LITTLE SALMON CARMACKS FIRST NATION SALMON KNOWLEDGE STUDY

CRE-141N-10

PREPARED FOR:

LITTLE SALMON CARMACKS FIRST NATION

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EDI PROJECT NO.:

10–YC-0058

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1 INTRODUCTION

The Little Salmon Carmacks First Nation (LSCFN) spearheaded a Chinook salmon habitat knowledge study in 2010 with the goal of beginning the groundwork needed for future salmon and salmon habitat management in their Traditional Territory. Funding was provided by the Yukon River Panel's Restoration and Enhancement (R&E) Fund, under project number CRE-141N-10. Part of this project involved a traditional salmon habitat knowledge study; completed by Grayston Consulting (Appendix A).

EDI Environmental Dynamics Inc. was retained to gather and compile existing scientific and technical information on Chinook salmon and their habitat within the LSCFN Traditional Territory. This report summarizes the information into tables and maps and provides recommendations on where to focus future assessment work to build upon existing knowledge. Site specific information collected during the Traditional Knowledge study (Appendix A) was incorporated in this report where applicable.

Prior to beginning future salmon related projects, it is important to have background knowledge on salmon stocks, habitat use, and habitat availability within the area of interest. Currently there is existing information on spawning areas used by adult Chinook within the Traditional Territory (Traditional Knowledge, aerial surveys, etc.), but relatively little is known about important rearing and overwintering areas used by juvenile Chinook. It is important for the LSCFN to identify what habitats are important for juvenile fish in order to protect them, and ultimately conserve the Chinook population as a whole.

1.1 Background Information – Yukon River Chinook Salmon

Yukon River Chinook spawning occurs in July through September depending on which portion of the Yukon River Watershed (Yukon River Panel 2008). During spawning, females deposit eggs in gravel spawning areas where males then fertilize the eggs. Eggs are left to incubate over the winter, and the young salmon, 'alevin', hatch and emerge from the gravel beds as fry in early spring the next year. The young salmon typically remain near the spawning grounds, but by June many of them migrate from the river where they were born ('natal' stream) and move into non-natal tributary streams (outside of the spawning areas) (von Finster 2006). Juveniles have been captured more than 40 km upstream from the mouths of some non-natal streams in late summer (Bradford et al. 2009). This migration into non-natal streams is beneficial to juvenile Chinook salmon as they can often escape from predators, such as pike, burbot and inconnu as well as birds like mergansers and kingfishers (Yukon River Panel 2008). Food for the young salmon is also more accessible in smaller streams where there is often more productivity in the way of aquatic insects (Yukon River Panel 2008). Chinook fry grow rapidly in their first summer in freshwater, building up reserves for the winter. Overwintering habitat is a critical resource for young Chinook salmon and survival is generally related to local ice formations and groundwater availability (Bradford et al. 2001). After the winter, after having spent one year in freshwater, fry leave overwintering and rearing habitats and begin their long migration down the Yukon River to the Bearing Sea where they will complete the marine stage of their lifecycle. Chinook remain in the ocean for 2-6 years until they return to freshwater spawning areas (Yukon River Panel 2008).

2 METHODS

The methods for this project included gathering existing scientific data on adult and juvenile Chinook salmon distribution and the compilation and summarization of that information into usable maps and reference tables.

For this study we took a watershed-by-watershed approach, dividing the LSCFN Traditional Territory into eight major watershed areas:

- Big Creek
- Big Salmon
- Little Salmon
- Nisling
- Nordenskiold
- Pelly
- Tatchun
- Yukon River (tributaries)

These areas were delineated in ArcGIS using the 1:50,000 watercourse and waterbody base data shapefiles.

2.1 Data Gathering

For each watershed area, we gathered a list of all the streams in the LSCFN Traditional Territory using the Yukon Fisheries Information Summary System (FISS) online interactive map[1]. Each stream was queried using the Yukon FISS database[2] which provides fish and fish habitat data for streams in the Yukon with a list of reference sources available at either government libraries or individual stream files at Fisheries and Oceans Canada (DFO). The FISS database references are linked to fish distribution points on the interactive FISS map.

Using these online sources, we made a list of all relevant references for each stream. It has been our experience that the source information is more descriptive and accurate than the summaries provided in the FISS database map. The DFO Habitat and Enhancement Branch (HEB) also provided the LSCFN with a list of information sources, including:

- DFO HEB Memo Citations – LSCFN Traditional Territory, gathered on January 3, 2010
- DFO HEB Publication Citations – LSCFN Traditional Territory, gathered on January 3, 2010
- Yukon River Panel R&E Projects within LSCFN Traditional Territory from 1997-2009
- Copy of Yukon River Chinook documented upstream limits – (DFO 2008 - *Work in Progress, December 23, 2008*)

[1] Available online at http://www.pac.dfo-mpo.gc.ca/gis-sig/maps-cartes-eng.htm

[2] Available online at http://habitat.rhq.pac.dfo-mpo.gc.ca/fiss/dcf01.cfm

All the relevant references from these lists were retrieved and the data is summarized in this report. A list of sources can be found at the end of this report in the References section.

A number of spatial databases with known salmon distribution were also gathered in order to start building a spatial database of known salmon distribution in the LSCFN Traditional Territory, these sources include:

- Yukon FISS fish distribution points ArcGIS shapefile (provided by DFO), which documents spawning and rearing locations based on existing sampling data. This file contains distribution data for all Yukon fish species and life stages, and links to reports and fish sampling study results (described above).
- The known extent of adult Chinook salmon utilization in the Yukon River watershed, mapped by DFO during the early to mid 2000s (DFO 2005), could not be provided in a usable digital format, so a hard copy of this data was used and reproduced digitally. This data includes highlighted sections of the watercourses and waterbodies where adult Chinook salmon have been known to spawn or migrate through.
- Yukon-wide juvenile Chinook salmon distribution points outside of the known adult Chinook salmon distribution summarized for DFO (EDI 2005). This data came from a thorough review of existing information on juvenile Chinook salmon presence available in 2005.

2.2 Data Compilation

Following data gathering, data was compiled into two main components, fish sampling points and extent of adult Chinook utilization:

- Fish Sampling Points
    - A database of fish distribution points in streams in the LSCFN Traditional Territory was developed using juvenile Chinook and freshwater fish data from the Yukon FISS distribution points shapefile and the Yukon-wide juvenile Chinook distribution outside of the known adult extent shapefile
    - Each point was reviewed and checked to ensure that it reflects what is described in the original source data (i.e. stream files and reports).
    - Any FISS points that were inconsistent with the original sampling data were removed and/or corrected to ensure accuracy and any sampling points from original sources that were missing in the FISS points were added.
    - Each point was designated a unique identification number that links to attribute data in Appendix B. The attribute data includes information on how many fish of which species were captured, using which method(s), and what level of effort. The UTM coordinates and data source are also provided as well as any comments associated with the data.

- Extent of Known Adult Chinook Spawning
    - Information from all known data sources was compiled into one map layer which highlighted the known extent of adult Chinook spawning in waterbodies and watercourses.
    - Adult salmon spawning points in the FISS database were compared to the known extent of adult Chinook salmon utilization layer (DFO 2005), as well as the data in the DFO file with coordinates for adult upstream extents (DFO 2008).
    - Any inconsistencies between the sources were corrected based on the original source data in the stream files and reports. In some cases, this resulted in the extension of the 'known extent' (DFO 2005) further upstream, based on more current data.

It is important to include freshwater fish sampling data in the fish sampling points database, because it provides an indication of the effort that has been spent fish sampling in the Traditional Territory, regardless of whether juvenile Chinook salmon were captured. The extent of known adult Chinook spawning is also important in summarizing information on juvenile Chinook, in identifying important non-natal rearing streams outside of the known adult extent.

Also of note, is the fact that there are many unnamed tributary streams that have been sampled in the past. These streams do not have gazetted names and show up in FISS as 'Unnamed Creek', but they may be assigned a name in a study, such as 'Unnamed Creek 1' or 'Unnamed Creek A'. Any names assigned to an unnamed creek in a study, have been preserved in this report for consistency.

3 RESULTS AND DISCUSSION

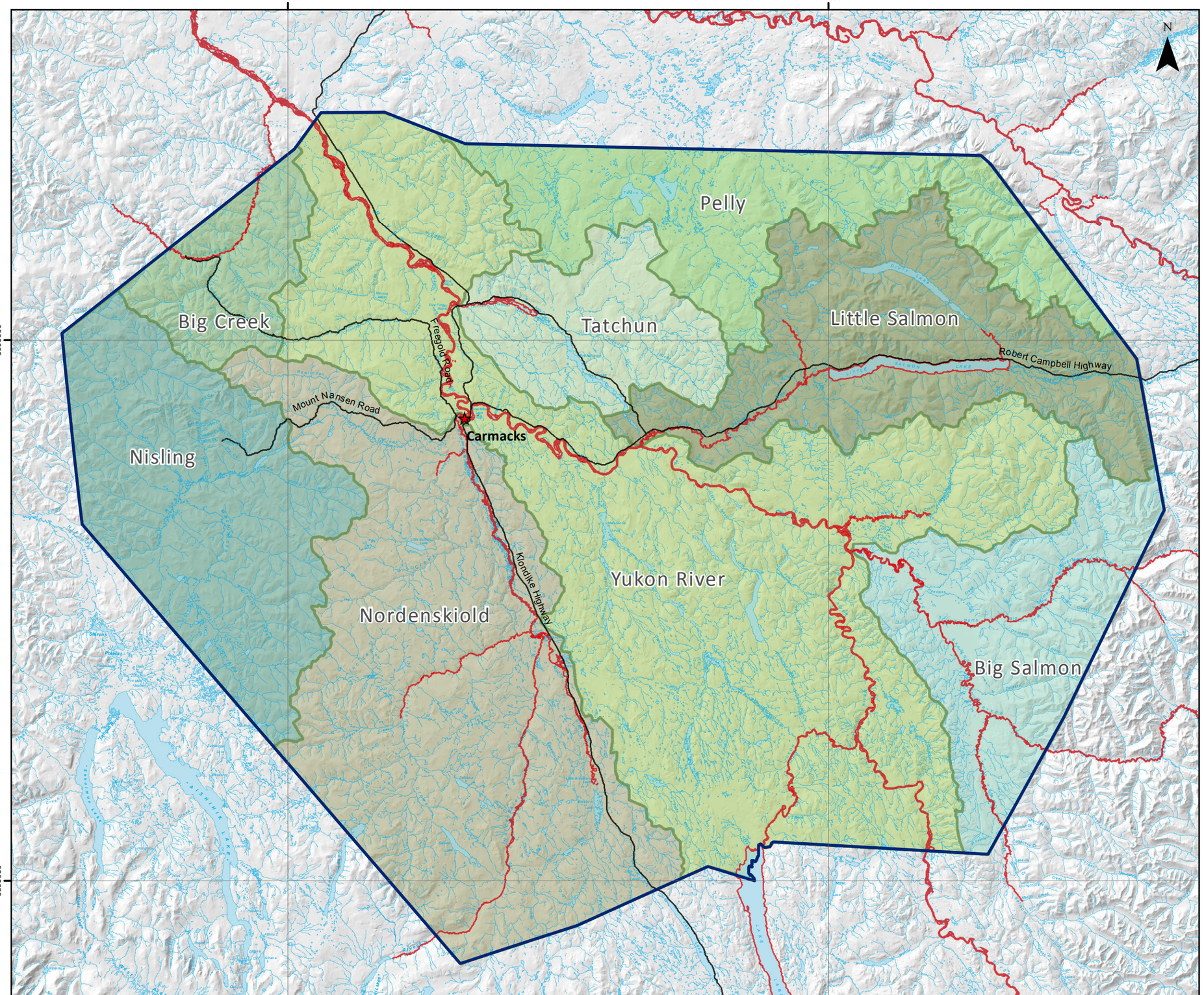
This report is divided into a section for each watershed area, which summarizes all known Chinook salmon and salmon habitat information. First, a general overview of the watershed area is provided, and then the scientific/technical salmon and salmon habitat information is summarized into subsections for 'Spawning & Spawning Habitat', 'Rearing & Rearing Habitat' and 'Overwintering'. A section is also provided for reference to any other sources of data for the area, i.e. hydrology, water quality, and benthos data. Data gaps and recommendations are also provided for each watershed area to direct future work.

The summary information for each watershed area is also supported with a map, which contains the known adult extent and juvenile Chinook distribution points in that watershed. Each fish distribution point has been assigned a unique identification number which can be used to refer to additional data in Appendix B. The data provided in Appendix B includes the number of fish captured, methods used, sampling effort and source data. Source information is also listed in the References Section. Figure 1 is an overview map of the study area, outlining the watershed areas, and known extent of adult Chinook utilization.

Table 1 provides a general assessment of the extent of existing knowledge available on salmon and salmon habitat for spawning, rearing and overwintering for each watershed area. Extent of existing knowledge is categorized into 'Extensive', 'Moderate', or 'Limited'; an extensive amount of data would generally reflect that there is knowledge on key habitats and salmon use within the watershed. Details on each watershed area are provided in the following pages.

Table 1. Summary of the extent of existing salmon knowledge available for each watershed area, for spawning, rearing and overwintering data.

Watershed Area	Extent of Existing Salmon and Salmon Habitat Knowledge		
	Spawning	Rearing	Overwintering
Big Creek	*Moderate*	*Moderate*	*Moderate*
Big Salmon	*Extensive*	*Limited*	*Limited*
Little Salmon	*Moderate*	*Moderate - Limited*	*Moderate*
Nisling	*Moderate*	*Moderate - Limited*	*Moderate*
Nordenskiold	*Extensive - Moderate*	*Moderate - Limited*	*Moderate - Limited*
Pelly	*Moderate*	*Limited*	*Limited*
Tatchun	*Extensive - Moderate*	*Moderate - Limited*	*Moderate - Limited*
Yukon River Tributaries	*Moderate - Limited*	*Moderate - Limited*	*Limited*



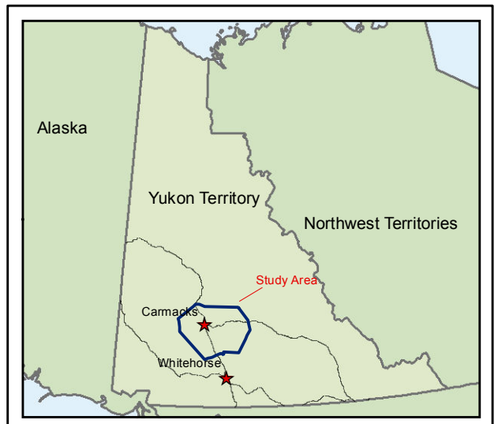


Figure 1. Overview Map of Salmon Knowledge Study Area within LSCFN Traditional Territory

Legend

- Main Roadways
- Watercourse Known Extent of Adult Chinook
- Waterbody Known Extent of Adult Chinook
- LSCFN Traditional Territory
- Watershed Area Boundaries (varied colour theme)

0 10 20 30 40 Km

Drawn By: L. Grieve and M. Marjanovic
Checked By: M. Power and Pat Tobler
Date: 18 March 2011
Projection: NAD 1983 UTM Zone 08
EDI Project #: 10-YC-0058

Digital Data Sources:

Yukon digital elevation model provided courtesy of Yukon Government - Geomatics Yukon.

1:50,000 waterbodies, watercourses, and LSCFN Traditional Territory boundary, and Main Roadways from Yukon Geomatics Corporate Spatial Warehouse.

Fish Capture Point Data: The FISS Yukon Fish Distribution Shapefile (provided by DFO) was checked against original source data and any new data acquired during EDI's scientific information gathering.

Known Extent of Adult Chinook: This data was reproduced digitally from a hard copy map developed by DFO (early 2000s) of known extent of adult Chinook salmon utilization, which was then checked against other source data (see Methods in report).

Watershed Areas: Project specific watershed areas digitized by EDI using 1:50,000 watercourse and waterbody data along with DEM and contour data.

Disclaimer: This document is not an official land survey and is presented without prejudice. The spatial data presented on the map is subject to change without notice.

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3.1 Big Creek Watershed Area

The table below summarizes salmon and salmon habitat information for the Big Creek Watershed Area. For additional details on the information provided below, refer to the relevant source citations. See Figure 2 for a map summarizing the existing scientific salmon habitat utilization knowledge available for the Big Creek Watershed Area. For specific map point information refer to Appendix B using the point ID numbers.

Watershed Overview	
Big Creek is a large tributary stream to the Yukon River in the north-western portion of the LSCFN Traditional Territory. Large tributaries in the watershed include Stoddart, Seymour and Bow creeks. Magman Creek and Dark Creek are also both tributaries to Big Creek, but lie just outside the Traditional Territory boundary. Part of the Big Creek watershed area lies along the Freegold Road and the proposed Casino Road extension.	
Spawning & Spawning Habitat Summary	
Big Creek	Chinook spawning has been documented to an extent of 47.4 km upstream from the Yukon River confluence (DFO et al. 1985). Chum spawning has been documented to 13.7 km (von Finster 1995).
Seymour Creek	Adult Chinook have been seen at the confluence of this creek (von Finster 1995).
Rearing & Rearing Habitat Summary	
Big Creek	Juvenile Chinook have been captured 58.8 km upstream of the mouth, outside of the known extent of adult utilization (Mathers et al. 1981; DFO et al. 1985).
Stoddart Creek	Chinook fry use the creek as non-natal rearing habitat; they have been documented up to 7.0 km upstream from the mouth (DFO et al. 1985).
Seymour Creek	Chinook fry use the creek as non-natal rearing habitat; they have been documented up to 7.8 km upstream from the mouth (DFO et al. 1985). Upstream of the confluence with Bow Creek, the gradient of Seymour Creek rapidly increases and the creek has been influenced by placer mining (DFO et al. 1985).
Bow Creek – Trib. to Seymour Ck	Chinook fry use the creek as non-natal rearing habitat; they have been documented up to 1.1 km upstream from the mouth (DFO et al. 1985). Suitable rearing habitat was noted further upstream to the confluence with the first major tributary to the west (6 km from the mouth) but no Chinook were captured (DFO et al. 1985).
No-Name Creek	This creek may be used as non-natal rearing habitat as Chinook fry were captured at the mouth of the creek in minnow traps (DFO 2002). However, no sampling was conducted further upstream.

Dark Creek	There is suspected Chinook rearing in this stream, but it has yet to be confirmed as electrofishing in 1994 only captured Arctic grayling fry and slimy sculpin (Hallam Knight Piièsold Ltd. 1994).
Magman Creek	This creek may be used as non-natal rearing habitat as juvenile Chinook were captured at the mouth through minnow trapping in 1998 (DFO 2002). Beach seining in 1984 captured Arctic grayling approximately 600 m upstream of the mouth (DFO et al. 1985). It was noted that the creek appeared to have marginal rearing habitat (DFO et al. 1985).
Overwintering	
Open water areas have been documented in Big Creek at the confluence with the Yukon River and at six other locations up to 33 km upstream (DFO 1995).	

3.1.1 Other Information

- **Water Quality:** The Client Services and Inspections Branch of Energy, Mines and Resources [EMR] collects water quality and hydrology data at various sites within the Big Creek Watershed Area. Data for 2008 and 2009 is available online[3], including information on turbidity, water temperature, pH, conductivity, and flow for each site. Note this EMR data is only collected during the open water season.

- **Hydrology:** There is a Water Survey of Canada[4] hydrometric station near the mouth of Big Creek (09AH003) which measures discharge and water levels. There is 33 years of data available.

- **Benthos:** There are several CABIN (Canadian Aquatic Biomonitoring Network) sites throughout the watershed area where aquatic benthic invertebrate and water quality and habitat data has been collected and summarized. Sites can be located on an online map[5].

[3] EMR Data:
http://www.yukonplacersecretariat.ca/mr_big_creek.html
[4] Water Survey of Canada Data:
http://www.wsc.ec.gc.ca/applications/H2O/graph-eng.cfm?station=09AH003&report=daily&year=2009
[5] Map of Current CABIN sites:
http://cabin.cciw.ca/Main/cabin_current_activities.asp?Lang=en-ca

3.1.2 Data Gaps

- **Spawning & Spawning Habitat:** It is known that Chinook spawning occurs throughout the portion of Big Creek within the LSCFN Traditional Territory; however, there is little data on spawning numbers over the years. Adults have also been observed at the confluence of Seymour Creek but no further information is available as to whether they migrate upstream in Seymour Creek for spawning.

- **Rearing & Rearing Habitat:** Some sampling for juvenile Chinook has been conducted throughout the watershed to document non-natal use; however, little is known on the extent of juvenile utilization and current habitat limitations (barriers). For example, Chinook were found in both Seymour and Bow creeks, but there is no data documenting the extent of upstream migration, aside from the suggestion that there is unsuitable/suitable habitat upstream.

- **Overwintering:** Open water areas have been documented in Big Creek, but there appears to be no data on overwintering potential in tributary streams.

- **Other Information:** A variety of data related to habitat has been collected for this watershed area; however, there appears to be a data gap for winter water quality data as EMR only collected water quality information during the open water season.

3.1.3 Recommendations

To build upon the existing knowledge base of Chinook utilization within the Big Creek watershed, the following activities are recommended;

- Conduct surveys to enumerate Chinook spawners in Big Creek.
- Investigate potential of Chinook spawning in Seymour Creek.
- Determine extent of juvenile Chinook use of non-natal rearing streams and document any barriers to juvenile upstream migration in Bow, Seymour, Stoddart, and Dark creeks and previously un-sampled unnamed creeks.
- Conduct fish habitat assessments in conjunction with fish sampling to fill gaps in habitat data and overwintering potential (e.g. number of deep pools and/or groundwater inputs).
- Data loggers could also be deployed in Big Creek and some tributary streams to monitor winter water temperatures to determine overwintering potential as well as winter surveys to identify areas of open water.

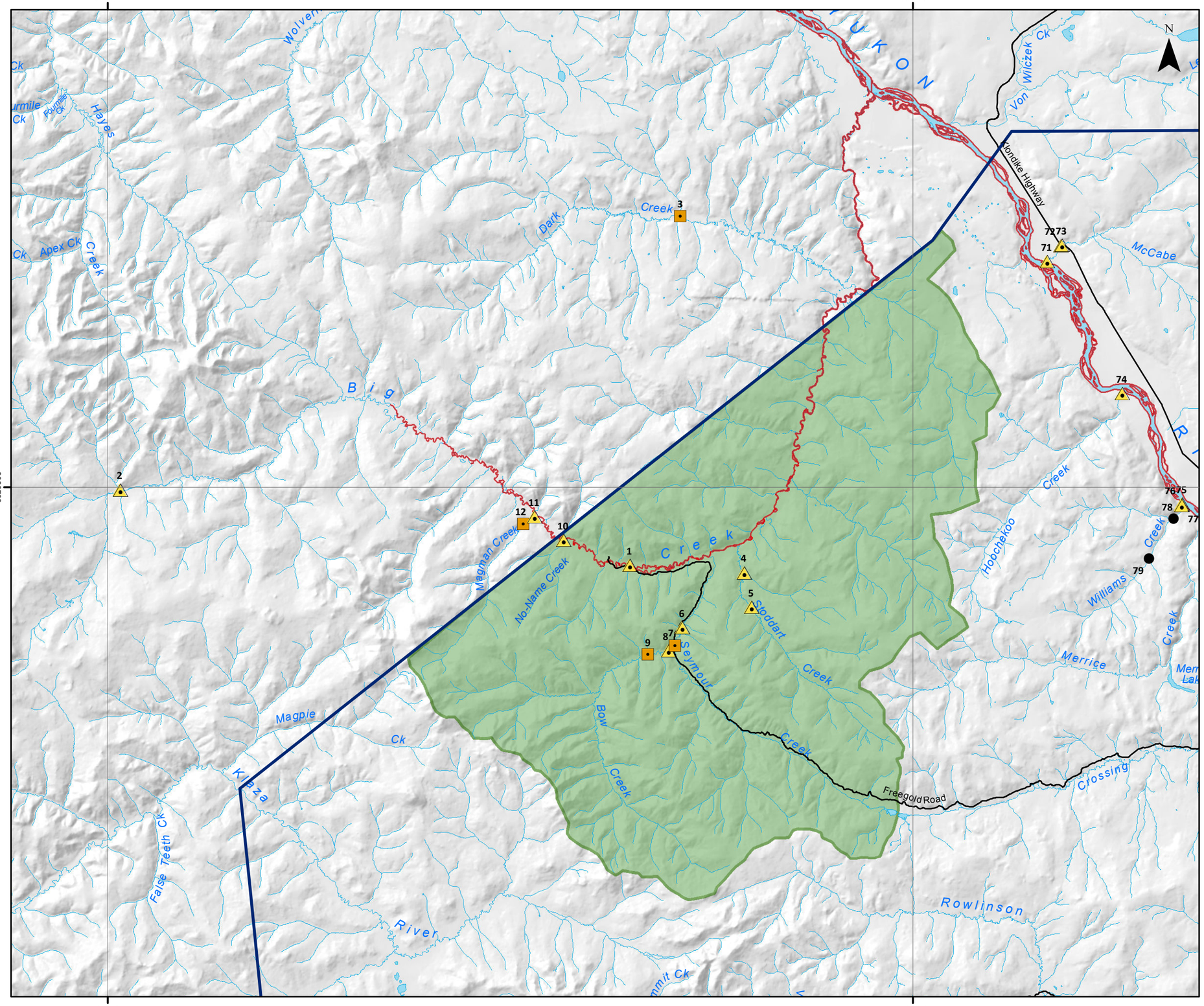

Figure 2. Big Creek Watershed Area Existing Chinook Salmon Knowledge

Drawn By:	L. Grieve and M. Marjanovic
Checked By:	M. Power and P. Tobler
Date:	18 March 2011
Projection:	NAD 1983 UTM Zone 08
EDI Project #:	10-YC-0058

Digital Data Sources:

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Watershed Areas: Project specific watershed areas digitized by EDI using 1:50,000 watercourse and waterbody data along with DEM and contour data.

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3.2 Big Salmon Watershed Area

The table below summarizes salmon and salmon habitat information for the Big Salmon Watershed Area. For additional details on the information provided below, refer to the relevant source citations. See Figure 3 for a map summarizing the existing scientific salmon habitat utilization knowledge available for the Big Salmon Watershed Area. For specific map point information refer to Appendix B using the point ID numbers.

Watershed Overview	
The Big Salmon River is a large river system entering the Yukon River in the southeast portion of the Traditional Territory, approximately 60 km upstream from Carmacks. It has several tributaries, including the South Big Salmon and North Big Salmon rivers. The headwaters are made up of a chain of lakes (Quiet, Sandy, and Big Salmon) which are located outside of the Traditional Territory. This is one of the more remote and mountainous watershed areas in the LSCFN Traditional Territory. Primary tributaries to the Big Salmon River include; • Big Salmon Mainstem: Headless Creek and Teraktu Creek • South Big Salmon: St. Germain Creek, Dycer Creek and Mendocina Creek (the latter two flow mostly outside of the Traditional Territory) • North Big Salmon: D'Abbadie Creek, Carison Creek, Solitary Creek and Northern Creek	
Spawning & Spawning Habitat Summary	
Big Salmon River	Spawning occurs along the river all the way upstream to the headwaters at Big Salmon Lake, however spawning is most concentrated in an area 13 km downstream from Big Salmon Lake, which lies outside of the Traditional Territory (Walker et al. 1974). Chinook spawners were also documented in Scurvy Creek (von Finster 1996), also outside of the Traditional Territory. The Big Salmon River system typically supports a larger Chinook run than the Little Salmon River system and is also used more heavily than the South and North Big Salmon rivers. There is a sonar counting station located on the Big Salmon River approximately 1.5 km upstream of the Yukon River confluence. The sonar has been in place from 2005, and the five year average count is 5,586 (maximum 9,261 in 2009 and a minimum of 1,329 in 2008) (JTC 2010).
South Big Salmon River	Adults have been documented spawning as far upstream as Martin Creek (outside of the Traditional Territory) (von Finster 1991). Suitable Chinook spawning habitat has been documented along the length of the river, with moderate stream velocities and appropriately sized gravels (Walker et al. 1974).
North Big Salmon River	Chinook spawning has been documented to an extent just upstream of Thomas Creek, just outside of the Traditional Territory (DFO 2008). The stream has moderate velocities and stretches of gravel with good salmon spawning potential (Walker et al. 1974).

Northern Creek – Trib. to N. Big Salmon	Spawning has been documented just below Northern Lake which lies just east of the Traditional Territory boundary (Barton 1983). The upper 3 km of the creek passes through a low gradient, marshy area with a sand-dominated stream bottom (Walker et al. 1974). Some beaver dams were documented in this area. The lower 10 km are faster flowing with rapids and mostly a gravel stream bottom (Walker et al. 1974).
Rearing & Rearing Habitat Summary	
Big Salmon River	As the entire river up to Big Salmon Lake is used for spawning, the river is also used throughout as natal rearing habitat for juvenile Chinook. • Juvenile Chinook also use a number of smaller unnamed tributaries for non-natal rearing, including Unnamed Creek 'I' and 'J' within the Traditional Territory (Hunka and Schuler 1988). These two streams drained small ponds or marshes (100 m upstream) and had wetted widths of 30-60 cm. They were low gradient with sandy bottoms and good riparian cover, and Creek 'I' had a beaver dam near the mouth. • Outside of the Traditional Territory, juvenile Chinook have been documented in Unnamed Creek 'E' and 'F', Moose, Sheep, Souch and Caribou creeks (Hunka and Schuler 1988). Creeks E and F had wetted widths of six to seven metres, sand/gravel/cobble substrate, and gradients of 2 - 1.5 %. The lower reaches of both creeks had lots of pools and cover, while upper reaches had more fast flowing riffle areas. Moose, Sheep, Souch and Caribou creeks were wider and had similar habitat characteristics to creeks 'E' and 'F'.
South Big Salmon River	Juvenile Chinook have been documented approximately 6 km upstream of the extent of adult utilization (upstream of the confluence with Sylvia Creek) (Mathers et al. 1981), which lies outside of the Traditional Territory boundary.
Mendocina Creek (a.k.a Mendocino Ck)	Juvenile Chinook use this creek for non-natal rearing, at least up to the confluence with Dycer Creek, but it is unclear if they migrate any further upstream (Mathers et al. 1981; DFO 1994).
Dycer Creek – Trib to Mendocina Ck	Juvenile Chinook were captured near the confluence with Mendocina Creek using minnow traps (Mathers et al. 1981; DFO 1994).
North Big Salmon	Juvenile Chinook likely use the North Big Salmon River as natal rearing habitat, within the extent of adult utilization. However, no sampling has been conducted outside of this area to determine non-natal use.
Northern Creek	Juvenile Chinook likely use Northern Creek as natal rearing habitat, within the extent of adult utilization (no sampling has been undertaken to confirm). The lower 10 km of the stream likely provides more suitable rearing habitat, with flowing water and gravel stream bottom, as compared to the marshy area upstream (Walker et al. 1974).
D'Abbadie Creek – Trib. to N. Big Salmon	von Finster (1985) predicted that juvenile Chinook are likely to ascend 500 m up the creek for rearing, but this prediction has not been confirmed with sampling. Arctic grayling were

	observed in the creek but no minnow trapping or electrofishing was conducted.
Overwintering	
No data currently exists on the overwintering potential of this watershed; however, it is likely that any larger streams provide suitable overwintering habitat for juvenile Chinook. Especially those that are lake headed.	

3.2.1 Other Information

- **Water Quality:** Some of the fish sampling studies (Hunka and Schuler 1988) collected basic water quality data at sampling sites, and some CABIN sites (see below) may also have water quality data associated with studies of benthos.

- **Hydrology:** There were two Water Survey of Canada[6] hydrometric stations in the Big Salmon Watershed Area; one on the Big Salmon River near the confluence with the Yukon River (09AG001) and one on the South Big Salmon River below Livingstone Creek (09AG003). The stations have since been discontinued.
    - 09AG001: Data collected from 1953-1996
    - 09AG003: Data collected from 1982-1998

- **Benthos:** There are several CABIN sites throughout the watershed area where aquatic benthic invertebrate and water quality and habitat data has been collected and summarized. Sites can be located on an online map[7].

3.2.2 Data Gaps

- **Spawning & Spawning Habitat:** Spawning has been well documented in the Big Salmon, South Big Salmon, and North Big Salmon rivers as aerial surveys have occurred frequently over the last 50 years, and a sonar station has been in operation for the past 5 years. Spawning has been less well studied in Northern Creek, and it is not clear how frequently this creek is used by spawners.

- **Rearing & Rearing Habitat:** There are many prominent creeks that have never been studied, including Illusion, Headless and Teraktu creeks on the Big Salmon River; D'Abbadie, Carison, and

[6] Water Survey of Canada Data:
http://www.wsc.ec.gc.ca/applications/H2O/graph-eng.cfm?station=09AG001&report=daily&year=1996
http://www.wsc.ec.gc.ca/applications/H2O/graph-eng.cfm?station=09AG003&report=daily&year=1996
[7] Map of Current CABIN sites:
http://cabin.cciw.ca/Main/cabin_current_activities.asp?Lang=en-ca

Solitary creeks on the North Big Salmon River; and St. Germain and the smaller unnamed tributaries of the South Big Salmon River. There are also some streams that have been sampled in the past, but most of these studies were limited in extent (for habitat and distribution) and results do not necessarily reflect true distribution of Chinook in each stream.

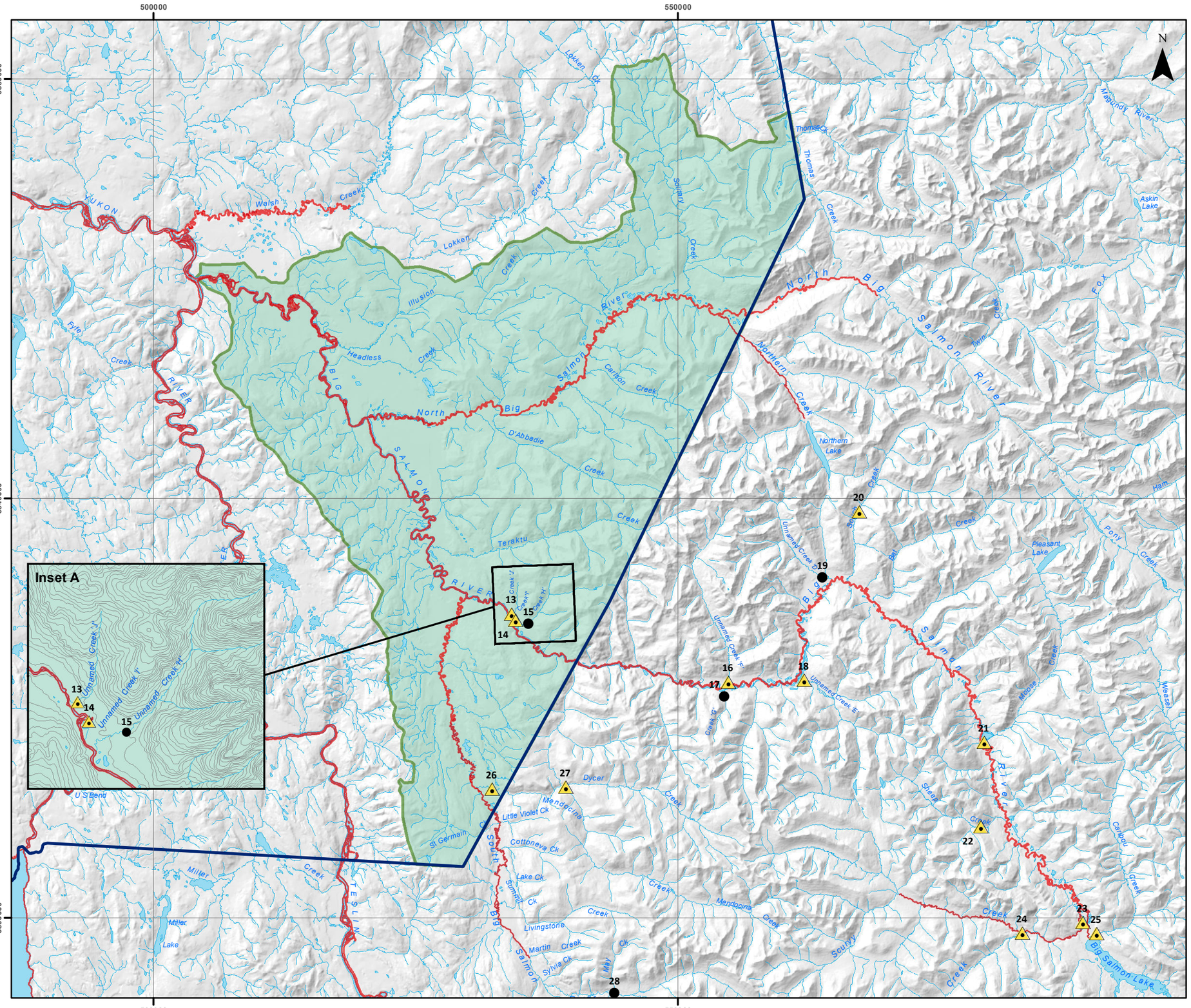
- **Overwintering:** There is no data on overwintering potential in this watershed area, aside from the presumption that larger tributaries, particularly those that are lake headed, sustain flows throughout the winter.

- **Other Information:** There is water quality and hydrology data for some creeks in the watershed area, but there are also many creeks that have never been sampled or monitored (see notes above in 'Rearing').

3.2.3 Recommendations

To build upon the existing knowledge base of Chinook utilization within the watershed, the following activities are recommended;

- Conduct juvenile Chinook sampling and habitat assessments in the prominent tributary streams with no past sampling data.
- Where Chinook are captured within 50-100 m of the mouth additional investigation into distribution and habitat limitations (i.e. beaver dams) should be conducted further upstream, from 500 m upwards to a couple kilometres depending on the stream.
- Investigate overwintering potential within the watershed area (aerial surveys during winter, temperature logger installation, and/or habitat assessments).
- Investigate whether spawning continues to occur in Northern Creek (aerial surveys/stream walks/carcass recovery).



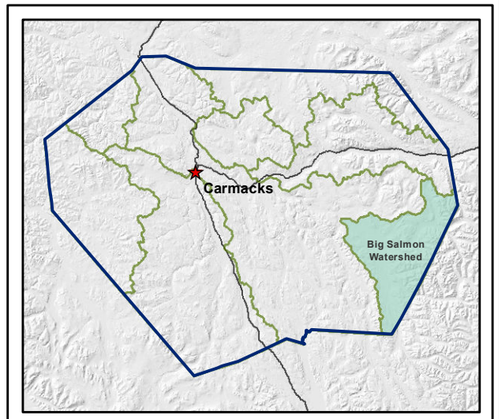


Figure 3. Big Salmon Watershed Area Existing Chinook Salmon Knowledge

Legend

- Juvenile Chinook Captured
- Freshwater Fish Captured
- No Fish Captured
- Watercourse Extent of Adult Chinook
- Waterbody Extent of Adult Chinook
- LSCFN Traditional Territory
- Big Salmon Watershed Area

0 5 10 15 20 Km

Drawn By: L. Grieve and M. Marjanovic
Checked By: M. Power and P. Tobler
Date: 30 May 2011
Projection: NAD 1983 UTM Zone 08
EDI Project #: 10-YC-0058

Digital Data Sources:

Yukon digital elevation model provided courtesy of Yukon Government - Geomatics Yukon.

1:50,000 waterbodies, watercourses, and LSCFN Traditional Territory boundary, and Main Roadways from Yukon Geomatics Corporate Spatial Warehouse.

Fish Capture Point Data: The FISS Yukon Fish Distribution Shapefile (provided by DFO) was checked against original source data and any new data acquired during EDI's scientific information gathering.

Known Extent of Adult Chinook: This data was reproduced digitally from a hard copy map developed by DFO (early 2000s) of known extent of adult Chinook salmon utilization, which was then checked against other source data (see Methods in report).

Watershed Areas: Project specific watershed areas digitized by EDI using 1:50,000 watercourse and waterbody data along with DEM and contour data.

Disclaimer: This document is not an official land survey and is presented without prejudice. The spatial data presented on the map is subject to change without notice.

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3.3 Little Salmon Watershed Area

The table below summarizes salmon and salmon habitat information for the Little Salmon Watershed Area. For additional details on the information provided below, refer to the relevant source citations. See Figure 4 for a map summarizing the existing scientific salmon habitat utilization knowledge available for the Little Salmon Watershed Area. For specific map point information refer to Appendix B using the point ID number.

Watershed Overview	
The Little Salmon River flows from Little Salmon Lake to the Yukon River, entering downstream of the Big Salmon River confluence. The watershed is located in the northeast portion of the Traditional Territory, just south of the Pelly Watershed Area. Much of this system is accessible via the Robert Campbell Highway. Primary tributaries to the Little Salmon River include; • Bearfeed Creek: drains into Little Salmon River, downstream from Little Salmon Lake. It is a lake headed system with moderate stream velocities and a coarse gravel streambed. • Drury Creek: feeds into the east end of Little Salmon Lake, the headwaters are in Drury Lake. • Unnamed Creek: enters the Little Salmon River close to its confluence with the Yukon River. This creek drains a small lake just south of Frenchman Lake. • Magundy River: feeds the east end of Little Salmon Lake, with its headwaters in the St. Cyr Mountain Range located east of the area. • Multiple Unnamed Tributaries: feed into the Little Salmon River and lake that also have the potential for Chinook rearing habitat.	
Spawning & Spawning Habitat Summary	
Little Salmon River	The known extent of adult Chinook use is up to the end of Little Salmon Lake, but spawning is mostly concentrated in the river from the mouth of Bearfeed Creek downstream for 8 km (Walker et al. 1974). Chum salmon have also been documented in the river, with a concentration observed approximately 3 km up the river in September 1973 (Walker et al. 1974). Aerial surveys of the Little Salmon River over the past 5 years have had an average count of 853 Chinook spawners, ranging from 1,519 in 2005 to 93 in 2008 (JTC 2010).
Bearfeed Creek	Adult Chinook were seen in the stream (Walker et al. 1974) and one radio tagged Chinook was documented there in 2004 (Mercer 2005), indicating adult Chinook likely spawn in the creek.
Drury Creek	Chinook are reported to spawn just below the Drury Lake outlet (Walker et al. 1974; Environmental Management Associates 1993), although it is not clear how frequently this area is used for spawning.
Magundy River	Spawning has not been documented in this river; however, NNRS (1977) indicated that suitable spawning habitat exists for freshwater species in general. The substrate is dominated

	by gravel and sand and the flows are moderate in the lower section, with faster flowing, higher gradient habitat further upstream. Walker et al. (1974) indicated that Chinook and chum spawning may occur here as both species have been reported in Little Salmon Lake.
Rearing & Rearing Habitat Summary	
Little Salmon River	The river is used by juvenile Chinook as a natal rearing stream. NNRS (1977) captured juvenile Chinook in addition to round whitefish, longnose sucker, northern pike and slimy sculpin using gill nets and beach seines.
Drury Creek	Depending on the extent of spawning within the creek this stream would be used as natal habitat by juvenile Chinook. Otherwise it is possible that other juvenile Chinook may use the stream as non-natal rearing habitat. An investigation during 1977 (NNRS) did not capture juvenile Chinook, only slimy sculpin and northern pike using minnow traps and seine nets.
Bearfeed Creek	Depending on the extent of spawning within the creek, this stream would be used as natal habitat by juvenile Chinook. Otherwise it could potentially be used as non-natal habitat. Previous sampling documented an extraordinary capture rate of 62 juveniles in 25 minutes upstream of the highway bridge (3 minnow traps; von Finster 1989). Other species captured include Arctic grayling, slimy sculpin and round whitefish (NNRS 1977).
Magundy River	The river could be used as natal or non-natal juvenile Chinook rearing habitat, depending on whether spawning occurred in the river (never been documented). NNRS (1977) identified the river as providing excellent rearing habitat for freshwater species and they captured adult round whitefish and juvenile Arctic grayling through gill netting and seine netting, but no fish in minnow traps. They also identified the tributaries to the river as providing marginal rearing habitat with poor overwintering potential, especially those that are crossed by the highway as culverts restrict fish passage in many areas.
Truitt Creek	This creek is a tributary to Little Salmon Lake, east of Drury Creek. Limited fish sampling was conducted in 1977 (NNRS) but no juvenile Chinook were captured through minnow trapping or seine netting (1 Arctic grayling was captured in a seine net).
Unnamed Creek 1 – Trib. to Little Salmon River, drains small lake south of Frenchman Lake	NNRS (1977) captured juvenile Chinook on two occasions through minnow trapping and seine netting; however, none were captured in minnow traps during a later study (von Finster 1988). Arctic grayling fry were seen in large numbers below the highway culvert in June 1988 (von Finster 1988).
Unnamed Creek 2 – Trib. to Little Salmon Lake, west of Drury Creek	NNRS (1977) conducted fish sampling, but no juvenile Chinook were captured in minnow traps or seine nets (only Arctic grayling were captured).
Unnamed Creek 3 – Trib. to Little Salmon Lake, west of Unnamed	NNRS (1977) conducted fish sampling, but no juvenile Chinook were captured in minnow traps or seine nets (only Arctic grayling were captured).

Creek 2	
Unnamed Creek 4 – Trib. to Little Salmon River west of Bearfeed Creek	NNRS (1977) conducted fish sampling and captured 3 juvenile Chinook near the mouth. No additional sampling upstream was conducted.
Unnamed Creek 5 – Trib. to Little Salmon River, upstream from Unnamed Creek 1	NNRS (1977) captured no juvenile Chinook during minnow trapping or seine netting (only Arctic grayling and slimy sculpin were captured).
Overwintering	
Elders noted during the Northern Tutchone Elders meeting that the Little Salmon River has many creeks that stay open or have thin ice (Appendix A: *Traditional Salmon Habitat Knowledge Study*). No current scientific data exists on the overwintering potential of this watershed; however, it is likely that larger lake headed streams (Drury and Bearfeed Creek) and Little Salmon River (possibly the lake as well) provide suitable overwintering habitat for juvenile Chinook. Some of the smaller unnamed streams may also provide overwintering habitat for juvenile Chinook, if they have groundwater inputs. Note the presence of slimy sculpin is also a good indication that overwintering conditions exist, because sculpin are not considered migratory and reside in one main area for their entire life cycle. This may suggest that Bearfeed Creek, Drury Creek, and Unnamed Creek 5 may provide overwintering habitat.	

3.3.1 Other Information

- **Water Quality:** Some general water quality data exists for the larger streams (Walker et al. 1974), but there is little information on water quality and fish habitat characteristics for the small unnamed tributaries. Some CABIN sites (see below) may also have water quality data associated with studies of benthos.
- **Hydrology:** There is a Water Survey of Canada hydrometric station near the mouth of Drury Creek at km 489 of the Robert Campbell Highway (09AH005), which measures discharge. The station is currently active and data is available from 1995 to the present[8].
- **Benthos:** There are two CABIN sites in the watershed area (Bearfeed and Drury creeks) where aquatic benthic invertebrate and water quality and habitat data has been collected and summarized. Sites can be located on an online map[9].

[8] Water Survey of Canada Data:
http://www.wsc.ec.gc.ca/applications/H2O/graph-eng.cfm?station=09AH005&report=daily&year=2009

3.3.2 Data Gaps

- **Spawning & Spawning Habitat:** Chinook spawning in the Little Salmon River has been well documented with frequent aerial surveys over the last 30 years. Less is known about the extent and frequency of spawning in Bearfeed Creek and Drury Creek. Also there is no record of salmon spawning in the Magundy River, which is only approximately 1.8 km from the mouth of Drury Creek, where spawning has been documented.

- **Rearing & Rearing Habitat:** Many of the small tributary streams to the Little Salmon lake and river have not been sampled for fish or assessed for suitable habitat. The data that exists for some of the small tributary streams, are limited to one or two points of a particular drainage and thus do not provide perspective to the extent of utilization and habitat limitations (i.e. barriers) of these areas.

- **Overwintering:** There is no scientific data on overwintering potential of the creeks in this watershed area, aside from the presumption that larger tributaries, particularly those that are lake headed, sustain flows throughout the winter, and that many small creeks remain open or have thin ice according to LSCFN Elders (Appendix A).

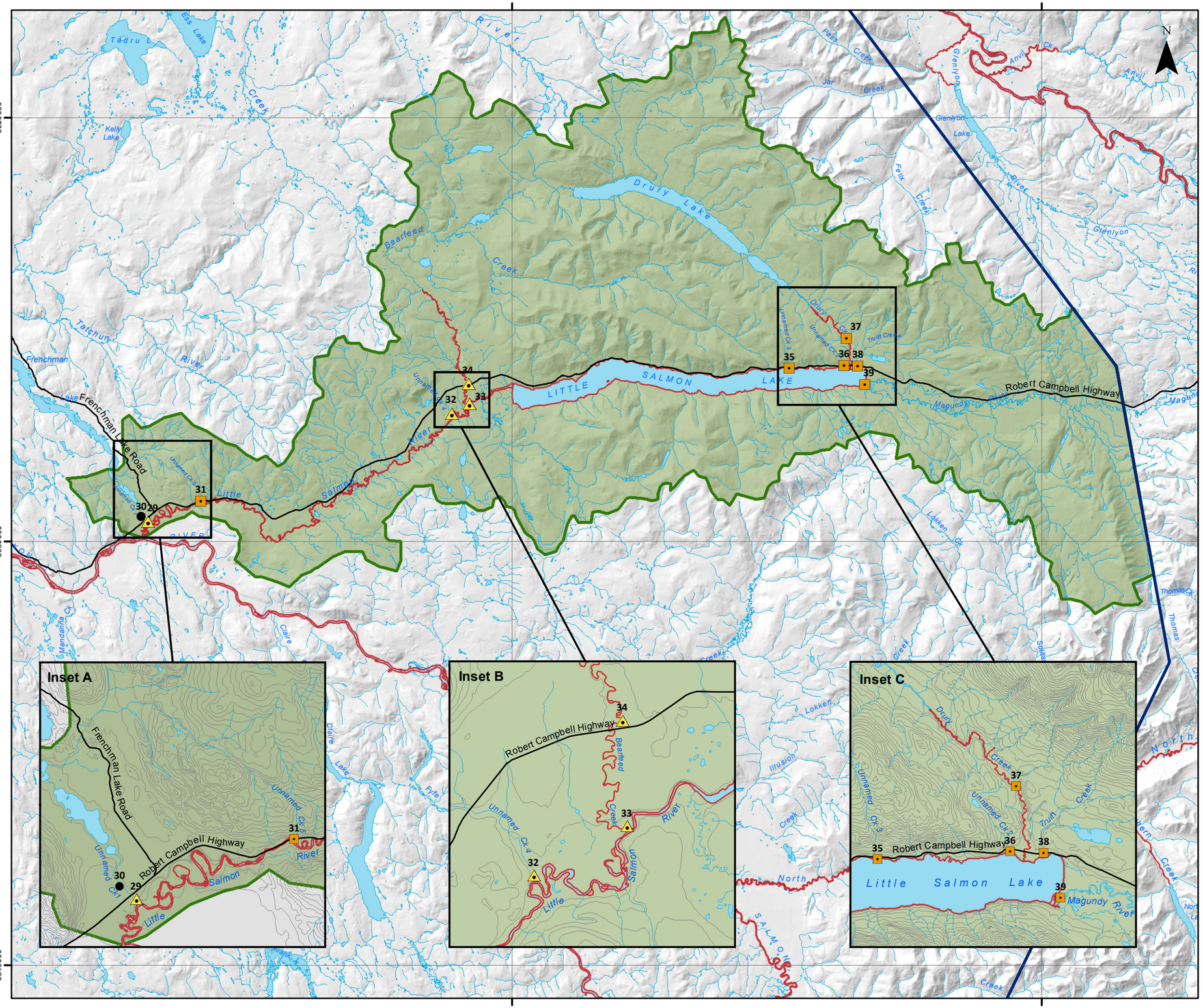
- **Other Information:** There is some water quality, hydrology, and benthos data for the larger tributaries (Drury and Bearfeed creeks), but none for the smaller tributaries which are likely used as non-natal rearing areas.

3.3.3 Recommendations

To build upon the existing knowledge base of Chinook utilization within the watershed, the following activities are recommended;

- Conduct potential carcass recovery/spawner surveys on Drury Creek and Bearfeed Creek to determine utilization by adult Chinook. Spawning in the Magundy River should also be investigated.
- Sample all easily accessible tributaries to Little Salmon Lake and river (i.e. by boat or road) for juvenile Chinook and conduct habitat assessments.
- Where Chinook are captured within 50-100 m of the mouth additional investigation into distribution and habitat limitations (i.e. beaver dams) should be conducted further upstream, from 500 m upwards to a couple kilometres depending on the stream.

[9] Map of Current CABIN sites:
http://cabin.cciw.ca/Main/cabin_current_activities.asp?Lang=en-ca



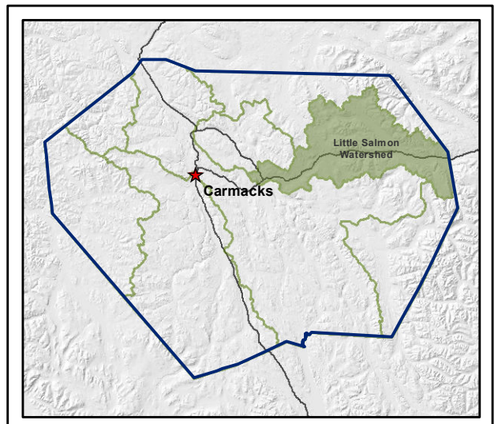


Figure 4. Little Salmon Watershed Area Existing Chinook Salmon Knowledge

Legend

- Juvenile Chinook Captured
- Freshwater Fish Captured
- No Fish Captured
- Watercourse Known Extent of Adult Chinook
- Waterbody Known Extent of Adult Chinook
- LSCFN Traditional Territory
- Little Salmon Watershed Area

0 5 10 15 20 Km

Drawn By: L. Grieve and M. Marjanovic
Checked By: M. Power and P. Tobler
Date: 18 March 2011
Projection: NAD 1983 UTM Zone 08
EDI Project #: 10-YC-0058

Digital Data Sources:

Yukon digital elevation model provided courtesy of Yukon Government - Geomatics Yukon.

1:50,000 waterbodies, watercourses, and LSCFN Traditional Territory boundary, and Main Roadways from Yukon Geomatics Corporate Spatial Warehouse.

Fish Capture Point Data: The FISS Yukon Fish Distribution Shapefile (provided by DFO) was checked against original source data and any new data acquired during EDI's scientific information gathering.

Known Extent of Adult Chinook: This data was reproduced digitally from a hard copy map developed by DFO (early 2000s) of known extent of adult Chinook salmon utilization, which was then checked against other source data (see Methods in report).

Watershed Areas: Project specific watershed areas digitized by EDI using 1:50,000 watercourse and waterbody data along with DEM and contour data.

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3.4 Nisling Watershed Area

The table below summarizes salmon and salmon habitat information for the Nisling Watershed Area. For additional details on the information provided below, refer to the relevant source citations. See Figure 5 for a map summarizing the existing scientific salmon habitat utilization knowledge available for the Nisling Watershed Area. For specific map point information refer to Appendix B using the point ID number.

Watershed Overview	
The Nisling River lies in the western portion of the LSCFN Traditional Territories and drains west into the Donjek and White Rivers (large tributaries to the Yukon River, outside of the LSCFN Traditional Territory). Some of the larger tributaries in this watershed area include the Klaza River, and Victoria, Nansen, Lonely and Mackintosh creeks. The Mt. Nansen abandoned mine is located in this drainage, and access to the area is gained by the Mt. Nansen Road. While no hard rock mining currently occurs at this location, there are exploration and placer operations throughout the drainage.	
Spawning & Spawning Habitat Summary	
Nisling River	Chinook salmon spawn in the Nisling River; however, their most upstream extent is about 28 km (straight line distance) outside of the LSCFN Traditional Territory boundary (just downstream of the Tyrell Creek confluence) (von Finster 2004). It is a large river with little or no storage in the form of lakes however may be significant underground storage of water as geese overwintering on ground water areas along river (von Finster 2004; von Finster 2005; Mercer 2005).
Rearing & Rearing Habitat Summary	
Nisling River	There is no data for juvenile Chinook rearing outside of the known extent of adult use.
Nansen Creek	Juvenile Chinook have not been captured in the creek by electrofishing, gill netting or minnow trapping; however Arctic grayling have been captured upstream of the confluence with Webber Creek (Norecol 1989; Osborne 1995a). Placer mining occurs in the upper reaches and when active causes the creek to be extremely turbid, with pools and cutbanks filling with sediment deposition (Osborne 1995a).
Victoria Creek & Tributaries (Back, Dome, & Pony creeks)	Several fish studies have been conducted on the Victoria Creek drainage (including Back Creek, Dome Creek and Pony Creek) and no juvenile Chinook have been captured (Osborne 1995a, EDI 2009a; EDI 2009b). Methods have included electrofishing, minnow trapping, and gill netting. Species captured include Arctic grayling (adult and juvenile), slimy sculpin, and burbot. Habitat in Victoria Creek includes gravel and cobble streambed material, numerous undercut banks, large woody debris, and pools for cover. There is occasionally high turbidity due to placer mining upstream and in tributaries such as Back Creek (Norecol 1989). Dome Creek drains the mine site and tailings pond area and may have had some impact on water quality

	historically in Victoria Creek. There are no fish in Dome and Pony creeks (barriers and poor habitat) and there are natural barriers to smaller sized fish in Back Creek(EDI 2009a and b).
Overwintering	
Some of the creeks in the area remain partially open through the winter, including portions of Victoria Creek and the Nisling River, where there are groundwater influences (von Finster 2004; EDI pers. comm.. 2011). Several tributaries of Victoria Creek are known to freeze to the bottom, including Dome, Back and Pony creeks.	

3.4.1 Other Information

- **Water Quality:** Water quality data is collected by Yukon Government Assessment and Abandoned Mines Branch on a monthly basis (in addition to water sampling for chemical analysis), for Victoria, Dome, Back, and Pony creeks. Water quality data is likely also collected at the CABIN sites (see Benthos sections below).

- **Hydrology:** There is a Water Survey of Canada hydrometric station on the Nisling River, below Onion Creek (09CA006) outside of the Traditional Territory (~90 km), which measures discharge. The station is currently active and data is available from 1995 to the present[10]. Yukon Government Water Resources also publishes snow survey results[11] for the Mt. Nansen survey station on Victoria Creek (09CA-SC) and Assessment and Abandoned Mines Branch has hydrology data for creeks within the Mt. Nansen abandoned mine area.

- **Benthos:** There are several CABIN sites in the watershed area (Nisling and Klaza rivers, and Lonely, Nansen, Dome, Victoria creeks). Sites can be located on an online map[12].

3.4.2 Data Gaps

- **Spawning & Spawning Habitat:** The extent of spawning has been documented based on aerial surveys and telemetry studies; however, 2005 was the date of the most recent survey. Regardless, it is unlikely that spawning occurs up to an extent within the Traditional Territory.

[10] Water Survey of Canada Data:
http://www.wsc.ec.gc.ca/applications/H2O/graph-eng.cfm?station=09CA006&report=daily&year=2009
[11] Water Resources Snow Survey Results:
http://www.environmentyukon.gov.yk.ca/monitoringenvironment/snow_survey.php
[12] Map of Current CABIN sites:
http://cabin.cciw.ca/Main/cabin_current_activities.asp?Lang=en-ca

- **Rearing & Rearing Habitat**: There is no known information on juvenile Chinook (non-natal use) or habitat conditions on the Nisling River and tributaries downstream of Nansen Creek.
- **Overwintering**: There is some data on overwintering capabilities of the Nisling River and some of its tributaries (Victoria, Back, Dome, and Pony creeks). Less is known about capabilities of the tributaries downstream of Nansen Creek.
- **Other Information**: There is water quality, hydrology and benthos data for many of the creeks in this watershed area. No data gaps were identified.

3.4.3 Recommendations

To build upon the existing knowledge base of Chinook utilization within the watershed, the following activities are recommended;

- Determine whether juvenile Chinook utilize the Nisling River watershed within the LSCFN Traditional Territory. Given they have not been captured in Nansen and Victoria creeks, assessment efforts should focus on downstream areas, near the western border of the Traditional Territory.
- If juvenile Chinook are found to migrate up the Nisling River into the LSCFN Traditional Territory, then collection of habitat and overwintering data may be warranted.