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**UPPER BONAPARTE RIVER WATERSHED**  
**WSC: 120-506800**  
**RECONNAISSANCE (1:20000) FISH AND FISH HABITAT INVENTORY**

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**June, 2000**

## PROJECT REFERENCE INFORMATION

FRBC Project Number:	CCM 98303
FDIS Project Number:	03-BONP-000000554-1999
FRBC Activity Number:	9915
FRBC Region:	Thompson-Okanagan Region
MoELP Region:	03 Southern Interior Region
MoELP District:	N/A
FW Management Unit:	3-30
DFO Sub-District:	29F Lillooet
Forest Region:	Cariboo
Forest District:	100 Mile House
Forest Licensee:	Ainsworth Lumber Co. Ltd.
First Nations Claim Area:	Bonaparte Indian Band

## WATERSHED INFORMATION

Watershed Group	Bonaparte
Watershed Name	Bonaparte River
Watershed Code	120-506800
UTM at downstream end of study area	10.608411 5647466
Watershed Area	4,487.1 km <sup>2</sup>
Total of all stream lengths	89.6km
Stream Order	5th
NTS Maps	92 P/3, 92 P/6, 92 P/7
TRIM Maps (entire project)	92P.092, 92P.093, 92P.002, 92P.003, 92P.004, 92P.005, 92P.006, 92P.011, 92P.012, 92P.013, 92P.014, 92P.015, 92P.016, 92P.017, 92P.018, 92P.019, 92P.021, 92P.022, 92P.023, 92P.024, 92P.025, 92P.026, 92P.027, 92P.028, 92P.029, 92P.032, 92P.033, 92P.034, 92P.035, 92P.036, 92P.037, 92P.038, 92P.039, 92P.042, 92P.043, 92P.044, 92P.045, 92P.046, 92P.047, 92P.048, 92P.052, 92P.053, 92P.054, 92P.055, 92P.056
TRIM Maps (1999 season)	92P.003, 92P.013, 92P.014, 92P.024 92P.015, 92P.025, 92P.035, 92P.026 92P.036, 92P.037
Airphotos	Airphotos were loaned for a brief time period only, and photo #'s were not recorded

## WATERSHED INFORMATION (CONT'D)

BGC Zones

ICH, IDF, SBPS

### SAMPLING DESIGN SUMMARY

Total Number of Stream Reaches (1999 study area)	2818
1999 Random Sample Sites Selected	41
1999 Random Sample Sites	35
1999 Bias Sample Sites Selected	30
1999 Bias Sample Sites	30
1999 Additional Sample Sites	4
Total Number of Lake/Wetland Reaches	3386
1999 Lake/Wetland Sample Sites Selected	0
1999 Lake/Wetland Sample Sites	0
1999 Total Sample Sites	69
1999 Field Sampling Dates	Sept. 19 – Oct. 31

## CONTRACTOR INFORMATION

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Water Chemistry Analysis	N/A
Aging Sample Analysis	N/A
Genetic Sample Analysis	N/A
Voucher Species ID	N/A

## **DISCLAIMER**

This product has been accepted as being in accordance with approved standards within the limits of Ministry quality assurance procedures. Users are cautioned that interpreted information on this product developed for purposes of the Forest Practices Code Act and Regulations, for example stream classifications, is subject to review by a statutory decision-maker for the purposes of determining whether or not to approve an operational plan.

## **ACKNOWLEDGEMENTS**

Of the many parties involved in the development and implementation of this project, Cariboo Envirotech Limited would like to acknowledge, in particular, the support and participation of Ainsworth Limited, who provided the opportunity for this work to occur, and the information and support required throughout the project.

Funding for this project was provided by Forest Renewal B.C., a partnership of forest companies, workers, environmental groups, First Nations, communities and government. Forest Renewal B.C. funding is from stumpage fees and royalties that forest companies pay in return for the right to harvest timber on Crown Lands. This money is reinvested in the forests, forest workers, and forest communities.

Ministry of Environment, Lands and Parks, Inventory Specialist David Tesch provided assistance and support in development of sampling plans and refinement of project protocols.

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## **LIST OF ATTACHMENTS (available at MELP Office, Kamloops)**

Attachment 1	Phase 1-3 Planning Report
Attachment 2	Field Notes
Attachment 3	Photodocumentation
Attachment 4	Digital Data
Attachment 5	FISS Update Forms
Attachment 6	FDIS7.3 QA Planning Report

## **1.0 Introduction**

This report, including appendices, maps, and attachments, presents the results of year one of a (1999) Reconnaissance (1:20,000) Fish and Fish Habitat Inventory conducted within the Upper Bonaparte River Watershed. Due to the magnitude of the Upper Bonaparte River watershed, this project will be completed in annual increments, based on yearly funding and operational priorities at Ainsworth Ltd. In 1999, sampling concentrated on two sub-basins within the upper Bonaparte River – the Rayfield River and Residual. Future year's sampling will cover the remaining areas identified in the pre-field plan (Cariboo Envirotech, 1999)

### **1.1 Project Scope/Objectives**

The objectives of this study are consistent with those of a Reconnaissance (1:200000) Fish and Fish Habitat Inventory. Information collected during this inventory is intended to:

- provide information of fish species, fish characteristics, and relative abundance at selected sampling sites throughout the watershed
- provide biophysical information on selected stream reaches, and
- accommodate Licensee requirements including classification of stream reaches potentially affected by forest development (i.e. within or adjacent to proposed cutblocks and road crossings)

This report focuses on findings from two sub-basins sampled in the 1999 field season. Sampling occurred in random and bias reaches selected from the lower portion of the Rayfield Creek sub-basin and from that portion of the Bonaparte River residual area located downstream from Bonaparte Lake. Figure 1 presents the 1999 study area relative to the remaining upper Bonaparte River sampling area. Specific study area details are discussed in 1.2.

**Figure 1. Study Area Location**

## 1.2 Study Area

For the purposes of this report, two separate study areas in the upper Bonaparte River watershed must be defined:

- i) The upper Bonaparte River study area encompasses the entire Bonaparte River drainage upstream of the confluence with Allen Creek (Figure 1) approximately 18.0 km south of Clinton, B.C. on Hwy 97. This portion of the Bonaparte River drainage covers an area of approximately 4,487 km<sup>2</sup>, and has been divided into nine (9) sub-basins (Table 1) which are proposed for sampling over the next few years.
- ii) In the summer of 1999, field crews surveyed portions of two of these nine sub-basins, sampling random and bias reaches within the Rayfield Creek and Bonaparte River residual area sub-basins (Figure 1). This report focuses on data collected from these two sub-basins.

**Table 1. Areas of the sub-basins in the upper Bonaparte watershed**

SUB - BASIN	WATERSHED CODE	AREA (ha)	AREA (sq. km)
Allen Creek	120-506800-23200-	16,240	162.4
Loon Creek	120-506800-28300-	52,190	521.9
Clinton Creek	120-506800-34500-	29,660	296.6
Fifty-Seven Mile Creek	120-506800-38200-	15,380	153.8
Chasm Creek	120-506800-38700-	35,010	350.1
Rayfield River	120-606800-57600-	140,480	1,404.80
Eagan Lake	120-506800-78100-	27,530	275.3
Bonaparte Lake	120-506800-	45,090	450.9
Residual Area	120-506800-	87,130	871.3
<b>TOTAL AREA OF WATERSHED</b>		<b>448,710</b>	<b>4487.1</b>

### 1.2.1 Access

The upper Bonaparte River watershed has an extensive network of public, forestry and private roads that provide access to almost all of the study area. During the 1999 field season, field crews stayed at Little Horse Lodge on the north side of Green Lake. Directions are provided for Green Lake, as it is located 10-20 kilometers from most 1999 field sites.

To gain access to the study area, directions from 70 Mile House are as follows:

- turn east from Highway #97 at the intersection in 70 Mile House, BC.
- Drive ~15km until reaching Boyd Bay (Green Lake) on the left hand side, then turn south (right) on the forest service road and continue until reaching Young Lake. Young Lake is located in the southeast portion of the 1999 study area.

The primary means of access to sampled reaches included vehicle and ATV (54 reaches) and foot (15 reaches).

## 2.0 Resource Information

The primary land uses in the upper Bonaparte River watershed include forestry and agriculture. This is also an area of high outdoor recreational activity which includes camping, hunting and fishing. The portion of the watershed which lies within the Kamloops LRMP is a local resource management zone (ARC Environmental Ltd., 1998), and the area of the Clinton Creek watershed upstream of the Clinton townsite is a Community Watershed area.

A summary of known fish presence is presented in attachment 1, the Planning Document (Appendices 1 and 2). Native salmonid species presence in the Upper Bonaparte River watershed has been documented as being rainbow trout *Oncorhynchus mykiss*, Kokanee *Oncorhynchus Nerka* (FISS) and Eastern Brook trout *Salvelinus fontinalis* have been introduced into the Chasm Creek and Clinton Creek sub-basins (Province of British Columbia, 1999a). Anadromous salmonid species were limited to the lower 2.6 km of the Bonaparte River, downstream of a natural barrier - a 6.0m falls - until a fishway was constructed in the late 1980's. Following the installation of the fishway, chinook salmon *Oncorhynchus tshawytscha*, coho salmon *Oncorhynchus kisutch* and steelhead *Oncorhynchus mykiss* have access to the upper parts of the watershed.

### **3.0 Standards and Methods**

The standards and methods used for each phase of this project are consistent with those found in the *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Standards and Procedures* (April, 1998), which are broken into six phases:

- Phase 1: Existing Data Review
- Phase 2: Classification and Sample Design
- Phase 3: Project Plan
- Phase 4: Field Data Collection
- Phase 5: Data Compilation
- Phase 6: Reporting and Mapping

The following sub-sections document major achievements and/or any modifications to recommended procedures that occurred throughout the six phases of the 1:20,000 Project.

#### **3.1 Phase 1: Existing Data Review**

The purpose of phase 1 is to collect and review all existing information pertaining to the study area. More specifically, phase 1 is intended to:

- Determine and delineate the 1:20,000 drainage network
- Identify known fisheries presence in the system
- Locate potential fish passage barriers
- Locate areas with potentially sensitive habitat

All available information was reviewed and analyzed, including internet and hardcopy FISS databases, 1:20,000 TRIM maps, air photos, and forest development plan maps. A bibliography of sources used for this overview and a contact list of persons consulted during phase 1 were assembled (Cariboo Envirotech, 1999).

All relevant information was transcribed onto working maps. Existing watershed codes and waterbody identifiers were annotated on working maps, and watercourses without watershed codes were assigned an Interim Locator Point (ILP). A request for watershed codes for ILP stream has been sent to Victoria.

### 3.2 Phase 2: Classification and Sample Design

Several changes were made to the 1:20,000 reconnaissance standards.

- i) A typical 1:20,000 FFHIP requires detailed map and airphoto analysis to determine reach breaks, to identify and classify sub-basins, and to determine individual reach characteristics for all watercourses. During the phase 1 literature review, Cariboo Envirotech Ltd. determined that reach breaking for the entire study area had been completed by ARC Environmental Ltd. in Kamloops, during a 1996 FHAP (ARC Environmental, 1998). In consultation with Ministry of Environment, Lands, and Parks (MELP) Inventory Specialist David Tesch and ARC Environmental Ltd., a decision was made to use existing reach breaks to maintain continuity between studies.
- ii) MELP Inventory Specialist David Tesch requested that lakes in the study area be included only in phases 1-3. Cariboo Envirotech identified, labeled, and entered lakes into FDIS databases. The intent of completing phases 1-3 for lakes is that if/when lake samples become a priority, pre-field information exists for all lakes. At the present time, phases 4-6 will not be completed for lakes in the study area.
- iii) Due to the magnitude of the upper Bonaparte study area, MELP Representative David Tesch requested that the maximum number of reaches entered into a FDIS table should be 4000. This was necessary to keep the overall sampling rate at an adequate level. During random sample selection, over 5000 stream reaches and over 3000 lake reaches were broken into 3 separate FDIS databases.  
  
To facilitate easier data management, these three databases have since been merged into one database. The 1999 FDIS database includes reach and site data from only the Rayfield and Residual sub-basins, and lake data from the entire upper Bonaparte study area. It is impossible to isolate lakes in the 1999 study area from other lakes in the project area, unless the lake is part of a stream network.
- iv) In joint consultation with Ainsworth and MELP, a decision was made to complete phase 4 (field sampling) in yearly increments, rather than sample all selected random and bias sites in one season. The reason for this is that certain sub-basins can then be sampled as funding and/or operational priorities of the Licensee become known.
- v) Data from a Cariboo Envirotech Ltd. study of the Brown Creek, Scot Creek, and Bonaparte Lake watersheds has been integrated into the Upper Bonaparte FFHIP. The random sampling design used for the current project

included data collected in the 1997 project, but as discussed with MELP Inventory Specialist David Tesch, Brown Creek, Scot Creek, and Bonaparte Lake watersheds will be excluded from all future field sampling, in order to eliminate duplication of efforts.

- vi) The Lakes Query Page on the BC Environment website includes data for several lake reaches that were sampled prior to this project. These lakes were removed from our sampling regime, as described, and approved in the project plan (Cariboo Envirotech, 1999).
- vii) During prefield phases, a decision was made by Cariboo Envirotech Ltd. to delay NID assignment until mapping phases of the project. For this reason, NIDs do not appear on site cards, as reaches did not possess NIDs at this time.

Digital TRIM data was obtained from MELP for the upper Bonaparte River watershed, and 1:20000 scale maps with TRIM information were plotted for this area by Paragon Resource Mapping, Williams Lake, B.C. From these field maps, sub-basins were identified, and air photographs were used in combination with the maps to classify sub-basins and to determine individual reach characteristics for the reaches previously delineated by ARC in 1996.

Following detailed map and air photograph analysis, all reach, lake, and feature data was entered into version 7.3 of the FDIS database. FDIS then selected the random sample reaches throughout the entire Upper Bonaparte watershed. A total of 359 sample sites\* were identified. MELP representatives, Ainsworth employees, and Cariboo Envirotech biologists identified portions of two sub-basins for 1999 field sampling, and 35 random sample reaches were chosen from the 359\* that were identified. In addition to random sites, 948 additional (bias) sites were identified by Cariboo Envirotech biologists that would provide information on streams located adjacent to proposed cutblocks, near proposed roads, or in areas lacking sufficient fish distribution information (Cariboo Envirotech, 1999).

\* includes 58 sites in Brown/Scot/Bonaparte Lake sub-basins that were removed from sampling design

### **3.3 Phase 3: Project Plan**

The intent of phase 3 was to develop a detailed sampling plan, including a planning report. Phase 3 activities required interaction between Cariboo Envirotech biologists, MELP representatives, and Ainsworth Ltd. staff, to ensure that all project priorities were met. Specific project objectives were refined, and a preliminary prioritization of sampling effort was conducted in order to maximize the value of data collected.

### **3.4 Phase 4: Field Data Collection**

The following sections provide an outline of the approach used for conducting field work. Specific sampling methodologies are outlined as well.

#### **3.4.1 Pre-field Preparation**

Much preparation was required prior to field data collection, to ensure that field operations could be carried out with maximum safety and efficiency. Before entering the field, the Cariboo Envirotech project team met to review:

- i) safety issues and procedures
- ii) specific project objectives
- iii) new inventory procedures
- iv) QA/QC requirements

Field copy maps and office supplies for field work were organized and mobilized. Required fish collection permits from MELP and DFO prior to commencement of field work.

#### **3.4.2 Stream Inventory**

Field work was conducted by 2 and/or 3 person crews, comprised of an experienced biologist and technician(s). A Smith-Root model 12-B electrofisher, along with other field gear (Table 2), was employed for fish sampling during this project.

Field crews used 1:20,000 TRIM maps to locate sample sites in the field, and FDIS reach card printouts were used to provide information on reaches of interest. Sample sites were located with the aid of a compass and a hip chain and annotated directly on to the field TRIM map.

**Table 2. Summary of Equipment Used by Cariboo Envirotech.**

Parameter	Equipment
Map measurements Distance  Area	Western Map Measure (Germany), and PiCo Design Map Wheel  Enduro Compensating Polar Planimeter (Japan) And Neville Crosby .01 sq cm grid
Channel measurements Gradient  Channel and wetted widths Depth	Sokkia 8047-10 Abney level, or Suunto PM-5 Clinometer Stainless steel measuring tape (mm) Dip net pole (10-cm calibration), or mini-rod (cm)
Electrofishing Electrofisher Anode ring Dip net Chest Waders Electrofishing Gloves Polarized sunglasses Buckets DFO & MoELP Fish Collection Permits	CSA Approved Smith Root Model 12-B 12-inch diameter 1.5-m length, 15-cm diameter sieve
Fish (general) Relaxant Length Identification  Weight	Alka-Seltzer tablets Fish trough (15-cm length, mm-calibration) Keys in Scott and Crosman (1973) and McPhail and Carveth (1994) Ohaus Electric Balance
Fish trapping Minnow Traps  Bait	Gee-type traps (22-cm diameter, 42-cm length, 3-cm funnel opening, 6 mm x 6 mm mesh) Friskies and Nine Lives cat food, sardines
Orienteering Compass Maps Air photos Walking distance, length surveyed  Position (field)	Silva Ranger 1:20 000 TRIM 1:11 000 and 1:15 000 (approx.)  Hip chain calibrated in meters (Topometric Products Ltd.)  TRIM Maps
Photography 35 mm Camera Film	Cannon Sure Shot A-1 or Pentax zoom-90WR 100 ISO and 400 ISO
Water conditions Conductivity Ph Temperature Calibration solutions  General Field Gear Field notebook with waterproof paper MoELP site cards, fish collection forms, individual fish data First Aid Kit	TDS TestR 3 Hanna pHEP 3 Alcohol-based thermometer (n35 to +50 °C) pH 4 and 7 buffers solutions and 100 µS/cm solution

## ***Fish Sampling***

The main objectives of fish sampling for this project were to determine fish species diversity and relative abundance of fish in stream reaches being sampled. Two methods were employed to conduct fish sampling: electrofishing and minnow trapping. In the study area, electrofishing was the most efficient method of fish sampling, and was the preferred method of sampling in all small streams and shallow-water habitats. A total of 9 sites were electrofished for either 100 m or 10 bankfull widths (whatever was greater) (Province of British Columbia, 1998a). Sampling efforts covered the range of habitats present in each stream reach, with techniques appropriate to the habitats and fish life stages that may be present. In some cases, it was not practical to use 2 methods for sampling, particularly when water was not deep enough for minnow trapping, and electrofishing was the only method employed. In situations where habitats were not suitable for electrofishing, such as wetlands or small ponds, minnow traps baited with sardines and/or cat food were set for a 24-hour period. A total of 21 minnow traps were set at 7 sites in the 1999 field season. Other sampling methods, such as angling, snorkeling, or beach seining, were not employed in 1999.

Fish sampling data were recorded on waterproof fish collection forms and individual fish data forms. Fork length (cm) and weight (g) was obtained for every fish captured. In order to minimize stress to live captured fish, fork lengths were recorded to the nearest 5mm. Identification of fish species was determined using RIC's Field Key to Freshwater Fishes of BC. Where possible, a photograph was taken of a representative fish specimen, and included in the photo section of the individual fish data forms. Voucher specimens or aging structures were not collected during the 1999 field season.

## ***Fish Habitat Description***

Data was collected in accordance with standards in the *1:20,000 Reconnaissance Fish and Fish Habitat Inventory Standards (April 1998)* and the methods specified in Schedule A of the contract. All fish habitat information was recorded on waterproof site cards, to provide accurate Riparian Management Area (RMA) classifications for each sampled reach. Sample site locations were marked on working maps.

Two features relevant to fish or fish habitat were found during the 1999 field season, and if they were documented and photographed. At the majority of sampling locations, representative upstream and downstream photographs were taken to aid in interpretation of fish habitat values at the site.

## ***Water Quality Sampling***

Water quality measurements including temperature, conductivity, and pH were taken at each sample site, to indicate general conditions in the watershed. No additional water sampling was done.

### **3.4.3 Reconnaissance Lake Inventory**

No lakes were surveyed in the 1999 field season. In cases when air photograph interpreted stream reaches were found to be non-channelized wetlands, photographs were taken and the reach was assigned an NVC-w designation which recognizes the potential for fish to utilize the reach under some conditions.

## **3.5 Phase 5: Data Compilation**

Following the field phase of this project, data were entered into MELP's inventory database (FDIS), photographs were developed, scanned into digital (CD) format, and captioned for inclusion in the report. Several attachments have been included with this report.

- Attachment 1 consists of the Phase 1-3 Planning Report which has previously been approved by MELP.
- Attachment 2 includes original field notes, site cards, fish collection forms, individual fish data forms, and field working maps.
- Attachment 3 typically consists of fish aging structures. No aging structures were requested or collected during the 1999 upper Bonaparte FFHIP.
- Attachment 4 typically consists of voucher/DNA samples, but no voucher specimens were taken during the 1999 upper Bonaparte FFHIP.
- Attachment 5 contains photodocumentation records including a photo CD, a photo CD index, plastic index sleeves containing all photos and accompanying negatives.
- Attachment 6 is comprised of a floppy disk containing digital deliverables

## 3.6 Phase 6: Reporting and Mapping

### 3.6.1 Data Organization

Data are presented in Appendix 1, and are organized in the following fashion: For each site sampled, all data, including Reach and Site card, the Fish Collection/Individual Fish Data Forms (if sampled for fish), representative photographs, and Non-Fish Bearing Status Reports (if applicable) are presented. The Overview, Project, and Fisheries Interpretive maps (Appendix 2) are contained in map sleeves in an accompanying binder.

### Stream/Riparian Classifications

- S1 Fish Stream >20m average channel width
- S2 Fish Stream 5m-20m average channel width
- S3 Fish Stream 1.5m-5m average channel width
- S4 Fish Stream <1.5m average channel width
- S5 Non-Fish Stream >3m average channel width
- S6 Non-fish Stream <3m average channel width

(Province of British Columbia. 1998c)

### 3.6.2 Report

This report follows the format provided by MELP in the *Reconnaissance (1:20,000) Inventory Standards* and on the MELP website. Included in the report are discussions on fisheries values, fish habitat values, and stream classifications. Recommendations for future sampling are presented for streams that could not be classified conclusively, and non-fish bearing report(s) (consistent with current non-fish bearing status report requirements) are included for established non-fish bearing reaches.

Several reaches sampled during the 1999 field season had no visible channel (NVC). For the purposes of this report, it is assumed that NVC reaches are non-fish bearing, and non-fish bearing reports have not been included for these reaches. Non-fish bearing reports are included for each reach with a definitive non-fish bearing status, and the discussion supporting that classification addresses sampling methods, sampling effort, habitat conditions, barriers to fish passage, and water quality conditions.

The *BC Forest Practices Code Fish Stream Identification Guidebook* recommends follow-up sampling in order to determine fish presence or absence where such information could not be determined during initial sampling. In the current study, depending on the results of the initial survey,

follow-up sampling has been recommended by either the survey team or by the reporting biologist during review and analysis of field card data. In the upper Bonaparte River watershed, optimal follow-up sampling conditions typically occur during or following spring freshet; however, this sampling may depend on priorities and funding available.

### **3.6.3 Mapping**

For the entire upper Bonaparte River study area, the TRIM maps (46) were merged when possible to produce a final total of 16 map sheets. The FDIS7.3 mapping tool (which presents hardcopy maps in Albers projection) was used to produce all maps. Project maps include watershed codes, ILPs for those streams or waterbodies awaiting watershed code assignment, stream and lake names, waterbody identifiers, reach breaks and reach data, fish species distribution, sample site locations and basic site data, features, and fisheries sensitive zones.

Map submissions are contained in Appendix 2 and include all 16 TRIM basemaps for the entire project area (16 Project maps and 16 Interpretive maps). In subsequent years, only the maps which contain site information will be submitted. This is the first year that all reach information has been digitized and plotted. The mapping process can be streamlined in subsequent years by performing quality assurance procedures on all the maps in year one, thereby reducing or eliminating mapping errors relating to the digitization of the base data.

## **4.0 Results and Discussion**

### **4.1 Logistics**

During the 1999 field season, four random sites were excluded from 1999 field sampling due to inaccessibility. Four alternate sites were substituted to maintain sampling goals. These changes are presented in Table 6.

The information listed under channel comments on the site card for site 400, 120-506800-32200 reach 1, indicates that the field crew drove 5.2 km too access the site. Actual driving length should have been closer to 5.7 km and the crew should have walked approximately 100m to access the site. The site card identifies the channel as NVC. Due to the possible discrepancy in location, this site has been added for resampling (Table 12).

## 4.2 Summary of Sub-basin Biophysical Information

A summary of information collected for the Residual and Rayfield sub-basins is listed in Table 3 and Table 4 respectively.

Table 3. A summary of information collected for the Residual sub-basin.

total stream length (km)	1213.48
average reach length (km)	2.16
average reach gradient (%)	13.13
total reaches	1127
reaches $\geq$ 30%	170
reaches $\geq$ 20%	285
total sites surveyed	50
average stream temperature (c)	8.8
average pH	8.3
average conductivity (uS/cm)	360
average site gradient (%)	9.5

Table 4. A summary of information collected for the Rayfield River sub-basin.

total stream length (km)	1272.56
average reach length (km)	1.51
average reach gradient (%)	5
total reaches	1691
reaches $\geq$ 30%	42
reaches $\geq$ 20%	88
total sites surveyed	19
average stream temperature (c)	10.2
average pH	8.2
average conductivity (uS/cm)	553
average site gradient (%)	3.92

## 4.3 Achievement of Project Objectives

Table 5 summarizes sampling activities in the 1999 upper Bonaparte River study area. Initial projections for proposed sampling are contrasted with sampling results for the 1999 field season. A total of 69 reaches (39 random and 30 bias) were selected for sampling, and a total of 69 reaches (35 random, 30 bias, and 4 alternate) were sampled in 1999 (Table 6).

**Table 5. Summary of 1999 Inventory Achievements**

Project Area Sampling Summary	
1:20,000 mapsheets (10)	92P.003, 92P.013, 92P.014, 92P.015, 92P.024, 92P.025, 92P.026, 92P.035, 92P.036, 92P.037

Watershed area	4,487.1 km <sup>2</sup>
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<b>Planning Targets and Field Sampling Achievements</b>
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# of proposed random reach sample sites	39
# of random reaches sampled in 1999	35
# of proposed bias reach sample sites	30
# of bias reaches sampled in 1999	30
# of alternate reaches sampled in 1999	4
total # of proposed stream reach surveys	69
total # of reaches sampled in 1999	69

<b>Lake Sampling Program</b>
------------------------------

# of proposed primary lake surveys	0
# of primary lake surveys completed in 1999	0
# of proposed secondary lake surveys	0
# of secondary lake surveys completed in 1999	0

**Table 6. Changes to 1999 Sampling Plan**

ILP/WSC	Site #	Reach	TRIM Map	Comments
81035	203	1	92P.026	unsampled random reach, poor access
82042	204	1	92P.026	unsampled random reach, poor access
120-506800-66800	324	5	92P.026	unsampled random reach, poor access
80170	187	2	92P.013	unsampled random reach, poor access
50071	501	2	92P.035	alternate site, replaces site 203
120-506800-61400	502	10	92P.036	alternate site, replaces site 324
120-506800-64800	503	2	92P.026	alternate site, replaces site 187
82039	504	1	92P.036	alternate site, replaces site 204

#### 4.4 Fish Age, Size, and Life History

During fish sampling efforts in the 1999 field season, only fry and juvenile fish were captured. All fish captured are resident species, except for chinook salmon juveniles captured at site 118 on Loon Creek reach 1. Fish scale samples were not taken and the reported ages, Figure 1, were determined by grouping lengths into appropriate age classes (Bustard 1991, Higginbottom, 1989). Voucher specimens will be collected for the entire project area over the duration of the study. Vouchers were not collected in 1999 as these sub-basins require further sampling and the fish identification specialist (Alex Peden) prefers to receive all vouchers for a given area at the same time. Length-frequency histograms for rainbow trout and white suckers are listed in Figure 2 and 3 respectively.

Figure 1. Linear regression of length vs weight for all rainbow trout captured in the 1999 field season.

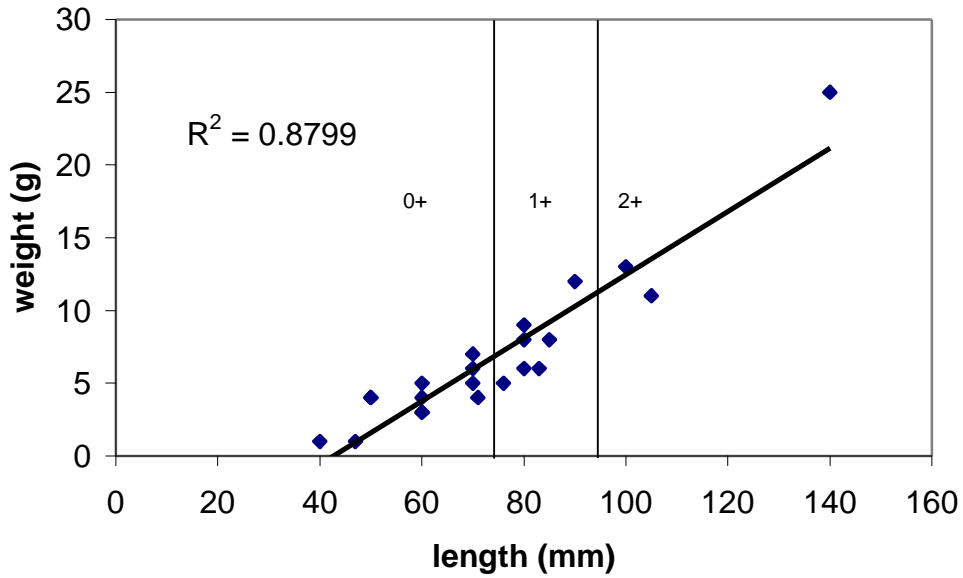


Figure 2. Length-frequency histogram for all rainbow trout captured in the 1999 field season.

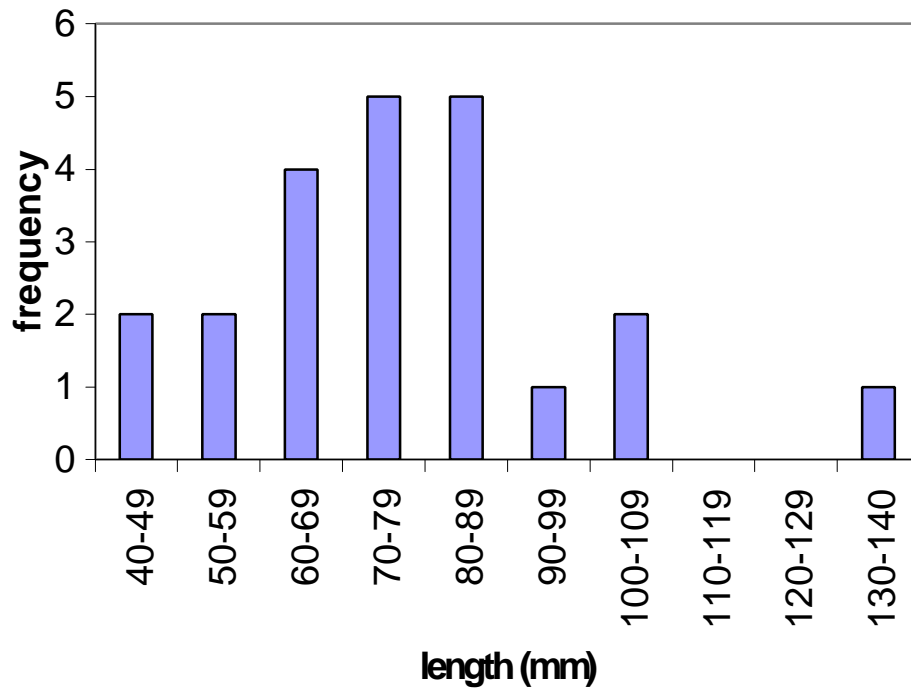
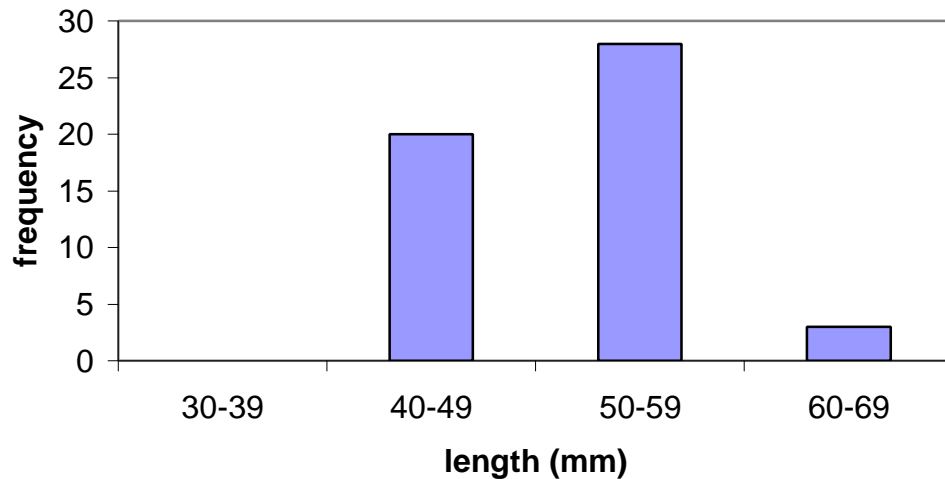


Figure 3. Length-frequency histogram for all white suckers captured in the 1999 field season.



## 4.5 Significant Features and Fisheries Observations

### 4.5.1 Fish and Fish Habitat

Of the 69 sites that were sampled in 1999, only ten reaches had enough water to allow for fish sampling (14.5%). Forty-nine (49) of sixty-nine (69) reaches, or 71% of reaches sampled were non-visible channels (NVC). In two cases when air photograph interpreted stream reaches were found to be non-channelized wetlands, photographs were taken and the reach was assigned an NVC-w designation which recognizes the potential for fish to utilize the reach under some conditions. These reaches are:

- Fly Creek –506800-51900 reach 4 NVC-w
- -57600-15100-0010 reach 5 NVC-w

The remaining reaches were either dry/intermittent (10/69 or 14.5%).

Anecdotal information from local residents suggests that rainbow trout have inhabited Fly Creek historically. To augment the limited fisheries information on this creek, 3 baited minnow traps were left overnight in lake reach 5 WBID 00617BONP. No fish were captured in this lake.

A total of 93 fish were captured in 1999. Fish sampling was conducted in ten reaches during the 1999 field season, with fish being captured in only three of these reaches. A discussion of the lack of fish presence at 7 sites follows.

**Site 409**, 120-506800-49600 reach 2

**Residual Sub-basin**

Reach 1 is directly accessible to fish inhabiting the Rayfield River. The gradient of reach 1 (13%) does not default reach 2 to non-fish bearing, however, fish habitat in reach 2 rates as poor to moderate, primarily based on a lack of water. Fish presence in reach 2 is possible but the available habitat is limited.

**Site 411**, 120-506800-51900 reach 4, Fly Creek

**Residual Sub-basin**

Reach 4 is a non-channelized wetland characterized by diffuse flow through sedge. There is no FISS information for this creek but fish were observed in a previous survey of Marsden Lake which is directly connected to Fly Creek reach 15 (Mitchell and Sydney, 1994). Three baited minnow traps were set overnight in lake reach 5 (WBID 00617BONP) but did not capture any fish. There is an abundant population of fresh water shrimp in this lake. There are flow control structures installed by Ducks Unlimited at the outflow of several upstream lakes. Fish presence in this creek appears to be restricted by low flows. Flood signs indicate that the water level has dropped significantly compared to historic levels.

**Site 502**, 120-506800-61400 reach 10, Campeau Creek

**Residual Sub-basin**

No fish were caught in a 1995 survey of Campeau Lake reach 7 (FISS 5461 and 5462) and no fish were captured by electrofishing for 400m or by minnow trapping during the present survey. The lack of fish capture in moderate habitat suggests that there may be a full obstruction to fish passage downstream. The channel in the upper end of reach 3 and the lower end of reach 4 appears to be confined and should be targeted for an aerial overflight to locate a potential barrier. The site in reach 3 (414) was dry and did not aid in defining fish species distribution in this stream.

**Site 501**, ILP 50071 reach 2

**Rayfield River Sub-basin**

No barriers to fish passage were observed. Fish presence earlier in the year is expected.

**Site 227**, 120-506800-57600-48200-9800 reach 22, Tin Cup Creek

**Rayfield River Sub-basin**

Tin Cup Creek drains into Green Lake and there are no barriers indicated in FISS. Lake Chub were captured in Tin Cup Lake (reach 17) in a 1977 survey (01826GRNL) and barring the presence of an unknown obstruction in reaches 18-21, this species should be present in reach 22. Green Lake rainbow trout may be obstructed from accessing reach 22 by a series of

wetlands. The possibility of a wetland obstruction(s) is supported by the Tin Cup Lake survey, where no rainbow trout were captured. Additionally, high water temperature may prohibit the establishment of salmonids in this habitat. The water temperature in reach 22 on September 20 was still relatively high (14 C) for the late sampling date, suggesting that stream temperature in mid-summer is definitely above the optimum temperature for growth (14 C) and potentially above the tolerance range for rainbow trout (0-28 C for adults). Water temperature in excess of 24 C and dissolved oxygen levels less than 3 mg/ml are generally lethal for juvenile rainbow trout (Ford, B.S et. al. 1995)

**Site 307**, 120-506800-57600-19500 reach 2

**Rayfield River Sub-basin**

Reach 2 offers moderate to high value rearing habitat for rainbow trout and water depth was adequate during the present survey to support this species. An attempt to identify a downstream barrier in reach 1 was made and revealed a 1m falls that may be a full obstruction. This falls was not identified as a feature because the degree of obstruction was inconclusive. If a second sampling does not capture fish, the 1m fall probably represents the upstream limits of fish distribution in this stream.

**Site 308**, 120-506800-57600-31200 reach 2

**Rayfield River Sub-basin**

The majority of flow within reach 2 is subsurface which may obstruct fish passage. Reach 1 drains into Pressy Lake, suggesting that an adfluvial population of rainbow trout probably utilises this stream at some time in the year.

Table 7 shows fish sampling data from the 1999 field season. Of the fish that were captured, five separate species were identified. Two sampling methods were employed, the primary method was electrofishing, and the secondary method was minnow trapping. Nine reaches were electrofished, for a cumulative effort of 2922 seconds and an average effort of 324.7 seconds. A total of 21 minnow traps were set at 7 reaches for a cumulative effort of 607.5 trap hours and an average effort of 28.9 hours per trap.

Due to the sparse fish distribution encountered in 1999, the general pattern of fish distribution cannot be accurately described. It is worth noting that fish were captured only in the Rayfield and Loon Creek mainstems, while no fish were captured in tributaries.

Reach 1 of Loon Creek (120-506800-28300) provides important rearing habitat for juvenile chinook salmon, mountain whitefish, and rainbow trout.

Rainbow trout, lake chub, and white suckers were captured in reach 6 of the Rayfield River (120-506800-57600). A 3.5m impassable falls barrier at the downstream end of reach 6 indicates that the fish above these falls are a resident population. Mainly rearing habitat was found in reach 6, although some overwintering potential exists because of the numerous deep pools.

Although no salmonids were captured in reach 4 of the Rayfield River (120-506800-57600), presence in upstream reaches means that reach 4 likely provides fish habitat at some time(s) of the year, and should be regarded as a fish bearing reach.

No special populations, rare/sensitive species, high value sportfishing opportunities, or other significant findings were noted during the 1999 field season.

**Table 7. Fish species captured in upper Bonaparte Watershed, 1999**

WSC/Gazetted Name	Site #	Fish Species	Life Stage	Number Captured
120-506800-28300 Loon Creek	118	rainbow trout <i>Oncorhynchus mykiss</i>	fry	11
120-506800-28300 Loon Creek	118	rainbow trout <i>Oncorhynchus mykiss</i>	juv/ad	8
120-506800-28300 Loon Creek	118	chinook salmon <i>Oncorhynchus tshawytscha</i>	juv	2
120-506800-28300 Loon Creek	118	mountain whitefish <i>Prosopium williamsonii</i>	juv	9
120-506800-57600 Rayfield River	304	lake chub	all	4
120-506800-57600 Rayfield River	304	white sucker	all	48
120-506800-57600 Rayfield River	305	rainbow trout <i>Oncorhynchus mykiss</i>	juv/ad	3
120-506800-57600 Rayfield River	305	white sucker	fry	3
120-506800-57600 Rayfield River	305	lake chub	fry	5

The location of two features in the upper Bonaparte study area that may effect fish migration were confirmed. These features were both waterfalls, and are included in Table 8. Both of these features have been previously identified, and exist in FISS databases.

**Table 8. Features Identified within the 1999 upper Bonaparte Study Area**

Watershed Code	Reach	Map	Type	Description
120-506800-57600	4	92P.035	F	3.5m high, 0.5m long bedrock falls
120-506800-57600	6	92P.035	F	10m high, 7m long bedrock cascade

Both of these waterfalls are located on Rayfield River, and they do not appear to limit fish distribution, as indicated by the presence of rainbow trout *Oncorhynchus mykiss* in upstream reaches. Photographs and accompanying information for these features are presented in Appendix 1.

#### **4.5.2 Habitat Protection Concerns**

##### *4.5.2.1 Fisheries Sensitive Zones*

No fisheries sensitive zones have been identified within the 1999 upper Bonaparte study area.

##### *4.5.2.2 Fish above 20% Gradients*

No fish were captured in stream reaches above 20% gradient during the 1999 field season. Seven reaches were sampled with gradients  $\geq 20\%$  and all were classified as NVC.

##### *4.5.2.3 Restoration and Rehabilitation Opportunities*

No restoration or rehabilitation opportunities were noted during the present survey. Refer to the ARC 1998 Fish Habitat Assessment for areas previously identified as impacted by forestry related activities.

## 4.6 Fish Bearing Status

Fish bearing status is either directly supported by sampling data, or indirectly inferred based on fish captures in associated reaches, or habitat quality and the lack of barriers to fish passage.

**Table 9. Summary of data from surveyed fish bearing reaches in the upper Bonaparte watershed**

Stream Name	WSC	Reach	Species	Channel Width (m)	Site Gradient (%)	Proposed Riparian Class	Follow-up Sampling Required?	Comments
Loon Creek	120-506800 -28300	1	CH, MW, RB	4	4.5	S3	N	
Rayfield River	120-506800 -57600	6	LKC, RB WSU	7.5	2.5	S2	N	
Rayfield River	120-506800 -57600	4	LKC,WSU	9.9	1.25	S2	N	Fish use assumed due to upstream presence

**Table 10. Summary of data from surveyed Non-fish Bearing reaches in the upper Bonaparte watershed**

Stream Name	WSC or ILP	Reach	Gradient (%)	Electrofishing Specifications				Other Methods		Comments
				Dist (m)	Time (s)	Cond (uS)	Temp (C)	Type	Effort	
unnamed	80271	1	6.5	none	none	none	none	none	none	300m subteranean channel, high gradients downstream

### 4.6.1 Riparian Management Area Classifications

Riparian Management Area (RMA) classifications have been assigned to 53 of the 69 reaches surveyed during the 1999 season. Of the 53 reaches that have been classified, 49 are classified as drainages, 3 reaches are fish bearing, and 1 reach is non-fish bearing. The remaining 16 unclassified reaches will be assigned a RMA classification after follow-up sampling establishes fish presence or absence.

#### 4.6.1.1 Fish Bearing Reaches

Fish-bearing status has been assigned to only 3 reaches in the upper Bonaparte River study area at this time. Table 7 lists fish bearing reaches in the upper Bonaparte study area.

#### 4.6.1.2 *Non-Fish Bearing Reaches*

One reach was assigned non-fish bearing status (Table 10). Non-fish bearing status can be assigned to reaches that have no fish habitat or reaches that have barriers which prevent fish from accessing and utilizing the reach. A non-fish bearing report provides a rationale for the single non-fish bearing reach in the 1999 study area, and appears in Appendix 3.

#### 4.6.1.3 *Unclassified Reaches*

Sixteen reaches in the upper Bonaparte study area have been assigned non-definitive classifications that require further sampling before final classifications are assigned (Table 10). These reaches have been recommended for additional sampling to determine classification.

#### 4.6.1.4 *No Visible Channel Reaches*

Forty-nine reaches were classified as drainages, officially designated as no visible channel (NVC), and receive a default non-fish bearing classification (Table 11).

#### 4.6.1.5 *Follow-up Sampling Required*

Ten of the sixty-nine stream reaches surveyed in the 1999 field season were not sampled for fish, due to insufficient flow or lack of water. Of the remaining fifty-nine, another nine sites were sampled for fish. No fish were captured at seven of these sites, although suitable fish habitat was present at the reach. For these reasons, follow-up sampling is required for 17 reaches of the 69 reaches in the 1999 study area (Table 12).

The optimal time to sample these reaches would be immediately following spring freshet. In high flows, these reaches may be accessible by fish, and fish could be intercepted as they use these habitats for migration, spawning, or rearing. Obviously, spring freshet is a valuable time for spawning trout, and caution must be exercised during sampling efforts to disturb spawning fish as little as possible. This sampling would occur outside the normal sampling window, and BC Ministry of Environment and the Department of Fisheries and Oceans would have to approve of sampling methods most suitable for second-pass efforts.

**KEY**

NS= Not sampled

NFC= No fish caught

NVC= No visible channel

RMA= Riparian Management Area

RMA classifications S1-S6 are explained on page 12 of this report

**Table 11. Riparian Management Area Classifications for upper Bonaparte River Study Area**

WSC/ILP	Site	Reach	Mapsheet	Site Length	Average Width	Fish Species	RMA Class	Comments
120-506800-28300	118	1	92P.003	100	3.97	CH,MW,RB	S3	Moderate juvenile salmonid rearing habitat, high value CH rearing habitat
80061	182	1	92P.003	100			NVC	
80110	183	1	92P.013	100			NVC	
80115	184	1	92P.013	100			NVC	
80120	185	1	92P.013	100			NVC	
80132	186	2	92P.013	100			NVC	
80179	188	2	92P.013	100			NVC	
80271	189	1	92P.017	100	0.63	NS	S6	300m subteranean flow d/s of reach
50008	191	1	92P.025	200			NVC	
80380	192	1	92P.025	100			NVC	
80384	193	1	92P.025	100			NVC	
80394	194	2	92P.025	200			NVC	
80461	195	1	92P.025	100			NVC	
81005	196	1	92P.025	100			NVC	
81006	197	1	92P.025	100			NVC	
81006	198	2	92P.025	100			NVC	
81009	199	1	92P.026	100			NVC	
82042	205	1	92P.026	100			NVC	
120-506800-57600-19500-2800	225	2	92P.035	100			NVC	
120-506800-57600-48200-5930	226	5	92P.035	100			NVC	
120-506800-57600-48200-9800	227	22	92P.035	100	1.02	NFC	S4/S6	resample during freshet to determine classification
50360	242	1	92P.035	200			NVC	
50054	243	2	92P.035	100			NVC	
50072	244	2	92P.035	150			NVC	
50108	245	1	92P.035	200			NVC	

WSC/ILP	Site	Reach	Mapsheet	Site Length	Average Width	Fish Species	RMA Class	Comments
50137	246	1	92P.035	100			NVC	
50932	249	8	92P.035	300			NVC	
120-506800-37500-62200	299	1	92P.013	100			NVC	
120-506800-44700	300	2	92P.014	100			NVC	
120-506800-48700	301	2	92P.024	100			NVC	
120-506800-51900	302	1	92P.024	100	4.83	NS	S3/S5	resample during freshet to determine classification
120-506800-51900	303	1	92P.024	200			NVC	
120-506800-57600	304	4	92P.035	100	9.92	LKC,WSU	S2	Moderate juvenile/adult salmonid rearing habitat, no salmonids captured during sampling, default S2 due to u/s presence
120-506800-57600	305	6	92P.035	100	7.5	RB,LKC,WSU	S2	Abundant juvenile/adult salmonid rearing habitat, limited spawning habitat
120-506800-57600-09100	306	3	92P.025	300			NVC	
120-506800-57600-19500	307	2	92P.035	120	1.06	NFC	S4/S6	resample during freshet to determine classification
120-506800-57600-31200	308	2	92P.035	100	0.38	NFC	S4/S6	resample during freshet to determine classification
120-506800-61400-00600	321	2	92P.025	100			NVC	
120-506800-66200	322	2	92P.026	100	1.63	NS	S3/S5	resample during freshet to determine classification
120-506800-66200-22700	323	3	92P.026	100	0.57	NS	S4/S6	resample during freshet to determine classification
80148	401	1	92P.013	100			NVC	
120-506800-42800-05200	402	2	92P.014	100			NVC	
80233	403	3	92P.014	100			NVC	
80246	404	2	92P.014	100	1.03	NS	S4/S6	resample during freshet to determine classification
120-506800-48700	405	7	92P.014	100	0.5	NS	S4/S6	resample during freshet to determine classification

WSC/ILP	Site	Reach	Mapsheet	Site Length	Average Width	Fish Species	RMA Class	Comments
120-506800-44600	406	2	92P.024	100			NVC	
80301	407	3	92P.024	100			NVC	
120-506800-50400	408	2	92P.024	100			NVC	
120-506800-49600	409	2	92P.024	100	0.43	NFC	S4/S6	resample during freshet to determine classification
120-506800-51900-00900	410	4	92P.024	100	0.68	NS	S4/S6	Resample during freshet to determine classification
120-506800-51900	411	4	92P.024	400	NA	NFC	Wetland	resample during freshet to determine classification
80399	412	4	92P.025	100			NVC	
1	413	1	92P.025	100	1.13	NS	S4/S6	resample during freshet to determine classification
120-506800-61400	414	3	92P.025	100	1.65	NS	S3/S5	resample during freshet to determine classification
81019	415	2	92P.026	100			NVC	
120-506800-70400-27400	416	4	92P.036	100			NVC	
120-506800-74100	417	4	92P.036	150			NVC	
81062	418	2	92P.036	100			NVC	
81088	419	4	92P.037	100			NVC	
81085	420	5	92P.037	150			NVC	
120-506800-57600-15100-0100	421	5	92P.035	100			NVC	
80	422	1	92P.035	100	0.44	NS	S4/S6	resample during freshet to determine classification
120-506800-57600-28600	423	3	92P.035	200			NVC	
50085	424	3	92P.035	200			NVC	
50071	501	2	92P.035	100	1.23	NFC	S4/S6	resample during freshet to determine classification
120-506800-61400	502	10	92P.036	100	1.06	NFC	S4/S6	resample during freshet to determine classification
120-506800-64800	503	2	92P.026	100			NVC	
82039	504	1	92P.026	100			NVC	

**Table 12. Reaches Recommended for Follow-Up Sampling**

Stream Name	ILP/Watershed Code	Reach	Timing	Methods	Comments
Tin Cup Creek	120-506800-57600-48200-9800	22	spring	EF,MT	Good rearing potential, distinct channel, may connect to Tin Cup Lake
Fly Creek	120-506800-51900	1	spring	EF,MT	Excellent spawning gravel, deep pool areas, good cover of boulders and LWD, signs of small flow this year -- stream is noted to support trout historically.
unnamed	120-506800-57600-19500	2	spring	EF,MT	Rearing habitat exists, also some upstream lakes
unnamed	120-506800-57600-31200	2	spring	EF,MT	Could offer seasonal rearing habitat
unnamed	120-506800-66200	2	spring	EF,MT	Abundant clean spawning gravel, LWD and OV cover, appears to be seasonal water
unnamed	120-506800-66200-22700	3	spring	EF,MT	Seasonal stream between two lakes, possible rearing habitat close to lakes.
unnamed	80246	2	spring	EF,MT	Seasonal flows present, may offer rearing habitat
unnamed	120-506800-48700	7	spring	EF,MT	Rearing habitat present in wetlands
unnamed	120-506800-49600	2	spring	EF,MT	Small open water area u/s, potential rearing habitat, evidence of good spring flows
unnamed	120-506800-51900-00900	4	spring	EF,MT	May have seasonal flow, possible fish in lake downstream ~200m from site
Fly Creek	120-506800-51900	4	spring	EF,MT	Beaver pond upstream of site, may be connected in freshet
unnamed	1	1	spring	EF,MT	Potential spawning habitat, some lakes present upstream
unnamed	120-506800-61400	3	spring	EF,MT	Potential spawning habitat, evidence of considerable spring flows, May be connected to lake downstream
unnamed	80	1	spring	EF,MT	May be connected to lake downstream
unnamed	50071	2	spring	EF,MT	Potential rearing habitat
unnamed	120-506800-61400	10	spring	EF,MT	Potential rearing habitat, presence of spawning gravel in d/s end of reach
unnamed	120-506800-32200	1	July	EF,MT	NVC classification but the crew potentially sampled in the wrong location. Resample.

**KEY**

EF=Electrofishing

MT=Minnow Traps

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