



## 5.3 Habitat restoration and enhancement

### What

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Habitat restoration (return of productivity to some pre-disturbance level) and enhancement (increase in productivity beyond natural levels) includes a broad range of actions that may be taken to increase the productivity of spawning and rearing habitats. Habitat restoration can include re-vegetating stream banks, adding structures including large organic debris and other materials to stream channels, stabilizing eroding stream banks to reduce sediment input to streams, restoring access to spawning or juvenile salmon over “soft” obstructions (non-bedrock) such as roadway stream crossings, beaver dams or log jams. Habitat enhancement includes building habitats and may include the excavation of groundwater-fed channels for rearing and overwintering Chinook, removing “hard” obstructions (bedrock) to allow Chinook access to areas that they have never occupied, or connecting isolated streams or water bodies to habitats used by Chinook. Removal of hard obstructions and beaver dams are described in separate restoration action write-ups.

### Where

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Past restoration works in the Canadian portion of the Yukon River include:

- The South McQuesten River induced avulsion conducted by the Na-Cho Nyak Dun and DFO to provide passage around the Haggart Creek Log Jam;
- The Wolf Creek Fishway constructed by the Yukon Fish and Game Association and DFO to allow passage over a sheet pile obstruction below the Alaska Highway; and
- The Fox Creek Channel Restoration project conducted by Ta’an Kwäch’än Council to isolate the channel of Fox Creek from two major sediment sources.

Most restoration undertakings have been restoration- and maintenance of access to upstream spawning and rearing habitats through beaver dam management as described in the next section. There have been several live staking projects. However, the plant species most suitable for live staking (willow and balsam poplar) are those preferred by beaver. As a result, re-vegetating is only advised along large rivers too large for beaver to dam, but doing so in these locations provides minimal benefits to Chinook salmon.

With the exception of placer mining streams and a small number of urban streams, important riparian functions for sub-arctic streams and rivers are naturally maintained and renewed, and so opportunities for habitat restoration are limited.

However, potential restoration opportunities that could currently be carried out include:

- Stabilizing the toes of two active landslides and the Klondike Highway embankment on the Tatchun River to reduce sediment input and encourage self-stabilization of downstream channels;



- Assessing upstream juvenile Chinook salmon passage for stream crossings at Cottonwood, Hayes, and Strawberry Creeks in the upper Teslin River Basin;
- Diversion of McIntyre Creek away from an eroding bank below Mountainview Drive in Whitehorse to allow passive restoration of downstream spawning habitats.
- Development of small ground water channels in select areas of the Klondike River floodplain.

## When

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- Live staking is best conducted when plants are dormant. Spring live staking will require supplemental watering unless the stakes are driven into or buried below the saturated soil zone.
- Slope stabilization or channel diversion type projects will require, at a minimum, one full year of community consultation, geo-technical engineering, environmental assessment and permitting/licencing and acquisition of funds, with two years more likely. Physical works, including access to the work site could be completed in one open water period. Monitoring and maintenance would probably be required as a condition of a water license for a five-year period.
- Assessments of the upper Teslin River Watershed could be conducted in a single year but may require downstream beaver dam management to ensure that juvenile Chinook salmon could reach the stream crossings in question. If the current crossings do not allow juveniles to pass upstream, options could be explored with regulatory and other agencies to restore passage.
- Development of overwintering habitats by excavating small, groundwater-fed channels or pockets in floodplains is a possible enhancement action. Large groundwater channels are not advised due to the risk of beaver damming. Existing groundwater discharge areas can be easily identified in late winter. Water quality and quantity can be determined during the following summer and winter, with consultation/permitting in spring. Excavation could occur in the autumn of the second year, or during the year that follows.

## Why

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- In locations where important rearing or spawning habitat is obstructed or degraded, restoration of such habitat can increase spawning and rearing success. For example, sediment input from landslides or erosion of highway embankments destabilizes downstream channels and isolates the spawning habitats they may have formerly supported. Fine sediments can be deposited into - or over stream gravels and result in degradation of spawning habitats. Restoring these habitats can therefore increase access to spawning and rearing habitats (e.g., Tachun River).
- Restoring fish passage through highway crossings (e.g., upper Teslin River Watershed stream) would allow juvenile Chinook salmon to exploit upstream habitats, reducing densities of juveniles below the obstruction and thereby providing more food and space for the overall population.
- In areas where overwintering habitat may be limiting fry survival, the development of overwintering habitats by excavating small, groundwater-fed channels or pockets in floodplains could reduce overwinter mortality.



## Pros and Cons

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### Pros

- Live staking is a simple technique and is a useful tool to increase community interest and support for Chinook salmon habitat stewardship. If limited to the banks and bars of larger rivers, the risk of adverse effects is low.
- Effects of sediment on spawning Chinook salmon and control of sediment through engineering is well understood and accepted by the scientific / technical community.
- Expertise in river engineering is locally available, and supplemental specific engineering advice may be available through engineers working in, or associated with, the Salmonid Enhancement Program.
- Local firms could carry out the required excavation and embankment works and associated labour. Monitoring and maintenance plans could be developed to maximize local involvement and benefits.
- Assessment of stream crossings that are owned by a third party is a low-cost activity. If juvenile Chinook salmon are abundant below the crossing and absent above it, a strong case may be made that the crossing is an obstruction, and pressure placed on regulatory agencies to require that passage be provided (and funded by) the Yukon Government as they own the crossings.
- Development of overwintering habitats could be a relatively inexpensive means of increasing the fry to yearling/pre-smolt success.
- Pre-project assessments, pocket excavation and post project monitoring could be conducted by local firms and residents under technical supervision of DFO or institutional staff.

### Cons

- Live staking provides little benefit to Yukon River Chinook salmon.
- Engineering works for slide stabilization are expensive, and a single project could exhaust the YRP R&E budget for several years. Costs will be on-going for at least 5 years post construction and the proponent of any project should be required to demonstrate the capacity to maintain and fund any required maintenance and renewal of structures or access.
- Developing and maintaining funding partnerships for engineering works can be time consuming, difficult and may not be accepted as a valid expense by funding agencies/bodies.
- Most "standard" restoration opportunities in the Upper Yukon River Basin are related to restoring spawning and rearing habitat that has been degraded by placer mining. However, the Yukon Placer Mining Act allows future direct and indirect disruption of restored channels and reclaimed lands and therefore these lands are poor candidates for investment as any restoration works could be immediately destroyed by the owner of the placer mining rights.
- Almost all streams and rivers in the Canadian portion of the Yukon River are unregulated and subject to a wide range of flows. Many are laterally unstable and permafrost degradation is widespread so works conducted on banks subject to shallow or deep permafrost have been short lived.
- Provision of overwintering habitats will be limited to a small number of accessible rivers.



## Critical Uncertainties

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- Overwintering habitats for juveniles may be a limiting factor for some Yukon River Chinook populations and some of these habitats may benefit from restoration. However, considerable uncertainty remains regarding which habitats due to a largely unknown, and possibly temporally variable, degree of emigration of 0+ fry from natal areas.
- Stabilization of the toe of landslides and isolation of the creek from sediment inputs is a recognized technique and can be conducted with a minimum of technical uncertainty. Acceptance of works in the Tatchun River by the Carmacks/Little Salmon and Selkirk First Nations is uncertain. Acceptance of works in McIntyre Creek by the Kwanlin Dun and Ta'an Kwäch'än First Nations is likely, but confirmation is required. Acceptance of assessments of stream crossings by the Teslin Tlingit Council is likely, but agreement by the DFO Fisheries Protection Program to require passage and by the Yukon Government to accept it is uncertain. All slope stabilization/sediment reduction projects will require a series of licences and authorization and application to and review by YESAB. However, the works proposed are relatively straightforward and the review should reflect this in both timing and outcome.
- Development of "pocket" type overwintering habitat for Chinook salmon is a new technique, albeit one based on naturally occurring groundwater-fed channels on the Klondike River and North Klondike River flood plains. The regulatory requirements for a project of this type are uncertain.
- Uncertainty in those factors outside of freshwater habitats in the Yukon River that may be limiting Chinook survival means that the success of this action is also uncertain.

## Supporting Actions

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- The positive effects of landslide toe stabilization and stream isolation from landslide-related sediment is based on general principles. If site-specific biological information is required, the pre-project assessments conducted on the Cowichan River to assess the effects of the Stoltz Bluff slide (LGL and KWL 2005) could be used as a template for designing the pre- and post-project biological monitoring.
- No supporting actions are required for live staking, except to discourage the technique on small(er) spawning and rearing streams vulnerable to beaver damming.
- Pressure may be required on both the DFO and the Yukon Government to provide passage through the upper Teslin River Watershed stream crossings.
- Formal studies of natural or semi-natural overwintering habitats in the Klondike River watershed could confirm present use and inform future use and creation.