost of culvert removal alone is compared with culvert removal plus bridge installation - our average cost per km of reconnected habitat is approximately \$15,000. This compares favourably with similar projects completed in Washington State, where 60 projects reconnected 351 kilometers of fish habitat at an average of \$54,000 per kilometre².

The inter-agency approach taken by TWG has been highly effective. MoE, FLNRO, and DFO members developed the strategic approach in tandem with forest industry input, and review the background information on fish habitat to assess high priority watersheds. BCTS and district engineering staff serve as the delivery agent for field assessments and remediation, while MoTI provides technical support and funding, and resolves issues related to non-functional structures on public roads. Cost-sharing arrangements and cooperation on fish habitat improvements have been developed by working with the Society for Ecosystem Restoration in Northern BC, the Pacific Salmon Foundation, DFO's Recreational Fisheries Conservation Partnerships Program, and BC Hydro's Fish and Wildlife Compensation Program.

The TWG has also been active on the engineering and practice side, developing an online training program³ for conducting fish passage assessments, and updating the engineering standards⁴ for restoration of fish passage. They have also assisted FLNRO's Compliance and Enforcement branch in developing a guidance document to define what is meant by 'material adverse effect' when protecting fish at stream crossings⁵, and have updated a 2002 Stream Crossing Guidebook to a 2012 edition⁶. For more information on the program, see the 2011 issue of Streamline Watershed Management Bulletin⁷.

Given the scope of the issue, it's imperative that fish passage be addressed across resource industries, to avoid creating new problems and to continue to remediate existing problems; thus the PSCIS database and online training tools are available for broad use. The TWG is keen to develop new partnerships and find additional resources to apply this strategic approach to fish passage remediation in all regions of the province. 🐟



Do you have a Science In Action story you want to share?

E-mail your story idea to Doris Sun,
editor, at dsun@abcfp.ca

Olga Vasik - Fotolia

Sarah Boon, PhD, has 15 years experience as a hydrologist, and as a freelance science writer and editor.

Ian Miller, RPF, has been a manager with Resource Practices Branch of FLNRO in Victoria since 2006. He is the past chair of the Fish Passage TWG, and works with many diverse teams on forest hydrology, visual resource management, effectiveness monitoring, and forest practices policy and legislation.

The TWG also includes: Brian Chow (FLNRO), Dave Hamilton (BCTS), Dave Maloney (FLNRO), Craig Mount (MoE), Holly Pulvermacher (DFO), Richard Thompson (MoE), Peter Tschaplinski (MoE), Sean Wong (MoTI), and Terje Vold (Contractor).

References

- ¹ <http://www.for.gov.bc.ca/hfp/fish/FishPassage.html>
- ² http://www.nfwf.org/results/evaluationreports/Documents/Fisheries_Benefits_Eval.pdf
- ³ http://www.for.gov.bc.ca/hfp/fish/Fish_Passage_Training/player.html
- ⁴ <http://www.for.gov.bc.ca/ftp/hcp/external/!publish/web/fia/FishPassageActivityEngStdsFinalApril2-2013.pdf>
- ⁵ <http://www.for.gov.bc.ca/ftp/HTH/external/!publish/web/frpa-admin/frpa-implementation/bulletins/CE-40-Material-Impact.pdf>
- ⁶ <http://www.for.gov.bc.ca/hfp/fish/Fish-Stream%20Crossing%20Web.pdf>
- ⁷ <http://www.for.gov.bc.ca/hfp/fish/Habitat%20Modelling.pdf>

Restoration Of Fish Passage ON ELBOW CREEK, SOUTHWESTERN BRITISH COLUMBIA

In the May-June 2015 issue of *BC Forest Professional*, we brought you the story of BC's Fish Passage Technical Working Group (FP-TWG), which included members from the BC Ministries of Environment (MoE); Forests, Lands, and Natural Resource Operations (FLNRO); and Transportation and Infrastructure (MoTI); and the BC Timber Sales (BCTS) program. This group is working to remediate fish passage at stream crossings on BC's forest roads.

In this issue we visit one of TWG's remediation sites, using it as a case study to describe how remediation takes place. The site is in the Elbow Creek watershed, located in the Harrison River Watershed Group, near Harrison Mills (100 km east of Vancouver).

In 2011, TWG-funded BCTS contractors conducted fish passage assessments at all stream crossings in the Harrison River Watershed, and identified a number of culverts that potentially restricted fish access to upstream habitat. Two of these culverts occurred where the Chehalis Forest Service Road (FSR) crossed Elbow Creek. When the contractors conducted follow-up habitat assessments, they confirmed that the culverts were impeding the ability of coho salmon, steelhead and cutthroat trout to access high value habitat. The TWG consulted with the

federal Department of Fisheries and Oceans (DFO) and the project biologist in early 2012 and decided to prioritize these sites for restoration, with the initial plan being to replace the two offending culverts with bridges.

Sarah Boon, PhD, has 15 years experience as a hydrologist, and as a freelance science writer and editor.

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BCTS's Dave Hamilton did a revised site assessment in June 2012, and realized that — instead of installing two bridges — a 410m section of the Chehalis FSR could be moved 35 metres west, out of the riparian zone, and the existing road could be deactivated. There were several benefits to this approach: it could be implemented over a shorter timeframe, would provide greater habitat benefits at a lower cost, and would also reduce sediment inputs to Elbow Creek. The revised design was also logistically easier to implement,

as it was no longer necessary to close an active haul road that was also used extensively by the public.

This revised project remediation plan was directed jointly by the TWG and local FLNRO staff and funded through a partnership agreement between DFO's Recreational Fisheries Conservation Partnership Program (RFCPP), the Pacific Salmon Foundation (PSF) and FLNRO's Land Based Investment Strategy (LBIS). The final project cost about \$100,000 less than if the originally planned bridge structures had been used, and opened the door to future partnerships with PSF.

Once DFO approved the new plan, a team of contractors and personnel was assembled to complete the work. These included

Infinity Pacific Stewardship Group (Mike Petrie: road design, deactivation plan development, and project management), B & D Excavating (Frank Boccia: road construction and deactivation), MC Wright & Associates (Brandalyn Musial: sediment management plan and onsite environmental monitoring), and FLNRO Chilliwack District (Jeff Ladd: engineering officer).

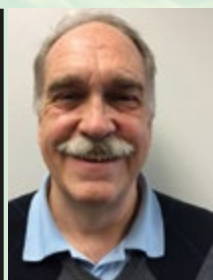
The bypass road was constructed in July 2013 to the appropriate build standards

required for a public road, and all traffic was redirected to this new road. In August of the same year, the two culverts from the old road were removed, and the stream channels at these locations restored. The old road was then deactivated by de-compacting the road bed, top-dressing with slash and other vegetation to improve stability and encourage regeneration, and seeding with grass. Follow-up work in spring 2014 included the planting of 600 trees and additional grass seeding. An informal camping area on the old road section near Elbow Lake was also decommissioned, as it was a source of pollution problems.

Both fish passage and ongoing road sediment delivery issues were solved by eliminating the two stream crossings and restoring the stream channel, and moving the road away from the creek. The project re-established fish connectivity both to Elbow Lake and to tributary streams to Elbow Creek, providing fish access to an additional 2.2 km of habitat.

Several stakeholders also benefitted from the project, as the Elbow Community Watershed supplies local communities and water licensees. One of the key water users was Eagle Point Development, a large residential subdivision. Residents there were initially concerned about additional impacts from sedimentation caused by moving the Chehalis FSR, as in the past they'd had to install a chlorination plant due to coliform problems from the informal campsite near Elbow Lake. Following project completion, however, Eagle Point was happy not only with the reduction in sedimentation issues, but also with the deactivation of the informal campsite. The local Sts'ailes First Nation was also involved; though there were no culturally significant sites in the area, BCTS employed a First Nations fisheries technician to assist the environmental monitor on the project.

Both fish passage and ongoing road sediment delivery issues were solved by eliminating the two stream crossings and restoring the stream channel





The road will be monitored by the forest licensee as per its road maintenance schedule and obligations. Given its easy road access, the Elbow Creek project also facilitates ad-hoc monitoring by field staff on the way to other sites in the lower Fraser Valley area. Sediment catch basins were installed in the event of any sediment mobilization following road reconstruction; however, none has occurred thus far. The site will also be used as a tour stop to showcase integrated resource management to a variety of audiences. A field trip by the FP-TWG in September 2013 identified the project as a huge success, and the project (among others) resulted in BCTS's Dave Hamilton being nominated for a P.J.J. Hemphill Award for Engineering Excellence.

The project was completed on time, under budget, and with a great team — just one of several success stories from BC's Fish Passage Technical Working Group. 🌿

Clockwise from top left:

Closeup of a culvert identified as detrimental to fish passage along the Chehalis FSR (note the road in the background).

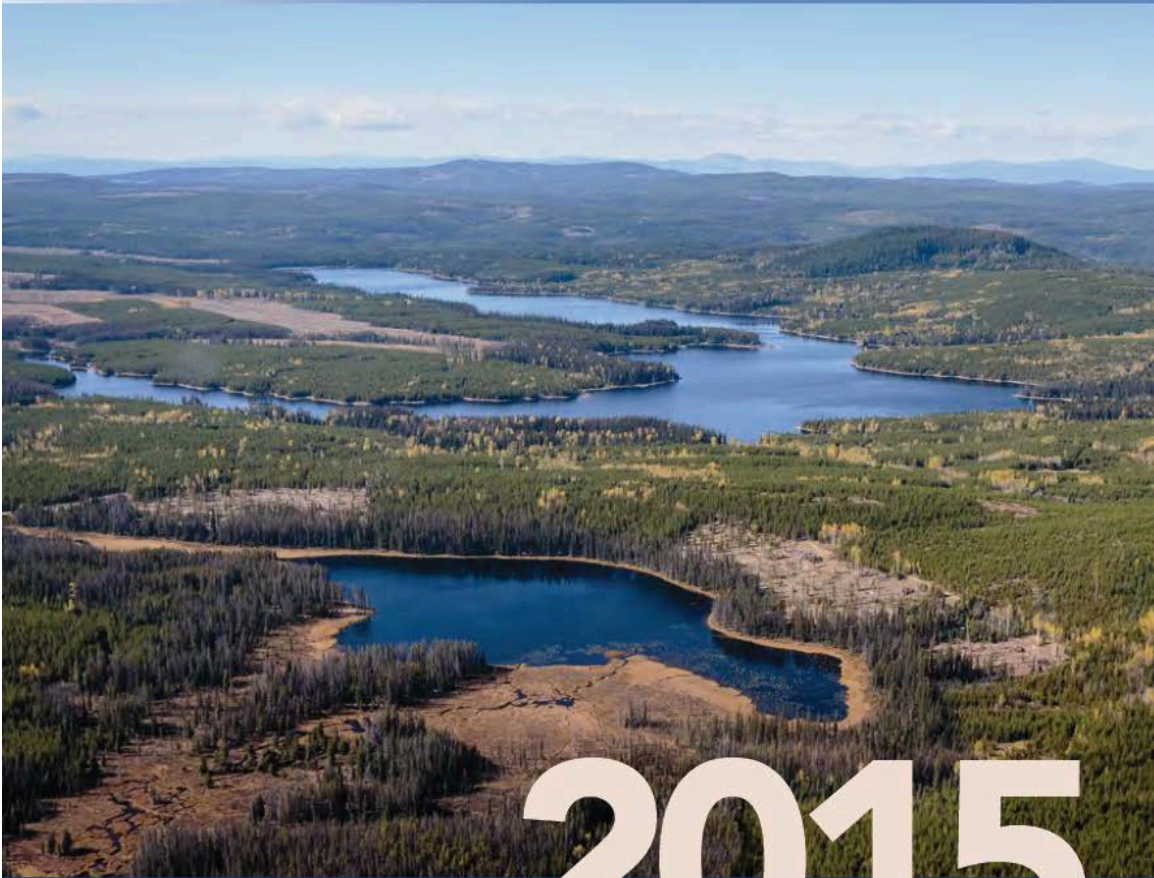
Free-flowing creek after removal of the culvert that was blocking fish passage.

Construction of the bypass road on the Chehalis FSR. Note the old road at the left of the image, and the bypass road on the right.

New bypass road on the left of the image and deactivated forest road on the lower right of the image. This remediation work moved the road away from the stream bed and removed the need for culverts.



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A strategic approach to fish passage in BC

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Abstract:

British Columbia is a large province (approximately 1,000,000 km²) with over 2,000,000 km of streams and rivers. BC also contains a wealth of natural resources and, to access those resources, more than 500,000 km of road have been built. Conservative estimates place the number of crossings at more than 430,000 and many of those we now know are partial or total barriers to fish movement. The result is thousands of kilometers of fish habitat that are no longer accessible

The Province of British Columbia in partnership with the federal government and other organizations has been working on implementation of a strategic approach to better understand the extent of the fish passage problem, and identify and set priorities for restoration.

This talk will provide an overview of that strategic approach, including the assessment techniques utilized. Over 15,000 assessments have been carried out under the BC Fish Passage Program, and while this is a small percentage of the total number of crossings on the landscape it does give us a reasonable sample size from which to draw some meaningful observations. This presentation will provide summary statistics from data collected to date, and highlight some interesting relationships between roads, streams and crossings which fail to pass fish. By using an updated fish habitat model, a more quantitative assessment of the opportunities for regaining habitat is also now possible. The results from this work will also be presented with a look at cumulative impacts.

Key words: fish passage; assessment; cumulative; watershed