Update on Upper Fording River Westslope Cutthroat Trout Planning and Implementation of Actions to Support Recovery

June 2023

Teck

Table of Contents

Teck

1 Introduction

In September 2019, a population assessment conducted for Teck Coal Limited (Teck) identified a decline in the abundance of subadult and adult Westslope Cutthroat Trout (WCT; *Oncorhynchus clarkii lewisi*) in the upper Fording River (UFR) (Cope 2020). Shortly thereafter, Teck initiated an Evaluation of Cause (EOC) process to investigate and report on the likely cause of the decline. Based on preliminary EOC findings, Teck commenced an action planning and implementation process to support recovery with assistance from Minnow Environmental Inc.

This document provides an update on the planning and implementation process. Background information is provided on the results of the EOC, the current status of the UFR WCT population, and the approach taken to date to develop and implement actions to support recovery. A status update is provided; it describes the approach to planning and implementation moving forward, as well as outlines recovery-focused projects that have already been completed or are in progress. The document concludes with next steps and planned communications.

2 Background

2.1 2019 Population Decline and Evaluation of Cause

As previously stated, a decline in the population of UFR WCT occurred in 2019, and an EOC process was initiated in January 2020. The final EOC findings were released in December 2021 (EOC Team 2021).

The EOC Team (2021) determined that the WCT population decline was not due to any single stressor but was likely attributable to several specific stressors that coalesced during the decline window and were exacerbated by existing conditions of the watershed, as well as characteristics of WCT biology. The decline likely occurred in February-March 2019, and resulted from the interaction of extreme ice conditions (due to extreme prolonged cold air temperatures, seasonal winter low flows and low winter snowpack), sparse overwintering habitat, and restrictive fish passage conditions during the preceding migration period in fall 2018. While some stressors, such as cold weather, are natural, mining development has altered the availability of overwintering habitats in portions of the river and exacerbated the challenges to fish passage through water use, channel widening and aggradation.

Although the specific mechanisms of effect are not known, the EOC Team (2021) identified the following potential causes of fish mortality:

- Direct physical effects of ice on fish (e.g., entombment, gill injury/suffocation from frazil ice).
- Stress and energy deficits associated with movement to avoid ice conditions, crowding, or challenges in accessing food.
- Low dissolved oxygen due to flow blockages or other mechanisms.
- Stranding due to earlier timing of drying in ephemeral reaches or because fish were forced into suboptimal overwintering habitat.

In addition, during the decline window, fish may have been more susceptible to predation due to the physical constraints of ice and seasonal low flows, along with a potential lack of energy to avoid

predators. Fish may also have been more susceptible to the above-noted stressors due to ongoing stress related to elevated constituent concentrations (e.g., selenium and nitrate) in the UFR watershed (EOC 2021).

2.2 Population Monitoring and Status as of Fall 2022

Teck initiated sampling of WCT in the UFR in 2012. Monitoring efforts between 2012 and 2019 were targeted primarily at adults in selected areas with a view to avoid overhandling of a blue listed species. Between 2020 and 2022, the program was expanded to provide a more comprehensive understanding of population status and to collect the information necessary to better understand natural variability and potential effects of mining on the UFR WCT population.

Monitoring data collected in 2020 and 2021 suggest that subadult and adult numbers have increased, and that the population is productive and recovering from the set of events that occurred in 2019 (Thorley et al. 2021, 2022). Monitoring information from 2022 (Thorely et.al. In press) indicates the adult population continues to increase, with numbers in the range of ~2,000 fish compared to ~1,500 in 2021, ~440 in 2020 and ~330 in 2019 following the decline window. Teck remains focused on continued planning and implementation of projects to support this positive increase in population size and to continue to strengthen its resilience.

2.3 Recovery Planning and Implementation

In early 2021, Teck initiated an action planning and implementation process to support recovery based on preliminary EOC findings. A team of qualified professionals was assembled, consisting of fluvial geomorphologists, hydrologists, engineers, hydrogeologists, and fisheries biologists. Participants included staff from Teck, GeoProcess Research Associates, Kerr Wood Liedal, SNC-Lavalin, ESSA and Azimuth Consulting Group. This team has been working to identify means and mechanisms to support the recovery of the WCT population and to strengthen its resilience; this work has progressed in collaboration and consultation with:

- the Ktunaxa Nation Council (KNC)
- the British Columbia (BC) Ministry of Environment and Climate Change Strategy (BC ENV)
- the BC Ministry of Forests (BC FOR)
- the BC Ministry of Land, Water, and Resource Stewardship (BC LWRS)

Teck's approach to recovery planning and implementation is organized around three pillars:

- Water quantity
- Physical habitat
- Water quality

Water quality is managed through the Elk Valley Water Quality Plan (EVWQP; Teck 2014) and the associated Implementation Plan Adjustment (IPA) process. This system of water quality management, mitigation and, where required, improvement (e.g., selenium and nitrate treatment) is established and continues to progress outside of recovery planning. Hence, efforts specific to recovery have been and will

continue to be concentrated on the other two pillars (i.e., water quantity and physical habitat), which are the focus of this update.

As noted above, Teck initiated the recovery planning process in early 2021 and has been developing and implementing recovery actions in a stepwise manner. The five-step approach consists of:

1) Information gathering
2) Generation of potential recovery actions
3) Review of those actions with internal and external stakeholders to gather feedback
4) Execution of an initial prioritization process
5) Continued planning and implementation

An overview of each step is provided below.

2.2.1 STEP 1 - INFORMATION GATHERING

The first step, information gathering, consisted of a review of relevant literature, including EOC and subject matter expert (SME) reports related to the decline, along with Teck's routine water quality, calcite, and WCT population monitoring reports. It also consisted of meetings with SME and mine professionals to understand current conditions in the UFR, initiatives already planned or underway to improve habitat and/or better define operational water use, and the specific stressors/constraints and limiting factors affecting the WCT population. Meetings occurred with the KNC, the Province of British Columbia and Fisheries and Oceans Canada (DFO) to discuss the situation and provide information on the planning process.

Several supporting studies were conducted. A drone survey of the UFR was completed to provide high resolution aerial imagery for use in assessing river form and function. The development of a hydraulic model of the UFR was initiated (the Hydraulic Model), and the continued development and enhancement of an existing fish population model for UFR WCT (the Population Model) was expedited. The Hydraulic Model can be used to characterize water depths and velocity under various flow conditions in the UFR, which contributes to a better understanding of available fish habitat and potential constraints on fish passage with changes to flow. The Population Model is a predictive tool that can be used to assess how potential recovery actions and other changes to the UFR may affect the WCT population.

2.2.2 STEP 2 - GENERATION OF POTENTIAL RECOVERY ACTIONS

The next step in the planning process involved identifying conceptual actions or projects to support WCT recovery. Water quantity project options focused on reducing water withdrawal from sources connected to the UFR with specific emphasis on annual low flow periods, be it through water reuse, prioritization of use of mine influenced water, formalizing existing and/or developing new water storage opportunities or a combination thereof. Project options for physical habitat focused on restoring, enhancing, and/or creating physical habitat for different WCT life stages within the UFR and improving connectivity between habitats. Project options in the form of research studies and/or development of additional tools to improve the collective understanding of the hydrology, form, and function of the UFR were also proposed.

2.2.3 STEP 3 - REVIEW AND FEEDBACK

Step 3 involved Teck meeting with the KNC and the Province to present the conceptual projects and gather feedback on the nature, scope and general details of each project. This consultation process resulted in the removal and addition of some projects, as well as the refinement of others.

2.2.4 STEP 4 - INITIAL PRIORITIZATION

The list of high-level, conceptual projects and actions produced at the end of Step 3 was reviewed and discussed with the KNC and the Province in a workshop that occurred in April 2022. The purpose of the workshop was to identify relative priorities. It consisted of comparing one conceptual project or action with another and identifying which should take precedent. These comparisons were completed with consideration of conceptual, high level relative costs where available (which was limited) and with varying degrees of information available on technical feasibility.

2.2.5 STEP 5 - CONTINUED PLANNING AND IMPLEMENTATION

Step 5 consists of a two-pronged approach. The first prong involves implementation of readily actionable projects that can be initiated quickly and are likely to either yield notable benefits or provide information to help inform design of other projects still in development. The second prong involves a further review and prioritization of the remaining conceptual recovery projects identified as part of Step 4 and not included in Prong 1. The purpose of the review and continued prioritization is to provide an opportunity to:

- Optimize execution to avoid duplication of effort (e.g., grouping projects in proximity to one another or actioning them at the same time to optimize the use of personnel and minimize disturbance)
- Review conceptual project options with consideration of technical feasibility and likelihood of success, taking into account permitting requirements, cost and potential benefits
- Remove project options that are, upon further examination of feasibility and design, identified as being impractical, net negative (e.g., result in more negative than positive effects) and/or yielding smaller benefits than previously assumed

This two-pronged approach will also provide an opportunity to consider fish recovery objectives that are intended to be released by the Province and KNC and understand how they may inform future recovery projects.

Focusing more specifically on physical fish habitat projects, this approach allows projects identified through the recovery planning process to be considered in a more holistic manner, integrating recovery efforts with those related to habitat offsetting and corrective measures. This integration will result in an overall habitat rehabilitation plan; conceptual projects will be organized and categorized by habitat type, then selected for further development and implementation based on addressing constraints in the system (which directly supports recovery) and upcoming habitat losses related to development (which directly supports offsetting and indirectly supports recovery). This approach of moving forward in a more holistic manner with respect to physical habitat is in line with and supported by the Elk Valley Fish and Fish Habitat Committee (EVFFHC), the membership of which includes the KNC, the Province and DFO.

3 Status Update

3.1 Prong 1 – Implementation

3.2.1 COMPLETED PROJECTS

Recovery-focused projects completed to date are listed in Table 1. They consist of two water quantity projects and six physical habitat projects. A brief description of each project is provided in Table 1, along with the project short title and its general location.

3.2.2 PROJECT IN PROGRESS

Recovery-focused projects, including studies and those involving tool development, that are in progress are listed in Table 2. They consist of five water quantity projects and 10 physical habitat projects. A brief description of each project is provided in Table 2, along with the project short title and its general location.

Two of the water quantity projects that are either completed or in progress relate directly to reducing raw water demand. They consist of improving the potable water distribution system at FRO by replacing aging or leaking infrastructure and separating several process buildings from the potable water distribution system. Both projects will reduce raw water demands and reduce water withdrawal from the potable water wells situated in a shallow aquifer that is connected to the Fording River.

Several of the physical habitat projects that are either completed or in progress similarly serve to improve conditions in the UFR. They include increased connectivity through culvert replacement, improvements to overwintering habitat and increased habitat diversity through the introduction of large woody debris.

3.3 Prong 2 – Continued Planning

3.3.1 WATER QUANTITY

Conceptual water quantity projects identified and initially prioritized as part of Step 4 are being re-examined, other than those listed above in Tables 1 and 2. The re-examination involves additional assessment of technical feasibility, operability and cost relative to anticipated benefit in terms of reducing raw water demands, increasing water use efficiency and reducing potential effects to instream flows in the Fording River, should they occur either directly via changes to surface flow inputs or indirectly via changes to sub-surface flows that may be connected to the Fording River. The net result will be a reprioritized list of conceptual projects; those ranking the highest will be identified for transition into Prong 1 soon (e.g., will move into more detailed design and costing) to support Teck's continuing efforts to increase water efficiency and reduce raw water use, particularly during annual low flow periods. Those remaining in Prong 2 may transition into Prong 1 later, may be further refined to increase their potential benefit or may be eliminated if found to be ineffective (e.g., not technically feasible, cost prohibitive and/or a low likelihood of successful implementation and operation).

3.3.2 PHYSICAL HABITAT

Teck is in the process of completing additional surveys of the UFR to identify additional physical habitat projects, as well as to refine others that have already been proposed through prior efforts (e.g., as an outcome of Step 3 of the recovery planning process). Teck is also in the process of developing a single physical habitat project catalogue, wherein all potential projects in the Valley can be identified, tracked and characterized by habitat type, potential benefit and potential or known challenges to successful implementation (e.g., technical constraints, permitting limitations, practical complications, potential level of disturbance or disruption during construction). Teck is anticipating completion of the additional surveys in Q4 2023. An initial version of the integrated habitat catalogue should be ready for internal use by the end of Q2 2023. The catalogue will be a living document that will be updated regularly to reflect new information, progress and feedback from external stakeholders, including the EVFFHC.

Table 1 Projects Completed to Date that Support Recovery Efforts in the Upper Fording River Watershed

Area	Location	Project Title	Overview
Water Quantity			
Fording River Operations (FRO)	On-site	FRO Process Water Audit - Phase 1	Identified process water demands on the potable water system
	On-site	Potable Water Separation - Tank Replacement	Replaced existing potable water storage tanks and piping to support future process water storage tank and reduce potential loss to leakage through aging infrastructure
Physical Habitat			
FRO	Chauncey Creek	Fording Highway Culvert Mitigation - Bridge Replacement	Reconnected tributary habitat to improve access to existing spawning and juvenile rearing habitat in Chauncey Creek
	Fording River (Clode Flats)	Fall 2021 Overwintering Remediation	Created and augmented overwintering pools and reconnected braided flows to provide for consolidated flow paths
	Near Kilmarnock Creek	Large Woody Debris Seeding Downstream of Kilmarnock Creek	New substrate provides cover for fish to reduce predatory pressure and improve complexity; large woody debris placed on gravel bars downstream of Kilmarnock Creek for approximately 2 km
	Near Kilmarnock Creek, North Tailings Pond and Turnbull	Riparian Planting South of Kilmarnock Creek and Near North Tailings Pond and Turnbull Bridge	32,549 seedlings planted south of Kilmarnock Creek, in vicinity of North Tailings Pond and near Turnbull Bridge to increase erosion control, bank stability and habitat complexity

	Fish Pond Creek	Bioengineering (Willow Staking) at Fish Pond Creek and Concrete Arch	Staking should result in increased erosion control, bank stability, habitat complexity, and cover at offsetting sites
	Clode Creek	Clode Creek Calcite Rehabilitation	Completed activities included reconstruction of a new and slightly longer channel (adjacent to the previous channel location) including appropriate channel substrate, removal of calcified substrate and regrading of the historical channel

Table 2 Recovery-Related Projects that are Underway in the Upper Fording River Watershed

Area	Location	Project Title	Objective / Overview
Water Quantity			
Fording River Operations (FRO)	On-site	FRO Breaker/ROM Process Water Separation	Reduce potable water usage by connecting the Breaker and ROM buildings to the Turnbull Reclaim Water System; potable water originates from the potable water wells situated in a shallow aquifer adjacent to the Fording River
	Fording River	Integrated Surface Water Groundwater Model	Develop a new numerical tool for the Fording River watershed that better reflects the current understanding of groundwater-surface water interactions
	On-site	Water Dispatch (Water Use Tracking)	Implement a system to monitor and track overall site water usage with the goal of optimizing site water management
	On-site	Water Audit - Phase 2	Review water use in process and potable water systems and identify opportunities for improvement within each system
	On-site	Clean Water Diversions	Continue to review water management and look for opportunities to continue to divert runoff from undisturbed areas above mining operations to the Fording River or its tributaries
Physical Habitat			
Greenhills Operations (GHO)	Greenhills Creek	Greenhills Creek Restoration Plan	Restore habitat in Greenhills Creek and reconnect to the Fording River; plan includes bypassing the sediment pond with natural channel design, water quality improvements, upper Greenhills Creek calcite remediation, and riparian zone enhancements in the reach adjacent to the conveyor belt crossing

FRO	Fording River	Fording River Abandoned Channel Reconnections	Redirect the Fording River into previously abandoned channels (due to an avulsion caused by the 2013 flood) with additional fish habitat enhancements
	Henretta Creek	Henretta Haul Road Culvert Removal and Weir Mitigation	Removal of two approximately 120m long culverts at the Henretta Haul Road with mitigation at downstream weir structures if needed. Proposing replacement of culverts with a restored open channel and/or crossing structure, with final design elements dependent on project needs
	Fording River (Clode Flats)	Clode Flats Outer Bend Remediation and Reconnection	Reconnection of an outer bend that was previously disconnected by channel cut-off (chute formation)
	Henretta Creek	Henretta Creek Geomorphology Study Reach	Review of channel morphology to identify geomorphically sustainable improvement opportunities
	Fording River (Upstream of Henretta Creek)	UFR Geomorphology Study Reach 1	Geomorphic analysis to assess sediment transport limitations for habitat improvement opportunities
FRO	Fording River (Henretta Creek to Clode Creek)	UFR Geomorphology Study Reach 2	Geomorphic analysis to assess sediment transport limitations for habitat improvement opportunities
FRO	Fording River (Clode Creek to Fording River Road crossing)	UFR Geomorphology Study Reach 3	Geomorphic analysis to assess sediment transport limitations for habitat improvement opportunities
FRO	Fording River (Fording River Road crossing to downstream South Tailings Pond)	UFR Geomorphology Study Reach 4	Geomorphic analysis to assess sediment transport limitations for habitat improvement opportunities
FRO	Fording River near North Tailings Pond	Streambank Vegetation Amendments	Augment select section of riprap bank with vegetation using joint plantings/vegetated buttress approach; project to start with an approx. 30 to 50 m pilot stretch, then expand depending on pilot project outcomes

4 Next Steps

Projects listed in Table 2 will continue, with emphasis on reducing Fording River Operations' reliance on the shallow groundwater wells (potable wells) located adjacent to the Fording River mainstem. Other near-term priorities include:

- Continued evaluation of conceptual water quantity projects and identification of those that should transition into Prong 1 in the next 12 months
- Development of an initial version of the holistic physical habitat catalogue

Teck will also review and incorporate the UFR objectives into ongoing planning and implementation activities, once they have been issued by the Province, KNC and DFO.

5 Ongoing Communication

Teck will continue to provide updates on recovery-related activities annually. These updates will be delivered in a similar format (i.e., issuance of a brief memorandum or report discussing the status of the UFR WCT population and Teck's progress related to both Prong 1 and Prong 2 actions and activities).

6 References

Cope, S. 2020. Upper Fording River Westslope Cutthroat Trout Population Monitoring Project: 2019. Report Prepared for Teck Coal Limited, Sparwood, BC. Report prepared by Westslope Fisheries Ltd., Cranbrook, BC.

EOC (Evaluation of Cause) Team. 2021. Evaluation of Cause – Decline in Upper Fording River Westslope Cutthroat Trout Population. Report prepared for Teck Coal Limited by Evaluation of Cause Team. December 2021.

Thorley, J.L., Kortello, A.K., and M. Robinson. 2021. Upper Fording River Westslope Cutthroat Trout Population Monitoring 2020. A Poisson Consulting, Grylloblatta Consulting, and Lotic Environmental report prepared for Teck Coal Ltd., Sparwood, BC.

Thorley, J.L., Kortello, A.K., Brooks, J., and M. Robinson. 2022. Upper Fording River Westslope Cutthroat Trout Population Monitoring 2021. A Poisson Consulting, Grylloblatta Consulting, and Lotic Environmental report prepared for Teck Coal Ltd., Sparwood, BC.

Thorley, J.L., Kortello, A.K., and Brooks, J. In Press. Upper Fording River Westslope Cutthroat Trout Population Monitoring 2022. A Poisson Consulting and Lotic Environmental report prepared for Teck Coal Ltd., Sparwood, BC.