

**THE ELK VALLEY FISH AND FISH HABITAT COMMITTEE: A MULTI-AGENCY
CONSENSUS BASED APPROACH TO MANAGING FISHERIES IMPACTS IN THE
ELK RIVER VALLEY OF BRITISH COLUMBIA**

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ABSTRACT

The Elk Valley Fish and Fish Habitat Committee (EVFFHC) is a multi-agency group that works in a collaborative manner to discuss technical information related to Teck Coal Limited's (Teck) fisheries obligations in the Elk Valley. The EVFFHC includes membership from the Ktunaxa Nation Council, British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development, Fisheries and Oceans Canada and Teck. In 2015, the EVFFHC developed a regional offsetting strategy for prioritizing habitat rehabilitation. Seven offsetting projects were identified, prioritized, ranked and matched to support Teck's *Fisheries Act* authorizations. These test cases focused on Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*) habitat rehabilitation in the upper Fording River watershed. This species is of high conservation value and rehabilitation areas were identified from a long-term population study. The process was collaborative resulting in full endorsement from the EVFFHC to move forward with this critical rehabilitation work. The test cases were constructed from 2016 to 2018. Success is being monitored according to the robust effectiveness monitoring programs also developed by the EVFFHC. The EVFFHC is an outstanding example of a multi-agency approach that works in an inclusive manner to advance mitigation planning for fish habitat throughout the Elk Valley.

KEY WORDS

Multi-agency collaboration, ecosystem approach, fish and riparian habitat rehabilitation, coal mine rehabilitation, Westslope Cutthroat Trout habitat, Fording River.

INTRODUCTION

Fisheries resources in the Elk River watershed have been subjected to various pressures and influences since the first European exploration, settlement and industrial resource extraction activities commenced in the watershed. There have been ever increasing pressures on the fish resources of the Elk Valley over the past 120 years, with further human settlement and the ensuing development of agriculture, commerce, recreation and industry in the Elk Valley. It is recognized that the human activity within the Elk River watershed (agriculture, logging, oil/gas exploration/development, coal mining, rail, road, gas lines, power lines, hydro-electric or other power development, rural and urban settlement and recreation including sport fishing), as well as climatic and weather-related events, can potentially impact the fish and fish habitat resources of the Elk River and its tributaries, of notable distinction, and the focus of this paper, in the Fording River.

Teck Coal Limited (Teck) operates five open pit steelmaking coal mining operations in the Elk Valley: Fording River Operations (FRO), Greenhills Operations (GHO), Line Creek Operations (LCO), Elkview Operations (EVO) and Coal Mountain Operations (CMO). To share and discuss technical information related to Teck's fisheries obligations, the Elk Valley Fish and Fish Habitat Committee (EVFFHC) was formed in early 2009. Membership includes the British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD), the Ktunaxa Nation Council (KNC), Fisheries and Oceans Canada (DFO) and Teck. The objective of the EVFFHC is to strive for a consensus based forum related to Teck's fish habitat management activities so that they are generally supportive of FLNRORD and KNC fish habitat management direction and consistent with DFO policy.

In 2015, the EVFFHC collaborated on developing Teck's Regional Fish Habitat Management Plan which included developing a regional offsetting strategy, an ecosystem approach for prioritizing fish habitat rehabilitation in the Elk River and its tributaries, specifically the Fording River. Fish habitat rehabilitation projects, also referred to as measures, were identified, prioritized, ranked and matched to support Teck's *Fisheries Act* authorizations that required offsetting. The habitat rehabilitation measures were developed as test cases for this novel ecosystem approach. The multi-agency approach and the success of the EVFFHC's collaboration to develop functional habitat is outlined in this paper.

BACKGROUND

Since 2009, Teck has partnered with DFO, KNC and FLNRORD to work together as the EVFFHC. A draft Terms of Reference for the EVFFHC was written in 2015 outlining the scope, membership,

meetings, procedures, and objectives of the committee. The EVFFHC is a venue to discuss technical information and provide input on Teck's existing and future *Fisheries Act* obligations including *Fisheries Act* authorizations, Environmental Assessment Certificate conditions and any other fish habitat management obligations that may arise. A work plan for the EVFFHC is developed each year based on the objectives outlined in Teck's Regional Fish Habitat Management Plan. The EVFFHC collaborates to develop, review and endorse programs, documents and plans relating to Teck's fish and fish habitat management activities in the Elk Valley.

Managing effects on fish habitat is inherently linked to Teck's corporate sustainability strategy and commitment to biodiversity. As part of Teck's sustainability strategy, biodiversity management is a key focus at all of Teck's operations. The Regional Fish Habitat Management Plan is the main driver for fish habitat management, and resides within the framework of Teck's Biodiversity Program (this is more fully described in a paper in this symposium see Franklin, Hilts, & Gullison, 2018). The purpose of the Regional Fish Habitat Management Plan is to develop a strategy for the management of fish habitat, at a regional scale, for our existing operations and future developments in the Elk Valley. This will be accomplished by achieving the following four main objectives:

1. Developing a consistent accepted approach to conducting baseline fish habitat assessments and quantifying fish habitat;
2. Standardizing and improving mitigation measures to avoid and minimize effects to fish and fish habitat;
3. Developing a regional offsetting strategy to identify, prioritize, construct and conduct effectiveness monitoring of offsetting measures in relation to our projects causing serious harm to fish requiring *Fisheries Act* Authorization; and
4. Guiding one-time fish and fish habitat studies based on fisheries management objectives.

Understanding effects on fish habitat in a regional setting is an important consideration to ensure planning is holistic in nature and applies mitigation that maximizes benefits to fish habitat throughout the Elk Valley. The approach taken through the consensus based engagement with the EVFFHC is an additional proactive measure that ensures clear communication and alignment of vision and values between the member agencies and is a key priority in the overall framework of fish habitat management. This framework is fully functioning, based in large part on an open, honest and transparent Terms of Reference that is valued by all participants and is an example of a highly functioning committee that is leading to on-the-ground mitigation that benefits the resource.

REGIONAL OFFSETTING STRATEGY

One of the objectives of the Regional Fish Habitat Management Plan was to develop a regional offsetting strategy to prioritize habitat rehabilitation measures in relation to Teck's projects causing serious harm to fish requiring *Fisheries Act* Authorization (Figure 1).

The regional offsetting strategy includes processes for planning, list development, and ranking of habitat rehabilitation offsetting measures and projects causing serious harm to fish and fish habitat.

These processes match the highest priority projects to the highest priority fish habitat rehabilitation measures. Once matched, an offsetting and effectiveness monitoring plan is developed and an application is submitted. Upon approval, construction and effectiveness monitoring processes occur with accounting/transaction system recording success. See the test cases described below for how this process is applied.

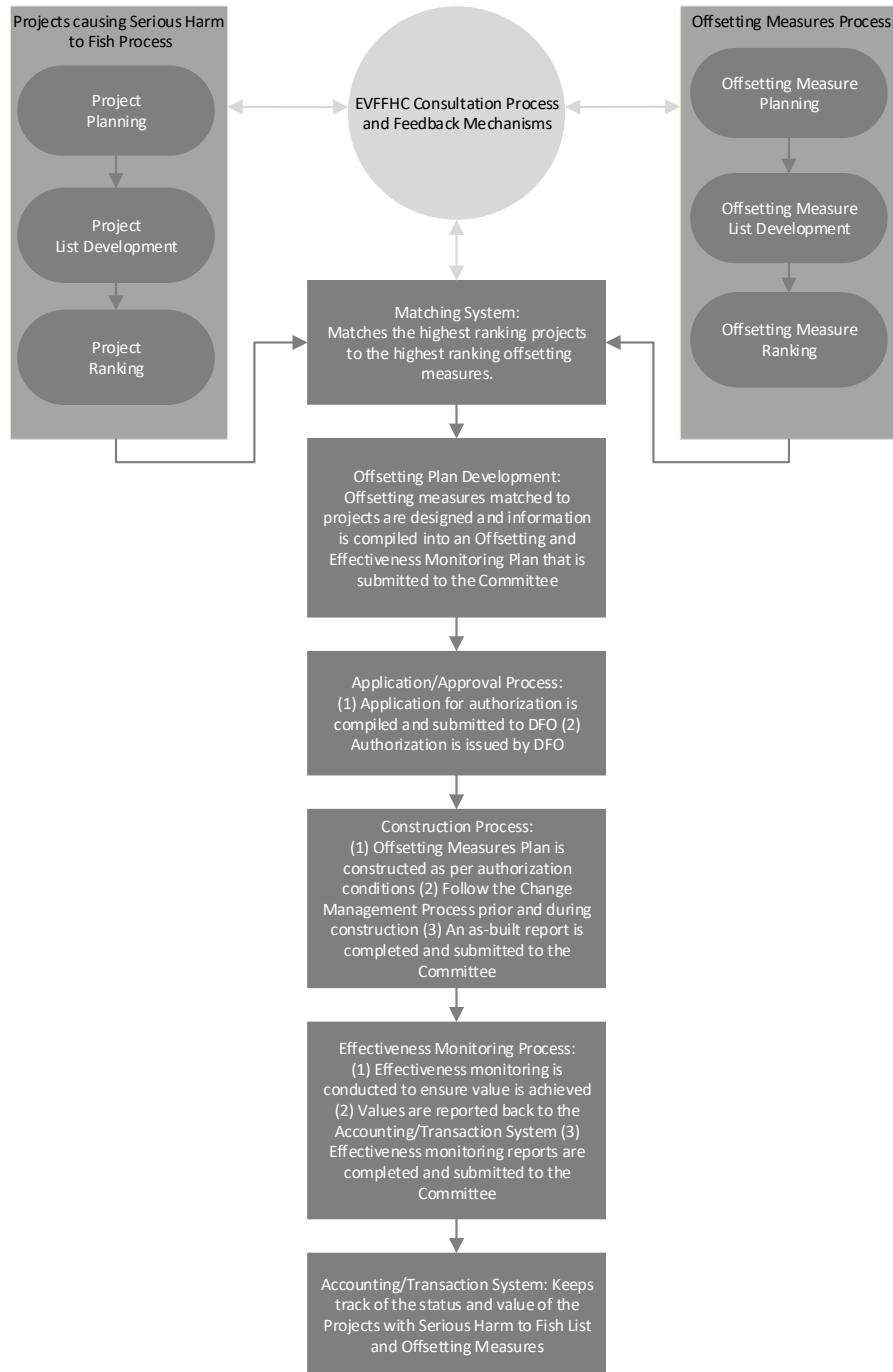


Figure 1 Regional Offsetting Strategy

In 2015, the regional offsetting strategy was developed in collaboration with the EVFFHC and includes a commitment for all offsetting plans to be endorsed by the EVFFHC. Ongoing consultation and collaboration with the EVFFHC and feedback mechanisms built into the processes of the regional offsetting strategy enables a consistent, agreed to approach for fish habitat rehabilitation measures. This approach also provides multiple touch points with regulatory agencies and First Nations throughout the development of the fish habitat rehabilitation measures and as a result the designs are pursued in a cost effective manner.

The regional offsetting strategy was developed over a series of five full day workshops with the EVFFHC in May and June 2015. The development of the regional offsetting strategy required an extensive time commitment from the EVFFHC members. Their participation and commitment to developing the process allowed for the progress achieved to date. One of the workshops included a two day meeting and site visit to tour areas in the Elk Valley. Visiting areas in the field aided in developing an aligned and clear set of values to support the regional offsetting strategy. Site visits, therefore, have become a key part of the successful relationships amongst member agencies of the EVFFHC. Site visits have been integrated into the regional offsetting strategy throughout the process and provide a transparency with the EVFFHC that is appreciated.

Under the regional offsetting strategy, the EVFFHC has developed a clear vision that focuses on long-term planning to benefit the resource. This enabled member agencies to proactively engage with a consensus based mindset and provide open, honest input to make the process effective and efficient. The efforts of the member agencies along with a common long-term goal of benefiting fisheries resources allowed for the development of a functional framework that was able to be applied in a short amount of time. In July 2015, the regional offsetting strategy was applied to Teck's current and proposed projects that required offsetting. The regional offsetting strategy continues to be applied effectively and efficiently in part from ongoing engagement and commitment of the EVFFHC members.

OFFSETTING MEASURE PROCESS

As part of the regional offsetting strategy, the offsetting measures process uses an ecosystem approach for prioritizing habitat rehabilitation. In May/June 2015, a vision and objectives for habitat rehabilitation were developed by the EVFFHC. The vision follows Teck's corporate sustainability strategy and commitment to biodiversity, which is captured in the following vision statement:

"We achieve a net positive impact on biodiversity in areas affected by our activities."

The EVFFHC identified several objectives to guide information collection and implementation of habitat rehabilitation measures in the region. The objectives are high-level statements of desired future outcomes, consistent with Teck, First Nations and regulatory mandates and policies. The objectives reflect, to varying degrees, many overarching goals of all EVFFHC member agencies.

Agreement and consensus on these objectives required thorough and open discussions with an extensive level of effort and engagement provided by all participants on the EVFFHC. The honest and open communication and relationships developed through this process have enabled the EVFFHC to function in a productive manner. Achieving these objectives has led to the successful implementation of on the ground mitigation that directly benefits fisheries resources in the Elk River valley.

The overarching objectives of the EVFFHC are to:

- Ensure the viability of native fish species in the Elk Valley watershed and improve understanding of status and trends of stream ecosystem health;
- Ensure that all actions are conducted safely and do not create a public hazard;
- Sustain or enhance opportunities for human use of fish;
- Ensure technical feasibility of actions prior to implementation; and
- Minimize cost of implemented actions.

Habitat rehabilitation measures are identified by the EVFFHC within an ecological unit (e.g., Upper Fording River watershed) based on findings and recommendations of fish population studies, if available, and/or fish and fish habitat studies completed as part of Teck's baseline reports for Environmental Assessments. Findings and recommendations from these studies typically provide the limiting fish habitat types (e.g., wintering, spawning, riparian) or key threats to the fish population (e.g., migration barriers) within an ecological unit in order to focus habitat rehabilitation measures.

Quantitative and qualitative information and data are collected for the list of habitat rehabilitation measures within the ecological unit based on the objectives (i.e., biological, safety, social, feasibility and cost). The list of habitat rehabilitation measures are then prioritized by the EVFFHC using a ranking system to appropriately plan and construct the habitat rehabilitation measures on a priority basis approach within an ecological unit. The highest priority habitat rehabilitation measures are then matched by the EVFFHC to the highest priority projects causing serious harm to fish. Once matched, the habitat rehabilitation measures move into design and construction phases (Figure 1).

The design of the habitat rehabilitation measures generally focus on applying natural concepts using natural riverine processes to guide the design. The general philosophy is to use a 'soft' approach to allow the system to form and develop by providing natural elements (e.g., trees and boulders) in key areas (example references: Newbury and Gaboury 1994, Chang 1988, Dunne and Leopold 1978). The philosophy allows the system to stabilize and improve fish and riparian habitat over time (i.e., years). The philosophy is supported and endorsed by the EVFFHC and can be applied in multiple areas deemed appropriate for rehabilitation based on channel type and a commitment from Teck to maintain/adjust the measures if needed over time to meet objectives.

Comprehensive and technical discussions occurred during several meetings with the EVFFHC in order to ensure that this philosophy would be successful in the Elk Valley. The technical experience and local knowledge of the EVFFHC members aids in development of designs that will produce beneficial results in the region. Applying key concepts and lessons learned from previous work and examples has been a focus of the EVFFHC in determining appropriate designs for fish habitat rehabilitation measures. In areas where expertise of the EVFFHC members is not as extensive, third party technical advisors have been involved in discussions and reviewing designs. This allows for a thorough review of all designs and a level of comfort with designs that have not been applied previously in the region. In addition, agreement by the EVFFHC on concepts and designs that will trial experimental designs has enabled mitigation in several areas that may not have been otherwise pursued. An appropriate level of flexibility along with the technical strengths of the EVFFHC members and a long-term planning vision allows for progress that supports the overall framework of fish habitat management.

To date all of the current offsetting measures constructed have performed as designed as evidenced through the effectiveness monitoring programs. Where minor maintenance has been required the information is brought back into the planning process and designs are updated in efforts to prevent recurrence. Early indications of the effectiveness monitoring programs are showing multiple fish use and occupation in all constructed areas.

TEST CASES

In June 2015, the EVFFHC selected seven agreed to habitat rehabilitation measures that met the vision and objectives for habitat rehabilitation. These seven habitat rehabilitation measures were test cases applying the offsetting measures process under the regional offsetting strategy for a current outstanding *Fisheries Act* authorization for the LCO Phase II Project and an application for *Fisheries Act* authorization for the FRO Swift Project.

The LCO Phase II and FRO Swift projects and the seven test cases are located in the upper Fording River watershed. All of the test cases are within the FRO mine boundary. Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*) (WCT) are a key fisheries resource in the Fording River watershed and is the only species known to occur in the watershed upstream of Josephine Falls. Due to the presence of Josephine Falls, which prevents upstream movement of fish thereby protecting this population from hybridization with non-native rainbow trout (and competition with non-native species in general), the upper Fording River can be considered an isolated upstream refuge where genetically pure WCT are present. WCT are a blue-listed species (i.e., species of concern) in British Columbia and the *Species at Risk Act* (SARA) lists the British Columbia population of WCT as Special Concern under Schedule 1 of SARA. Carscadden and Rogers (2011) confirmed that the upper Fording River population is consistent with the COSEWIC (2006) designation of a genetically pure WCT population.

A multi-year study from 2012 to 2015 was conducted to understand the current status of the WCT population in the upper Fording River watershed upstream of Josephine Falls. The upper Fording

River WCT Population Assessment and Telemetry Study (Westslope *et al.* 2016) was developed under the guidance and direction of a steering committee that consisted of representatives from Teck, FLNRORD, KNC and Simon Fraser University. The study was conducted to provide supporting data for decision making within the upper Fording River watershed.

The WCT Population study identified fish passage, connectivity and overwintering and tributary habitat as limiting the upper Fording River population (Westslope *et al.* 2016). The vision and objectives for the seven habitat rehabilitation measures in the offsetting measure process and the selection of the habitat rehabilitation measures were based on these findings. Further monitoring of the WCT population in the upper Fording River will take into consideration corresponding effectiveness monitoring programs for the habitat rehabilitation measures in the watershed.

The test cases were collectively agreed upon short-term solutions to the immediate concerns identified in the upper Fording River. It should be noted that long-term measures and closure planning were also a part of the regional offsetting strategy and that the test cases support and work within the long-term strategy. In July 2015, a long-list of fish habitat rehabilitation measures was reviewed and shortened to the seven agreed upon measures. In August 2015, the EVFFHC reviewed concept designs and visited the fish habitat rehabilitation measures sites in the field. In October 2015, the seven fish habitat rehabilitation measures were ranked and prioritized and then matched to the projects. The seven test cases are summarized in Table 1.

Table 1 Summary of projects causing serious harm to fish and habitat rehabilitation offsetting measures in the upper Fording River prioritized under the regional offsetting strategy.

Project Causing Serious Harm to Fish	Habitat Losses		Habitat Rehabilitation Measure Name	Instream Measures		Riparian Measures	
	Instream (m ²)	Riparian (ha)		Habitat Gains (m ²)	Construction Date	Habitat Gains (ha)	Construction Date
LCO Phase II	11,539	13.362	1 Henretta Creek Culverts Fish Passage Improvement	1,230	Fall 2016	n/a	n/a
			2 Fording River Rehabilitation near the Concrete Arch Crossing	6,600	Fall 2016	9.310	Spring/Fall 2017/2018
			3 Fording River at the Multi-plate Culvert Fish Passage Improvement	3,520	Fall 2016	n/a	n/a
			4 Fording River Rehabilitation at the North Tailings Pond	6,624	Fall 2016	5.130	Fall 2017/2018
Fording Swift	24,426	24.200	5 Henretta Lake and Inlet/Outlet Rehabilitation	13,325	Fall 2017/ Fall 2018	6.400	Spring/Fall 2018/2019
			6 Fish Pond Creek Creation and Rehabilitation	9,925	Fall 2017	5.500	Spring/Fall 2018/2019
			7 Fording River Rehabilitation near Swift Creek	11,100	Fall 2018	21.200	Spring/Fall 2017/ 2018/2019
Total:	35,965	37.562	Total:	52,324	n/a	47.540	n/a

The key objectives for the test case habitat rehabilitation measures were identified by the EVFFHC and focused on the following:

- improving fish passage for multiple WCT life stages;
- restoring the channel form and function (e.g., riffle-pool morphology) and increasing habitat complexity to provide greater fish habitat values for spawning, overwintering, rearing and migration habitat;
- creating and rehabilitating tributary habitat; and
- establishing reclaimed areas to conditions that support the ecological trajectory towards natural climax riparian ecosystems to provide long-term stability to the fluvial system while supporting microhabitats for small mammals, avi fauna, amphibians and invertebrates.

Data and information for each of the habitat rehabilitation measures was collected to inform the design and to establish preconstruction conditions for effectiveness monitoring for the offsetting and effectiveness monitoring plans. Methods for completing preconstruction condition surveys, developing habitat gain calculations, reporting as-built surveys and conducting effectiveness monitoring (including frequency and reporting) were developed to be consistent for the objective of the habitat rehabilitation measure and included in the plans. The offsetting and effectiveness monitoring plans for the projects were reviewed and endorsed by the EVFFHC in May and September 2016. Values and accounting for the seven fish habitat rehabilitation measures were also discussed and agreed upon by the EVFFHC for inclusion in the offsetting plans.

The offsetting and effectiveness monitoring plans outlined the schedule for construction and effectiveness monitoring. The four habitat rehabilitation measures matched to the LCO Phase II Project were constructed in the fall of 2016 and the remaining three habitat rehabilitation measures matched to the FRO Swift Project were constructed in the fall of 2017/2018. As-built surveys were completed to meet permit requirements. Benchmarks established during pre-construction surveys were used in the as-built surveys to correlate both sets of data. As-built surveys also document any field fitting relative to the siting of the structures at the time of construction.

Effectiveness monitoring methods for fish passage, stability of structures, channel morphology and vegetation quality and site-specific metrics and targets for each habitat rehabilitation measure were developed. The WCT population study provided the baseline information for the biological assessment for the habitat rehabilitation measures including adult and juvenile density estimates and regional reference data. Biological monitoring of the habitat rehabilitation measures was incorporated into the continued population monitoring conducted under the WCT population study.

Frequency of effectiveness monitoring varies by type, site, and magnitude of flow experienced in a given year (i.e., event-based monitoring trigger). Event-based monitoring refers to an objective monitoring program that aims to conduct sampling in response to flow conditions of a specific magnitude. Event-based triggers were set to guide monitoring to occur over a range of flows expected to produce changes in channel morphology (e.g., 1:2 to 1:5; 1:5 to 1:10 year return

interval) and during flows where substantial changes may occur and maintenance may be required (i.e., 1:10 year return interval). Monitoring reports will be submitted for review by the EVFFHC and will present the results of the site-specific effectiveness monitoring metrics. The results will be used to describe trends in rehabilitation and determine maintenance needs for the habitat rehabilitation measures.

Effectiveness monitoring began the year following construction of the offsetting measures and the accounting/tracking system is keeping track of the value and success of the offsetting measures. An example of a fish passage improvement habitat rehabilitation measure (Henretta Creek Culverts Fish Passage Improvement) and restoring a channel form and function habitat rehabilitation measure in an area fully confined by mining activities (Fording River Rehabilitation at the North Tailings Pond) and in an area semi-confined by mining activities (Fording River Rehabilitation near the Concrete Arch Crossing) are provided below.

Henretta Creek Culverts Fish Passage Improvement

This habitat rehabilitation measure improved upstream WCT migration over three grouted weir structures that backwater two culverts on Henretta Creek. The culverts were installed in 1991. Three grouted weir structures were installed in series over an approximately 30 m distance downstream of the culvert outlets. Since 1991, streambed erosion and down-cutting has increased the drop of the most downstream weir, presenting an impediment to upstream migrating fish, particularly for juvenile WCT life stages.

To improve fish passage over the weirs, the design included building two riffles downstream of the three grouted weirs to reduce the hydraulic drop over the downstream-most grouted structure (Figure 2). Effectiveness monitoring has shown improved fish passage for juvenile WCT.

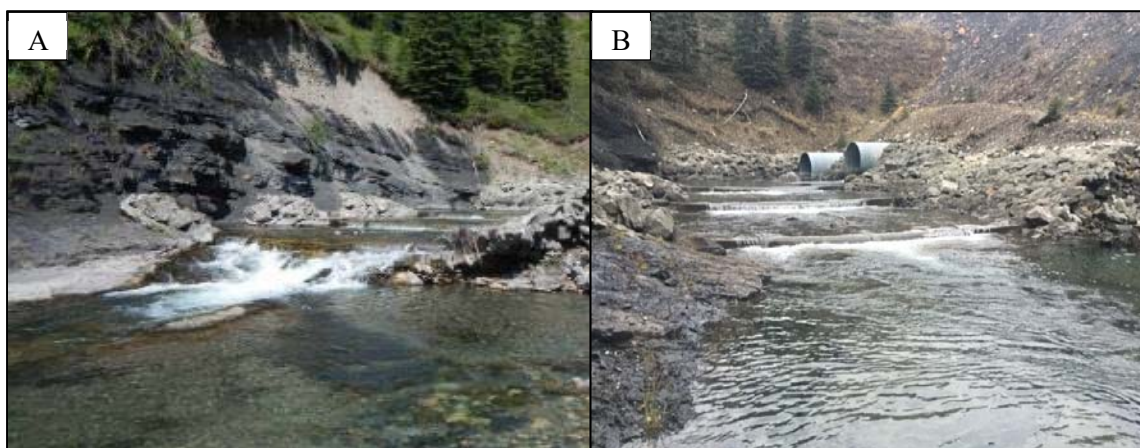


Figure 2 Henretta Creek Fish Passage Improvement habitat rehabilitation measure (A) before in August 2016 and (B) after construction in October 2016. View is looking upstream.

Fording River Rehabilitation at the North Tailings Pond

This habitat rehabilitation measure is intended to increase habitat complexity by restoring suitable proportions of pools, riffles and glides and to improve migration conditions for juvenile and adult WCT. The Fording River flows for 1 km through a channelized section that is confined on both sides from mine development. As a result, this portion of the stream has low sinuosity and a high gradient. Both banks were armored with riprap following the 2013 flood.

The design was to create a stable riffle-pool morphology by constructing a series of approximately 20 riffles (Figure 3). The body of the riffles was constructed using boulders and top dressed with finer native stream sands, gravels, and cobbles. This process infills the voids of the larger rock used to build the riffle form and thus force the stream to flow over the riffles as opposed to through it. The riffles were built with larger rocks being placed on the surface to create chutes and small drops providing diverse habitat and assisting fish passage at low flows. Effectiveness monitoring is showing that the structures are functioning as intended.

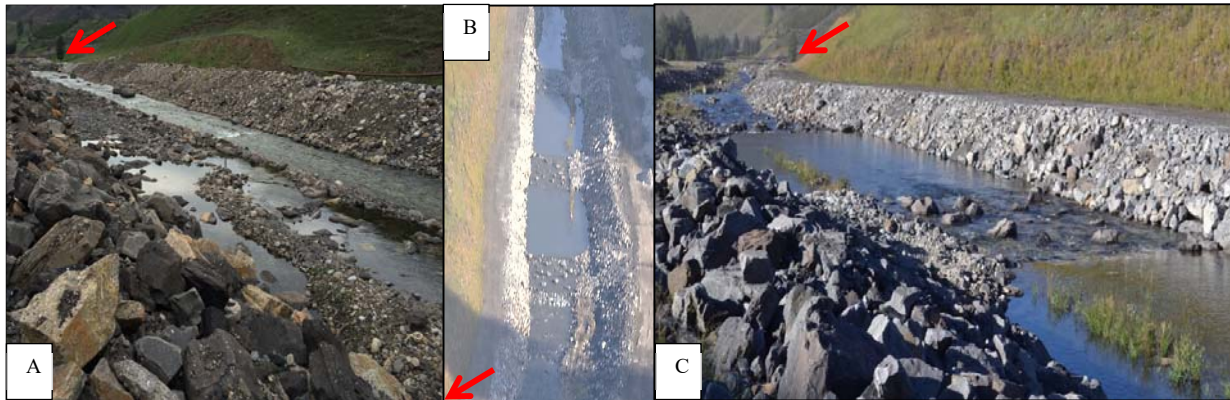


Figure 3 The Fording River at the North Tailings Pond habitat rehabilitation measure channel before (A) and after construction in September 2016. The riffle structures (B) are shown from an aerial view looking upstream and (C) from a ground view looking downstream. Red arrows indicate the same location.

Fording River Rehabilitation near the Concrete Arch Crossing

This habitat rehabilitation measure was intended to restore channel form and function and improve fish use within this section of the upper Fording River. This habitat rehabilitation measure includes a 1,100 m section of the river. The preconstruction condition survey indicated that this section is characterized as a shallow, disturbed channel that has extensive braiding, an over-widened channel, and a lack of cover. The disturbance in this section is from a combination of vegetation loss from forest fires, road crossings for mining activities and extensive flooding in 1995 and 2013 causing bank erosion and material deposition.

The design realigned the Fording River to a stable riffle-pool morphology with a sinuous channel alignment by constructing large woody debris instream structures (Figure 4) and large woody debris bar top structures on gravel bars. Together, the structures will guide fluvial processes to produce the desired channel morphology overtime, including a reduced width-to-depth ratio, increased pool habitat, and improved channel complexity. A total of 27 instream large woody debris structures and 103 bar top structures were built at the site. Effectiveness monitoring is showing fish use within the structures.



Figure 4 Fording River Rehabilitation near the Concrete Arch Crossing habitat rehabilitation measure example of an instream large woody debris structure (A) during construction (view looking upstream) and (B) after construction (view looking downstream) in September 2016.

CONCLUSION

The test case fish habitat rehabilitation measures were successfully constructed. This is a direct result of the effort, time and commitment of the EVFFHC to the vision for fish habitat management in the Elk Valley. A consensus based approach to engagement allowed for agreement on concepts and designs for fish habitat rehabilitation measures that support the objectives of the regional offsetting strategy. The guidance and input provided by all members of the EVFFHC enables mitigation of fish habitat that follows a functioning framework. With an open, honest and transparent Terms of Reference that is valued by all participants, progress has been achieved to benefit the resource.

Feedback and lessons learned from the EVFFHC on the 2016/2017 construction was incorporated into the regional offsetting strategy process and, as a result, the construction in 2018 was improved and provided further benefit to fisheries resources in the Elk River valley. By considering input

from the EVFFHC on a regional scale, fish habitat management can be coordinated in a cost effective manner that works in alignment with goals and objectives of all of the member agencies.

The regional offsetting strategy continues to be successfully applied in part from the ongoing engagement and commitment of the EVFFHC members. A second round of projects and fish habitat rehabilitation measures have been identified, prioritized, ranked and matched. Progress continues to be achieved from the thorough, open and honest discussions provided by all participants on the EVFFHC.

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