



**EDI ENVIRONMENTAL DYNAMICS INC.**  
*Natural Resource Consultants*

**FOX CREEK CHINOOK  
STOCK RESTORATION  
CRE-52N-07**

PREPARED FOR:

**TA'AN KWACH'AN COUNCIL**

117 INDUSTRIAL ROAD

WHITEHORSE, YT

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EDI PROJECT NO.: 07-YC-0028

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## ABSTRACT

All planning, regulatory, and permitting requirements to conduct activities for restoration of an extirpated stock of Chinook salmon into Fox Creek were completed. This included the completion of a Chinook Salmon Stock Restoration Plan, as well as all required environmental assessment and permitting processes. Interested parties were consulted and relevant operational planning was completed with participating agencies. Implementation of stock restoration activities began in the summer of 2008, with trail clearing, juvenile Chinook bio-physical monitoring, brood stock collection and incubation.



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## 1 PROJECT BACKGROUND

The purpose of the Chinook Stock Restoration (CRE-52N-07) project as stated in the project proposal was to build upon the results of previous work to undertake permitting and planning requirements for the reintroduction of an extirpated run of Chinook salmon.

Fox Creek is a lake-headed tributary to Lake Laberge and therefore the Yukon River, located approximately 50 km north of Whitehorse. It is reported that at one time Fox Creek supported a spawning population of chinook salmon (von Finster pers. comm., 2006; Wynne-Edwards, 1947). However, in more recent times extensive beaver activity has restricted or eliminated any possible access to areas of potentially valuable spawning and/or rearing habitat. This project follows the recommendations of a preliminary undertaking in 2006 (CRE-54N-06) to assess the current state of the stream, and to investigate the regulatory/permitting requirements to undertake Chinook re-introductions in Fox Creek (Anderton, 2007).

Objectives of this project included the following:

- Undertake all permitting/regulatory processes to re-introduce Chinook salmon stocks to Fox Creek in 2008, including a YESAB screening and permitting through the Yukon Transplant committee (YTG & DFO).
- Plan for and arrange incubation of brood stock in 2008/2009.
- Prepare long-term stock restoration plan.



## 2 PROJECT ACTIVITIES/RESULTS

During spring/summer/fall of 2007, planned project activities were delayed upon request from Fisheries and Oceans Canada (DFO) while internal policy regarding brood stock selection and release densities was considered. In early winter, 2007, project activities resumed. Discussions and meetings were held with interested parties regarding possible arrangements for brood stock collection and incubation.

It was agreed by all relevant parties; including DFO, Whitehorse Rapids Fish Hatchery (managed by R&D Environmental), Northern Research Institute (NRI), and Ta'an Kwäch'än Council (TKC), that brood stock would be collected by Hatchery Staff with help from TKC Stewards and NRI students. It was also agreed upon that the eggs will be fertilized and incubated in the McIntyre Creek Salmon Incubation Facility. Once the Chinook fry have reached sufficient size for marking (conducted by NRI), they will be released into Fox Creek using accepted protocol by TKC Stewards and NRI students. TKC Stewards will conduct bio-physical monitoring activities as required. DFO will provide assistance where necessary.

A Chinook Salmon Stock Restoration Plan was developed for Fox Creek, outlining brood stock, fry release, and monitoring requirements for one complete cycle (6 years). Provisions to plan for a second cycle (additional 6 years) are indicated. The complete plan is attached as Appendix A.

A proposal to implement the Stock Restoration Plan was submitted for screening to the Yukon Environmental and Socio-Economic Effects Board (YESAB) on behalf of the TKC. Application was also made to DFO and the Yukon Department of Environment (Yukon Introductions and Transfers Committee) to transport and transplant Chinook salmon eggs and live fry. The YESAB screening was completed with a recommendation that the project be allowed to proceed as proposed, subject to required permitting. A license under Part VIII, Section 56 of the Fisheries (General) Regulations was issued by the Yukon Introductions and Transfers Committee.

A final meeting of all participating parties was held to confirm arrangements and confirm decision-making processes for determining in-season brood stock allocation. These arrangements were confirmed in a follow-up letter, and operations are scheduled to move forward, beginning with brood stock collection and required monitoring activities (as per Appendix A), during the summer of 2008.

In the early summer of 2008, a meeting was organized with all parties to go over logistics and confirm everyone's role in the project for this year, particularly for the brood stock collection. Target allocation was decided on 12 females and 24 males, but it was understood that the run size might not allow for this and that the hatcheries needs will take priority.



In September, the TKC Stewards (as part of Yukon River Panel Project CRE-54-08) aided staff at the Whitehorse Rapids Fish Hatchery with egg and milt collection from 6 females and 11 males. They also aided with transportation to the McIntyre Creek Facility where eggs were fertilized and set in incubation trays. Responsibility was turned over to NRI to care for the eggs over the winter and spring.

Bio-physical monitoring was undertaken throughout the summer. Trail maintenance and clearing along the creek was also conducted over the summer with the help of a Y2C2 (Yukon Youth Conservation Corps) crew (as part of Yukon River Panel Project CRE-54-08).



### 3 CONCLUSIONS/RECOMMENDATION

This project has succeeded in achieving the completion of a Chinook Stock Restoration Plan for Fox Creek, as well as successfully seeing the project through the necessary environmental assessment (YESAB) and permitting processes. The scheduled activities in 2008 were carried out 2008, as per the Stock Restoration Plan. Therefore, all project objectives have been met.

TKC, DFO, NRI, Whitehorse Rapids Hatchery Representatives and EDI will need to continue to work together to ensure that the Stock Restoration Plan is implemented as designed. Whenever possible, it is suggested that the TKC Stewardship Program (provided future funding is obtained) complete the required components of the Stock Restoration Plan; however, they will require the support of the all the above mentioned agencies.



## Appendix A. Chinook Salmon Stock Restoration Plan for Fox Creek





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# CHINOOK SALMON STOCK RESTORATION PLAN FOR FOX CREEK

PREPARED FOR:

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# 1 INTRODUCTION

The Ta'an Kwach'an Council (TKC) has undertaken an effort to restore an extirpated stock of Chinook salmon (*Oncorhynchus tshawytscha*) to Fox (Richthofen) Creek, a tributary to Lake Laberge and the upper Yukon River. This plan provides an overview of project operations and associated timelines for project implementation, monitoring, and evaluation.

Fox Creek is a small lake-headed tributary to Lake Laberge, approximately 50 km north of Whitehorse, and is reported to at one time have supported a spawning population of chinook salmon (von Finster pers. comm., 2006; Wynne-Edwards, 1947). Reasons for the disappearance of adult chinook salmon in Fox Creek are unknown, and possible causal factors in this regard are diverse. One such potential factor is that extensive beaver activity has occurred throughout the stream, likely at times eliminating access to areas of potential spawning and/or rearing habitat. TKC conducted assessments of the stream in 1997, 1998, 2006, and 2007 to identify the potential for the restoration of Chinook stocks in Fox Creek. In 2006 regulatory and operational requirements for such an undertaking were identified to facilitate further project preparations and planning. In 2007, further planning and field assessments were conducted (Grady, 1997 & 1998; Anderton, 2007 & 2008).

## 1.1 OPERATIONAL REQUIREMENTS

In order to facilitate optimum results and work within a dynamic aquatic environment over a time frame of multiple years, this plan is intended to be flexible in many regards and to facilitate adaptive management techniques throughout its implementation. The general approach to management of this program is intended to be iterative in nature, composed of assessment, intervention, and then monitoring. The results of monitoring will be evaluated in cooperation with relevant agencies having an interest in salmon management (Kwanlin Dun First Nation, Fisheries and Oceans Canada, etc.), with the details of the following year's stocking and monitoring plan to be developed cooperatively.

It should be noted that the area of interest within Fox Creek is downstream of the mouth of Pilot Creek, located approximately 2.7 km upstream of the North Klondike Highway crossing and 16.3 km upstream of Lake Laberge. Upstream of Pilot Creek, Fox Creek contains little habitat meeting the requirements of Chinook salmon spawning.

It is suggested that the proposed stock restoration program be conducted for two full Yukon River Chinook life-cycles, or twelve years. Planning and operations for the second restoration life-cycle should be informed by outcomes of the first cycle. Should interest in additional artificial incubation/fry release continue beyond two full Chinook life-cycles, it is suggested that brood stock collection from any established adult Chinook returns to Fox Creek be considered.



Table 1 details program operational requirements and associated timelines for one life-cycle of Chinook stock restoration, as well as planning for a second cycle.

### 1.1.1 BROOD STOCK REQUIREMENTS

It has been determined by Fisheries and Oceans Canada that the brood stock for Fox Creek should be taken from stocks passing through the Whitehorse Rapids Fishway. Discussions have been held with the Whitehorse Rapids Fish Hatchery to cooperatively collect brood stock at the Fishway. Discussions have also been held with the Northern Research Institute regarding incubation of the eggs at their McIntyre Creek facility as part of current operations.

The method for determining target numbers of fry release as provided by Fisheries and Oceans Canada is based upon available rearing habitat, with 1 m<sup>2</sup> of stream area per juvenile Chinook salmon in the upper Yukon River watershed. In order to calculate the area of habitat available in Fox Creek, the average wetted width of the stream within the area of interest of 5.5 m (from data provided by Grady, 1997) is multiplied by the estimated 16,300 m length of the stream from its mouth at Lake Lebarge to the confluence of Pilot Creek. This calculation results in an estimated 89,650 m<sup>2</sup> of available juvenile Chinook rearing habitat. However, this estimation is based upon very limited wetted width data. Therefore improved estimates will be generated based upon more thorough monitoring of wetted width as part of the ongoing adaptive management strategy. In consideration of dynamic annual adult returns through the Whitehorse Rapids Fishway, the limitations of available data, and other operational limitations, the target number of fry for release into Fox Creek should be 50,000 to 100,000.

To achieve the target fry release numbers, an estimated production of 4,000 fry per adult female (brood stock) can be used for reference. Fecundity and egg to fry survival rates vary from year to year and between fish. Therefore this can be considered a conservative estimate based upon an estimated average fecundity of 5,000 eggs per female and an 80% egg to fry survival (Tanner pers. com., 2008). To achieve a target of 50,000 to 100,000 fry for release, 12 to 25 adult females are required. The number of adult males required for fertilization is generally double that of the females taken, however, the males can generally be released alive after a portion of their milt is removed.

In consideration of Year 1 of the proposed program being a pilot, the target fry release should be 40,000 to 50,000. Therefore, subject to operational limitations, the target brood stock collection in Year 1 should be up to 12 adult females and 24 adult males.

Consideration may be given to the limited use of in-stream incubation boxes and/or artificial spawning redds in an experimental capacity with a small number of eggs (up to 100).

See Table 1 for further details regarding program operational and timing requirements related to hatchery operations.



### 1.1.2 MONITORING REQUIREMENTS

Ongoing monitoring of stream/habitat dynamics and of released juvenile Chinook salmon should be undertaken as part of the ongoing stock restoration program. These parameters should include water temperature, stream flows, assessment of juvenile Chinook growth rates/movements, and assessment of beaver activities. The following items detail planned annual monitoring activities:

- Stream stage:
  - One station be developed, tentatively re-commission the DIAND hydrometric station immediately upstream of the North Klondike Highway.
  - Stream gauging to be conducted during planned biological sampling events.
- Water Quality:
  - Two water winter quality sampling stations will be placed at or near the stream stage sampling site, with the following parameters monitored during February/March:
    - dissolved oxygen;
    - pH;
    - turbidity;
    - conductivity;
    - total metals;
  - Data loggers be placed at each of the stations and will operate continuously with temperatures measured every hour on the hour.
- Biological sampling:
  - Three juvenile Chinook sampling stations will be established at locations downstream of the Pilot Creek confluence, at the North Klondike Highway Crossing, and downstream of the North Klondike Highway. Sampling will be conducted at the following times:
    - mid May, to determine success of overwintering 1+;
    - immediately prior to release, to determine numbers and characteristics of salmon remaining in the stream at that time;
    - one month after annual release of fry to determine distribution and growth;
    - thereafter, monthly until the end of September;
  - Sampling will involve the capture of juvenile Chinook salmon using standardized methodology.
  - A random statistically significant sub-sample of juvenile Chinook captured will be anaesthetized, measured for fork length, and carefully weighed with each fish blotted and scales calibrated. This will provide a base from which to assess juvenile growth.



As the program progresses, planning for and implementation of enumeration/monitoring of adult returns will be undertaken appropriately. See Table 1 for further details regarding program operational and timing requirements related to monitoring requirements.



**Table 1: Operational Requirements and Timelines for Fox Creek Chinook Stock Restoration**

Year	Age of Year 1 Fish (for ref.)	Return Status	Hatchery Activities Required	Field Activities Required
1 (2008)	n/a	none	<ul style="list-style-type: none"> <li>CH broodstock collection from W. R. Fishway.</li> <li>incubation of eggs, with target production of 50,000 CH fry.</li> </ul>	<ul style="list-style-type: none"> <li>maintain and develop access (footpath) along Fox Creek.</li> <li>validate area of available rearing habitat.</li> <li>design and implement bio-physical monitoring framework.</li> <li>plan CH fry release strategy (release timing, sites, and quantities) .</li> </ul>
2 (2009)	1	none	<ul style="list-style-type: none"> <li>rear CH fry to release period (tentatively late June).</li> <li>mark CH fry as per accepted protocol.</li> <li>CH broodstock collection from W. R. Fishway.</li> <li>incubation of eggs, with target production of 50,000 to 80,000 CH fry, depending upon brood stock availability.</li> </ul>	<ul style="list-style-type: none"> <li>implement CH fry release strategy, at multiple accessible sites (late June).</li> <li>maintain and develop access along Fox Creek as required.</li> <li>standard biophysical monitoring (temp., flows, jCH growth rates &amp; movement, etc.).</li> </ul>
3 (2010)	2	none	<ul style="list-style-type: none"> <li>continue activities with adjustments and modifications informed through adaptive management.</li> </ul>	<ul style="list-style-type: none"> <li>implement CH fry release strategy, at multiple accessible sites (late June).</li> <li>maintain and access along Fox Creek as required.</li> <li>standard biophysical monitoring (temp., flows, jCH growth rates &amp; movement).</li> </ul>
4 (2011)	3	limited possible jacks	<ul style="list-style-type: none"> <li>continue activities with adjustments and modifications informed through adaptive management.</li> </ul>	<ul style="list-style-type: none"> <li>implement CH fry release strategy, at multiple accessible sites (late June).</li> <li>low intensity monitoring for return of precocious adults (jacks).</li> <li>maintain and develop access along Fox Creek as required.</li> <li>standard biophysical monitoring (temp., flows, jCH growth rates &amp; movement).</li> </ul>
5 (2012)	4	possible jacks	<ul style="list-style-type: none"> <li>continue activities with adjustments and modifications informed through adaptive management.</li> </ul>	<ul style="list-style-type: none"> <li>implement CH fry release strategy, at multiple accessible sites (late June).</li> <li>moderate intensity monitoring for return of precocious adults (jacks).</li> <li>maintain access along Fox Creek as required.</li> <li>standard biophysical monitoring (temp., flows, jCH growth rates &amp; movement).</li> <li>develop adult enumeration plan for expected returns in year 6 (methods to be based upon available technology and resources for enumeration).</li> <li>develop monitoring plan for utilization of spawning habitats.</li> </ul>



Year	Age of Year 1 Fish (for ref.)	Return Status	Hatchery Activities Required	Field Activities Required
6 (2013)	5	adults expected (from year 1) plus jacks (years 2 & 3)	<ul style="list-style-type: none"> <li>continue activities with adjustments and modifications informed through adaptive management.</li> </ul>	<ul style="list-style-type: none"> <li>implement CH fry release strategy, at multiple accessible sites (late June).</li> <li>pilot implementation of full enumeration/monitoring of adults returns (methods to be based upon available technology and resources).</li> <li>maintain access along Fox Creek as required.</li> <li>standard biophysical monitoring (temp., flows, jCH growth rates &amp; movement).</li> </ul>
7 (2014)	6	adults expected (years 1 & 2) plus jacks (years 3 & 4)	<ul style="list-style-type: none"> <li>continue activities with adjustments and modifications informed through adaptive management.</li> </ul>	<ul style="list-style-type: none"> <li>implement CH fry release strategy, at multiple accessible sites (late June).</li> <li>first year of full intensity enumeration/monitoring of adults returns (methods to be informed by pilot/adaptive management).</li> <li>maintain access along Fox Creek as required.</li> <li>standard biophysical monitoring (temp., flows, jCH growth rates &amp; movement).</li> <li>develop plan for second cycle of CH stock restoration &amp; apply for permitting as required.</li> </ul>
8 (2015)	n/a	Adults expected (years 2 & 3) plus jacks (years 4 & 5)	<ul style="list-style-type: none"> <li>continue activities with adjustments and modifications informed through adaptive management.</li> </ul>	<ul style="list-style-type: none"> <li>implement plan for second cycle of CH stock restoration.</li> <li>implement CH fry release strategy, at multiple accessible sites (late June).</li> <li>second year of full intensity enumeration/monitoring of adults returns (methods to be informed through adaptive management).</li> <li>maintain access along Fox Creek as required.</li> <li>standard biophysical monitoring (temp., flows, jCH growth rates &amp; movement).</li> </ul>



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