Disclaimer

Re: Westworth Associates Environmental Ltd. 1998. "Isle Pierre Reconnaissance Fish and Fish Habitat Inventory (1996), Spring Sampling and Additional Sampling Sites (1997)." Canadian Forest Products Ltd. 180p. *(referred to as the spring sampling report)*

and

Westworth, Brusnyk & Associates Ltd. 1998. "A (1996) Reconnaissance-Level Fish and Fish Habitat Inventory of Portions of the Chilako and Nechako River Watersheds." Candadian Forest Products Ltd. Isle Pierre Division. *(referred to as the 1996 report and project maps)*

The 1997 spring sampling work was done to 1) resample some 1996 sites and 2) finish parts of the 1996 sample plan that were not completed. Later, the 1996 project maps were updated with the results of this spring sampling effort. Some information presented in Tables 1 and 2 of the spring sampling report is incorrect. As well, some information in these tables is incorrect, or missing, on the associated 1996 project maps.

The attached "Revisions to Table 1" and "Revisions to Table 2" document **in bold text** clarifications and changes to Tables 1 and 2 and the 1996 maps. Users are advised to consider the information in these revised tables as correct and approved by the Ministry, and should note that some RMA stream classifications have now been changed from those in the spring sampling report and 1996 maps. Only data records of concern are included in the Disclaimer Tables. Other information presented in Tables 1 and 2 of the spring sampling report and on the 1996 maps was previously approved by the Ministry.

Readers are advised to disregard the reach numbers presented on the maps within the spring sampling report; refer instead to the reach numbers on the 1996 project maps, 1997 spring sampling data cards and database.

Revisions to Table 1 (Westworth Isle Pierre 1997) Sites previously sampled, revisited during the spring of 1997.

Watercourse Name/Code	RSS #	TRIM	UTM (Zone 10)	Sample Date	Fish Presence 1997	Fish Species Presence in Downstream Reach	Downstream Reach classification	New Stream Classification	Classification that appears on Maps	Comments/Corrections
Naltesby Lake Tributary (Grizzly Lake): WSC # 180-0690-580										
180-0690-580-867-499	25	**093G.062**	**453205.5944305**	6/21/97	0	0	S4	S4	**None**	**The map symbol should say NFC (MT set) , not NVC channel**
180-0690-580-919	26	**093G.062**	**451554. 5944305**	6/21/97	0	RB	S4	**NVC**		**Comments indicate that there is no defined channel (NVC).**
180-0690-580-855	27	**093G.062**	**453272. 5942745**	6/21/97	0	RB, LKC	S3	**NVC**	**P-S3**	**Comments indicate a gully with NVC.**
Chilako River Tributary # 4 : WSC # 180-0690-231										
180-0690-231	1	**093G.065**	**491100.5946820**	7/10/97	LKC	Chilako R	NA	S3	**P-S2**	**This site was first sampled at a location that was not representative of the reach putting it into an S2 classification. The 97 sample is more appropriate (default S3). Site symbol width should be 2.7 not 5.5 metres.**
Lumpy Lake (Chilako River Tributary # 8) WSC# 180-0690-580-191										
180-0690-580-191-454	6	**93G.063**	**472264.5939066**	6/25/97	0	RB	S4	**S3**	**P-S3**	**Channel widths varies from S4 to S3 over two sample efforts. Default classification is S3.**
180-0690-580-191-624	10	**93G.064**	**475472.5942279**	7/10/97	RB	RB	S3	S4	**P-S4**	**The map symbol (NS) should read RB and should be attached lower in the reach. This site is an S4.**
Chilako Tributary # 9: WSC # 180-0690-636										
180-0690-636	1	**093G.053**	**464512.593798**	6/26/97	SU/LKC	NA	Chilako	S3	**P-S3**	**Site symbol indicates NFC, should read SU and LKC.**
180-0690-636-380-999-003	17	**093G.053**	**466854.5934783**	6/26/97	LKC	NA	Lake	S4	**P-S4**	**Site symbol should indicate that LKC were caught, not NS.**
Clucluz Creek Tributary: WSC 180-1913										
180-1913-752-118	7	**093G.072**	**456929.5950325**	6/24/97	RB	RB	S3	S4	**P-S4**	**NS on site symbol should read RB. S4 stream.**
180-1913-798-597-122	63	**093G.061**	**445314.5949671**	6/24/97	0	RB	S3	S4	**P-S4**	**Map symbol should read NFC, and it should be relocated to proper location. The map symbol appears near site 62. The S4 classification is correct.**

Revisions to Table 2 (Westworth Isle Pierre) Sites initiated in 1996, completed in 1997.

Sub-Watersheds in the Isle Pierre operating area, initiated in 1996, completed in 1997.

Watercourse Name/Code	RSS #	TRIM	UTM (Zone 10)	Sample Date	Fish Presence 1997	Fish Species Presence in Downstream Reach	Downstream Reach classification	New Stream Classification	Classification that appears on Maps	Comments
Naltesby Lake Tributary (Grizzly Lake): WSC 180-0690-580										
180-0690-580-769	7	**093G.062**	**455897.5941267**	8/24/97	RB/LKC	RB	S3	S3	**None**	**Sample symbol not placed on map as required. The UTM for this site should be 10. 455774.5941263. This is an S3 stream.**
180-0690-580-766	21	**093G.062**	**455793.5940186**	8/24/97	NA	RB	S3	**NVC**	**None**	**Sample site symbol not placed on the map as required. The site should be at UTM 10. 455628.5940262, and the classification should be NVC, not UC.**
180-0690-580-751	18	**093G.062**	**457049.5941468**	8/24/97	NA	RB	S3	**NVC**	**NVC**	**The map symbol is correct, Table 2 in the report is not; classification should be NVC.**
180-0690-580-714	6	**093G.062**	**458049.5940084**	8/24/97	NA	RB	S3	S4	**None**	**There is no information for this site on the map.**
Norman Creek Tributary: WSC 180-1913-284										
180-1913-284-948	17	**093G.073**	**470211.5960410**	8/25/97	NA	RB	S3	**NVC**	**None**	**No information was presented on map; it should read NVC.**
180-1913-284-503	15	**903G.083**	**465337.5962695**	8/30/97	NA	RB	S3	S4	**None**	**No information is presented on the map.**
180-1913-284	5	**903G.083**	**463649.5966539**	8/25/97	RB/LKC/ WSU	RB	S3	S3	**None**	**No information was presented on maps for this site.**
180-1913-284-627	21	**903G.073**	**467059.5961212**	8/25/97	NA	RB	S3	S4	**None**	**No information was presented on the maps.**
180-1913-284-564	16	**903G.083**	**465999.5961850**	8/25/97	NA	RB	S3	S4	**None**	**No information was presented on maps. UTM should be 10.465803.5961894.**
180-1913-284	22	**903G.083**	**466297.5961824**	8/25/97	LKC/ WSU	RB	S3	S3	**None**	**No information presented on maps.**
Norman Lake Tributary: WSC 180-0690-205-648										
180-0690-205-648	18	**093G.074**	**473802.5951959**	7/20/97	RB	RB	S3	S3	**None**	**No information presented on maps.**
Cluculz Creek Tributary: WSC 180- 1913										
180-1913	49	**093G.071**	**446209.5956839**	7/12/97	RB	RB	S4	S4	**None**	**This site is an S4 (RB caught), but has no mapped information regarding stream class or sample site. The UTM for this site should be 10.446432.5956845.**

1.0 INTRODUCTION

In recent years, concern has been growing over the health of forest ecosystems in British Columbia. With ongoing timber harvesting and expansion of the forest products industry, concerns have been expressed that current commitments and forest practices may threaten biodiversity and other non-timber values (e.g., fish, wildlife, recreation and wilderness) in the province and the ability of forest ecosystems to sustain themselves. In response, the provincial government enacted the Forest Practices Code which provides a set of guidelines governing day-to-day forestry activities in British Columbia. To assist in managing and directing forest renewal investments associated with these guidelines, Forest Renewal BC was established.

Canadian Forest (CANFOR) Products Ltd. received approval from Forest Renewal BC to inventory potential fish-bearing streams in the Prince George region according to the requirements of the Forest Practices Code of British Columbia and various standards and procedures developed by the Resources Inventory Committee (RIC). Information obtained from this study would not only guide forest development plans by identifying fish-bearing streams but would also improve the resource management capabilities of public and private sector agencies by expanding the existing fisheries data base for the region.

The project provides one component of an inventory program designed to assist Canadian Forest Products Ltd. meet the requirements of the Forest Practices Code. This fish and fish habitat inventory is consistent with Forest Renewal BC objectives in that it will provide an improved understanding of the interactions between non-timber resources and forest management activities in the region. It also provides an information base upon which future forest management decisions can be made that meet the needs for sustained yield of timber while ensuring the protection of non-timber values and ecological integrity of the forest.

1.1 Objectives

The overall objective of the project was to undertake a reconnaissance-level fish and fish habitat inventory of the 16 sub-watersheds within the Chilako and Nechako River drainages. Specific objectives of the project were to:

Compile and review existing fisheries and stream classification information for the watershed.

Conduct sampling according to Ministry of Environment, Lands and Parks (MoELP) requirements for accurate determination of watercourse type and fish presence/absence as outlined in various RIC standards and procedures manuals.

Compile results of the field work in an approved RIC and FRBC/MoELP acceptable format

so that the information can be used to prescribe riparian management reserves and management zones and to facilitate forest harvesting plans that protect fisheries resource values in the watershed.

2.0 STUDY AREA

2.1 Location

Canadian Forest Products Ltd., Isle Pierre Division, has a mill that is located approximately 56 kilometers west of the City of Prince George and located adjacent to the Nechako River. The Isle Pierre Division operates a dimensional sawmill that is located to the north of the study area. The operating area includes portions of FWMUs 7-11 and 7-12 and although all weather and seasonal roads and trails are present, ground access is not as well developed as other operating divisions of CANFOR.

The study area is located in the Prince George Forest District of central British Columbia (Figure 1). This region of the province is bisected by two major utility-transportation corridors (Highways 97 and 16, and railway, pipeline and transmission line rights-of-way). Prince George is the major business centre in the community having a population of 75,000 people. Forestry is the number one industry in the area. Other major land uses in the region include various outdoor recreation and tourism activities (e.g., snowmobiling, horseback riding, camping, hiking, hunting and fishing), trapping, and cattle ranching.

The Chilako River, which forms part of the southern boundary of the Isle Pierre area, is the major watercourse in the area, although a number of smaller watercourses are also present. Bobtail (Naltesby) Lake, Little Bobtail Lake, and Graveyard (Eulatazella) Lake are the largest lakes in the study area.

2.2 Access

Access to the Isle Pierre area watershed is Highway 16 west of Prince George and a series of forestry roads that are located south of Cluculz and Bednesti lakes.

Access during the fisheries inventory was largely accomplished by 4-wheel drive vehicle, all-terrain vehicle (ATV), or on foot. Helicopter access was restricted by the lack of suitable landing locations but sites requiring helicopter access were accumulated for cost saving purposes and will be completed in 1997 or 1998. Figure 2 shows the tributaries, 16 sub-watersheds, reach sample sites and access in the Isle Pierre operating area which is covered by the Chilako and Nechako drainage areas.

2.3 Resource Use

Road development in the area has been primarily associated with timber harvesting. CANFOR has operated in the Isle Pierre area since 1969, after acquiring the mill from Lloyd Bros. who built the mill in 1960-61. The CANFOR, Isle Pierre Division operating area comprises 148,000 ha, of which approximately 23,000 ha have been logged. As a result of the road access, the fish, wildlife, and recreational resources have been used more completely. A number of camping areas and tourist facilities have been developed in the general area.

3.0 STUDY DESIGN AND METHODS

The work program was developed to reflect a number of distinct components or tasks required by the contract schedules. However, to ensure that the study met its objectives and maintained a high level of scientific and public credibility, it was designed and carried out with the following guidelines in mind:

Use of Standard Measurement Criteria **-** British Columbia has developed a set comprehensive of standards that cover all aspects of fish and fish habitat inventories in the province (Resources Inventory Committee 1995). These standards provide guidelines for project development, data collection, stream classification, mapping, digital files and report presentation. To ensure that the standards established for conducting reconnaissance-level fish and fish habitat inventories are met, the study team consulted extensively with MoELP personnel. In addition, the following documents provided overall direction for the fish and fish habitat inventory of the 16 sub-watersheds within the Isle Pierre area:

- Handbook for Land-based Programs (FRBC 1996),
- Lake and Stream Inventory: Standards and Procedures (RIC 1995),
- Ambient Freshwater and Effluent Sampling Manual (RIC 1994),
- Field Key to the Freshwater Fishes of British Columbia (RIC 1993),
- Fish Sampling Manual (RIC 1996),
- A Field Guide and Manual to the Collecting and Preserving of Aquatic Plants (RIC 1994),
- Identification Keys to the Aquatic Plants of British Columbia (RIC 1994),
- A Guide to Photodocumentation (RIC 1996),
- Aerial Photography and Videography Standards for Fish Habitat Channel Assessment (RIC 1996),
- Interior Watershed Assessment Procedure Guidebook (FPC),
- Fish-stream Identification Guidebook (FPC),
- Riparian Management Area Guidebook (FPC),
- Stream Survey Field Guide, Fish Habitat Inventory Program (DFO/MoELP

1989),

- Channel Assessment Procedure Guidebook (FPC), and
- BC Standards, Specifications, and Guidelines for Resource Surveys Using Global Positioning Systems (GPS) Technology (RIC 1995).

Companion Studies and Existing Information - This study avoided the unnecessary collection of redundant information and focused on those areas where the information need was greatest. The synthesis of the existing information was an important component of the project particularly in identifying reach sample sites.

Data Management Strategy - There was a need to establish a well-defined data management approach using geographical information systems (GIS) based on the requirements identified in Schedule A of the Detailed Request for Proposal.

Quality Control - Quality control guidelines developed for assessing the consistency and quality of field data collection, and mapping developed by RIC were followed throughout the course of the study.

The Study design incorporated the requirements as described in the Fish and Fish Habitat Request for Detailed Proposals - Schedule A. The approach that was followed included the following steps:
(a) review existing information,
(b) preliminary reach selection,
(c) logistical planning and orientation,
(d) field sampling program,
(e) refinement of reaches and sampling program,
(f) completion of field program and data compilation, quality assurance, and
(g) report preparation.

The major aspects of this study design are outlined in the following sections.

3.1 Use of Existing Information

One of the primary goals for the study was to maximize use of existing information. Biophysical data are costly to obtain and unnecessary duplication of sampling effort would limit the availability of resources required to address areas for which no information exists. Based on the review of background information, we have a reasonably complete understanding of the extent of existing data that is available for the 16 sub-watersheds in the

Isle Pierre study area.
Several sources of information which were examined included:

- Stream Information Summary System (SISS),
- Department of Fisheries and Oceans salmon escapement database system (SEDS),
- Fish Information Summary System (FISS), MoELP.
- Various aquatic biophysical inventory maps,
- Water Survey of Canada records,
- Historic precipitation records,
- Water license information,
- Fish stream and riparian area classification maps,
- and other general information such as land use, or other resource values (mineral prospecting, hydroelectric developments, etc.).

In addition, other potential sources of information were identified and the appropriate personnel were contacted. Some contacts included Canadian Forest Products Ltd. personnel, other operators in the general region, MoELP and the Department of Fisheries and Oceans. This was necessary to ensure that any information relevant to the projects was not overlooked since the last update of the FISS was in 1995.

3.2 Preliminary Reach Selection

Preliminary reach selection and selection of sampling sites within representative areas of a reach were based upon 1:50,000 map, 1:20,000 map, airphoto interpretation and field verification of reaches within the mainstem stream and tributaries. Reach breaks were located a) at the confluence of a tributary entering a watercourse in which discharge and widths were influenced significantly, b) at the mouth of streams entering other streams having distinct watershed codes, c) at locations where stream gradient changes occurred rapidly (e.g., waterfalls, hanging culverts) and d) where the confinement or the form of the channel changed significantly (RIC standards).

Reach sample sites were identified on all separate watercourses (tributaries) that appeared to be of significant size. This was completed with no field verification at the preliminary phase of the study. These reach sampling sites were random selections but were chosen strategically to provide an effective inventory of fish distribution within the study area. Subsequent field examination resulted in some changes in the number or reaches and the number of reach sampling sites. Each sampling site was selected to ensure that it:
(i) was representative of the river/stream reach in which it is located;
(ii) provided pertinent biological and hydraulic information of relevance to the study (e.g.,

(iii) channel morphometry, flow characteristics and presence of critical fish habitat); and was sufficiently large to provide a range of riverine habitats, yet small enough to permit efficient sampling using a variety of methods. This allowed field crews a significant amount of operational flexibility once in the field. The significance and importance of indicating fish absence was well-understood and the study team ensured that recommendations for any other seasonal sampling were documented.

With each reach sample site a stream survey form was completed. In some cases, the sampling site involved a complete measurement of all of the parameters identified on the standard stream survey forms.

However, survey forms were still completed for sampling sites where:

- channels were absent,
- channels were not well-defined,
- channels contained very low water flows,
- seepage areas occurred,
- bogs were present,
- channels were dry and,
- sub-surface flows were determined.

In these instances, the information recorded included descriptions, observations, locations, and if channels were distinct, width measurements (six measurements). All measurements of channel width were made in homogeneous and representative reaches of the various streams throughout the study area. Reaches having an intermittent flow were described and assessed as to their suitability as a fish habitat. When streams had defined banks and distinct channels but little or no flow they were considered to be intermittent. When identified watercourses had no defined banks and no channels they were described as drainages. Some of the drainages were seepage areas, dry bogs, terrestrial gullies and wetlands of varying types. Drainages did not have typical characteristics of permanent streams and did not have definable features associated with defined banks and beds.

Upper reach breaks were identified and located for many watercourses in the study area. These reach breaks generally identified the upper location of fish habitat in that particular reach. The information was recorded on the site card of the reach being sampled.

Where watershed code numbers were not available or did not exist, the Interim Watershed Locational Guidelines were applied to establish a temporary code. A total of nine uncoded streams were identified in the 1996 inventory.

3.3 Logistical Planning and Orientation

Field crews were properly trained and equipped to deal with the range of conditions that were encountered while working on complex and somewhat remote stream systems. Worker safety and strict adherence to the sampling protocols established by RIC were principal considerations for the study team.

To meet the expected needs of Canadian Forest Products Ltd., Westworth, Brusnyk & Associates Ltd. prepared a preliminary logistical plan that was based on the following considerations:

1. Organization of Field Crews - Because of the amount of effort required to collect the information at each sampling site (i.e., backpack electrofishing, fish habitat characteristics, etc.), the survey crew was comprised of a fish biologist/senior fish technician and one fish technician.

2. Access to Reach Sample Sites - Although some ground access by all weather and seasonal roads and trails exists, the areas are characterized by hilly to mountainous terrain, and as a result, some sampling sites such as headwater tributaries, were relatively inaccessible by ground. In these instances, foot travel was used to access these sampling sites.

3. ***Field Accommodation*** - Another important aspect of the logistical plan was the establishment of field camps at key locations, to best achieve efficient access to reach sampling sites.

4. ***Communications Support*** - It was necessary to establish a reliable communication system for crews operating in the field for safety, logistical and sampling protocol considerations. Trucks were fully equipped with mobile radios, ensuring close coordination and monitoring of field crews. This provided a degree of safety to crews operating in the field and also allowed us to coordinate and expedite the field logistics of the project in an effective manner. In addition, the Project Monitor, Industrial Forestry Service Ltd., was informed on the progress of the project on a regular basis, ensuring that any potential problems or issues that may arise in the field could be dealt with quickly.

Strict operating procedures and training requirements were instituted to ensure the safety of field crews. The detailed safety plan was finalized prior to the initiation of the field collection program and some of the issues which were dealt with included:

Communications **-** As described above, a key component of the field program was the implementation of a communications system to not only assist with the coordination of field logistics, but also to provide a method of providing emergency assistance in the unlikely event of injury or illness.

Bear Encounters **-** Field crews followed a number of procedures when at the field headquarters (and temporary camps) to avoid attracting bears. Food was stored to minimize odours and all garbage disposed of in approved disposal sites. Field crews carried bear spray and were supplied with a manual on safety procedures in bear country.

First Aid **-** Members of the study team held valid emergency or wilderness first aid (WCB approved Level 1 first aid with transportation endorsement) certificates and had access to WCB approved Level 1 first aid kits. Field crews were made fully aware of the wilderness, water, boat and aircraft safety procedures prior to the initiation of the field collection program. Field crews were also briefed on safety and operating procedures around trucks and aircraft. All members of the study team had valid driver's licenses and were fully aware of the nearest medical facilities when working in the field.

Because of the logistical difficulties involved in conducting inventories in remote areas, it was essential to ensure that crews were fully trained and familiar with sampling procedures before field work was initiated.

All individuals participating in the projects attended an orientation session designed to familiarize field crews with field equipment (trucks, ATVs, backpack electrofishers, etc.) and the sampling methodologies to be used in the field. The orientation and training session helped to ensure that the field sampling was conducted accurately and efficiently and that the sampling methodologies and protocol outlined in various RIC standards and procedures manuals were strictly followed by the field crews. A field sampling protocol booklet was provided to each crew member. Throughout the study, efforts were made to ensure that the DFO/MoELP stream survey cards were completed legibly and accurately.

3.4 Field Sampling Program

3.4.1 Reconnaissance-level Inventory Parameters

The stream inventory guidelines as outlined in Schedule A of the Request for Detailed Proposal formed the basis of the field sampling protocol. In addition, RIC standards and procedures were followed should there be any confusion as to the methods or parameters that were to be used in the study area. Additional measurement standards or deviations from the standards were coordinated with provincial agencies. Aquatic habitat parameters that were inventoried and the basic equipment that each field crew used is summarized in

3.4.2 Spatial and Temporal Sampling Plan

The parameters that were sampled as part of the reconnaissance-level fish and fish habitat inventory are summarized in Table 2. This table identifies the number of samples that were to be collected within each drainage for the entire study area along with the timing of the sampling. The information gathered at the upper ends of all the tributaries was intended to confirm the stream classification and to determine the extent of the watercourse. The following information was recorded by field crews at the upper ends of each watercourse:

- location where distinct channel definition ends (e.g., GPS location and delineation on aerial photographs or 1:20,000 TRIM maps)
- width measurements of defined channels including those that did not have any water flow at the time of field sampling, and
- recommendations associated with possible spring sampling to confirm spring spawning and fish presence when water flows may occur.
- Sampling was conducted during the mid-summer to early fall period to ensure that water levels, water temperatures (e.g. 4°C for electrofishing) and fish distribution/development was suitable to achieve the objectives of the proposed project.

3.4.3 Fish Absence

When fish were absent from a particular reach sample site, a second sampling site was selected within the reach and the fish sampling protocol was repeated. If the second sampling site also indicated the absence of fish, no further fish sampling in that reach was undertaken. This allowed field crews a significant amount of operational flexibility once in the field. This approach, was finalized with MoELP personnel. Procedures outlined in Schedule A of the Detailed Request for Proposal were followed to deal with streams that appear to have no fish. The significance and importance of indicating fish absence was well-understood and the study team ensured that recommendations for any other seasonal sampling were recorded.

The electrofishing undertaken with Coffelt Mark 18 backpack units which are designed for low conductivity waters. Crews utilized pulse frequencies and pulse widths that would provide the best attraction but least damaging to fish. Throughout the study area, the major fish species that were observed were relatively small-sized salmonids. As a result, a 90 Hz frequency was used with a 5 ms pulse width which results in a 45% duty cycle. If no fish appeared as crews moved through a section, the voltage levels were increased as repeat electrofishing occurred. Normally increased voltage rarely produced fish if they were not observed earlier.

Upstream limits of the fish distribution were based on actual sampling and as a result were reported in that manner. Assumptions of fish distribution were then made as field personnel moved upstream to a point at which either another reach break was observed or a termination point was identified. If no changes were noted the stream was considered as fish bearing based on the evidence from the sample site.

3.4.4 Headwater Tributaries

The upper reach break of the watercourses was identified and the channels at these points described. When spring spawners were noted in lower reaches of these streams, a need to examine these headwaters during the spring period was identified, especially if the upper reach was well-defined. A "P" notation was used with the stream classification (eg P-S4) to indicate a preliminary or provisional designation with regard to fish presence and thus, the need for additional sampling. A list of these watercourses is provided in this report.

3.4.5 Incidental Wildlife Observations

General wildlife observations were recorded by crews in the field, particularly as they relate to activities that may affect fish populations (i.e., beaver dams). As identified in the Detailed Request for Proposal, special attention was directed towards amphibians encountered during the fish capturing process. Any rare and endangered species were recorded in detail and if any accidental mortalities occurred during electrofishing, voucher specimens were to be collected.

3.5 Refinement of Reaches and Sampling Program

Following the initial field sampling program, some information gathered in the field resulted in the need for additional reach sampling sites. This was the result of larger tributaries than expected or apparent fish barriers that established additional reaches. This additional field information resulted in the establishment of a few more reaches and sampling sites that were completed to provide a complete reconnaissance level fish and fish habitat survey. Modification of such objectives involved consultation with MoELP personnel and Industrial Forestry Services Ltd.

3.6 Completion of Field Sampling Program

Based upon the refinement of the reaches and the establishment of additional reach sampling sites, further field sampling would be implemented to complete the reconnaissance level fish and fish habitat inventory.

3.7 Data Compilation/Quality Assurance and Report Preparation

A project management system was designed to ensure maximum control and maintain a high level of task completion throughout the project. This was based on a systematic

approach to deploying available resources to achieve the objectives of the study with consistent control on schedule, cost, scope and quality.

Our quality control program was designed to eliminate inconsistencies in field sampling and data handling/transcription. Periodic checks during the field and data transcription/entry phases of the projects were made to ensure that the sampling protocols were being followed and quality control objectives were being met. An important aspect of the field program was to ensure that all necessary information for the stream survey data cards were accurately completed. At the end of each day, each crew leader reviewed the data cards for completeness so that any deficiencies could be dealt with quickly. To ensure systematic collection of field data was completed, a reach sampling site protocol was developed. With this protocol, a number of working stream sketches were used to record data such as: a) stream cover, b) unstable banks, c) riparian vegetation, d) extent of tributaries marked with UTM coordinates, e) sensitive fisheries zones, f) fish barriers, and g) stream classes. These sketches provided empirical field data which were transferred to the stream survey forms. The maintenance of this empirical field data on sketches of the reaches formed the base record and ensured a recovery route to the information gathered in the field. Aerial photographs and 1:20,000 and 1:50,000 maps accompanied the field crew and were used as supplementary information for the reach sketches. Quality control during the data entry phase of the projects was maintained by implementing a double entry procedure utilizing DFO/MoELP Microsoft Access electronic stream card entry software. Any typographical errors that may occur during data entry were eliminated by entering the data set twice by two different people. This ensured that any errors could be identified by cross-referencing the original field data sheets with the first data file and then the appropriate corrections could be made. The data file was output on 1.44 M 3.5" diskettes in ASCII format upon completion of the study.

The final report was based on the Table of Contents listed in the Detailed Request for Proposals. The report includes reach maps and various tables summarizing fish species composition, stream habitat characteristics, fish-stream survey cards, and photographs of representative sections of each sampled reach, and other pertinent information.

The content and format of the reach maps and associated legends and other maps were completed to the required cartographic standards. Digital map files were provided in ARC/INFO format and were based on GIS data standards developed by MoELP. In addition, digital files of the DFO/MoELP stream data cards were provided on diskette.

4.0 RESULTS

The results of this reconnaissance-level fish and fish habitat inventory will be presented on the basis of sub-watershed units. Common descriptive names will be used so as to provide orientation but the watershed code will also be indicated to meet British Columbia Watershed Code Standards. The 1996 inventory included complete or portions of 16 sub-watershed units which ranged in drainage area from 880 to 14,419 hectares. Some of the watershed units had extensive tributary networks, such as, Cluculz Creek (W.C. #180-1913). upstream of Eulatazella Lake and hence required a large number of sampling sites (58) while a single watershed unit such as Tributary #4 (W.C. #180-0690-231) required only 3 sampling sites. A summary of the 16 sub-watershed units indicating the common name, watershed code number, date of sampling, drainage area, and the number of sampling sites completed is provided in Table 3.

A total of 211 locations were sampled in the 16 sub-watershed units over a total drainage area of 64,500 ha. Each of these sub-watershed units are described in this report. The stream survey forms provide the detailed information gathered from each reach sample site and they include a planimetric view and a photograph of each sampling site. The forms are incomplete in all cases in a few areas where the software would not accept the methods used to make various measurements. The methods used are indicated in Section 3.4 but specifically include: water temperature (thermometer), turbidity (meterstick), channel form (visual observation), and flood signs (meterstick). Also, the software for the stream survey forms that described drainages or intermittent streams, would not accept the recording of channel widths without the completion of other parameters on the form. Other parameters were not measured as these watercourses did not at times have defined channels, banks or flow; as a result, channel widths were recorded in the comments section of these stream survey forms.

Field crews encountered a number of potential reach sampling sites that were characterized by defined banks and channels, the presence of stream beds and possibly the presence of aquatic vegetation but contained very little or not water flow. These sites were referred to in the report as reach sample sites but because of the lack of water, the complete suite of reach sample site information could not be completed. In most cases, basic measurements such as channel width, vegetation descriptions and photographs were taken to describe these areas. A number of these sites were also identified as requiring additional sampling to be conducted in spring to verify the presence or absence of fish during the spring period when water levels are higher. These sites are referred to as intermittent streams. Some intermittent streams received a "P" designation and were identified as sites that should be re-sampled during a different time of year.

During the 1996 field program, many of the potential reach sample sites encountered by field crews were characterized as drainages that had no definable stream banks or channels with little or no water flow. Some were seepage areas with bog characteristics while others contained terrestrial vegetation or a mixture of terrestrial and aquatic vegetation. These sites also had assigned watershed codes. Field crews generally provided descriptions of the site along with UTM coordinates which were recorded on reach sample site cards. These sites were referred to as drainages in this report and technically do not represent complete reach sample sites. But the drainages do reflect the random selection of the initial sampling plan. Drainages by definition are not streams and as a result, a stream classification was not assigned to these areas. The importance of drainages to fish as water discharge areas for downstream habitats is significant in insuring a healthy aquatic ecosystem.

Upper reach breaks were located and identified and provided the upper extent of the reach. UTM coordinates, photographs and biophysical descriptions were recorded on the site card of the sampling site within the upper reach.

Also, the stream survey forms were used to present the stream classification ranging from S1 to S6, with S1 to S4 being game fish bearing and S5 to S6 being non-game fish bearing. A "P" notation was used to indicate the need for additional sampling and it represented a preliminary or provisional delineation on the stream classification.

4.1 Existing Information

Existing information that was gathered is provided for each sub-watershed in that particular section of the report. Generally, existing information on fish and fish habitat was not extensive and where information was available, it was often not consistent or comparable with the stream survey guidelines or the requirements established by the Resources Inventory Committee.

The major source of the information was gathered from the Fish Information Summary System (FISS) that is maintained by MoELP. FISS is an information data base that summarizes existing fisheries information on a 1:50,000 NTS mapsheet basis. Information contained on each mapsheet is cross-referenced to the appropriate reports or information sources at the MoELP library in Prince George.

4.2 Physical Conditions

During the spring, summer and fall of 1996 mean air temperatures were below normal while precipitation was higher than the mean experienced over the past 40 years. The stream flows were 15% above normal in July, 35% lower in August, and 2% below

normal in September, in the Chilako River drainage area in 1996.

4.2.1 Weather

Temperature data are available from the Environment Canada, Atmospheric Environment Services Vanderhoof weather station.

Normal temperatures in the Vanderhoof (Isle Pierre) area for July, August and September are 16.2 C, 15.9 C, and 11.0 C respectfully. The temperature for the same months in 1996 were 16.3 C, 15.2 C and 9.8 C which are generally lower than normal.
Precipitation for July, August and September near Vanderhoof is normally 43.7 mm, 38.2 mm and 42.2 mm respectively. In 1996, precipitation in July, August and September for the Vanderhoof area was 57.8 mm, 44.8 mm and 61.4 mm respectively.

4.2.2 Stream Conditions

Stream discharge data for the current period are available from the West Road River, near Cinema, and reflects the general nature of the stream flows in the Chilako River drainage. No water discharge monitoring is being done on the specific sub-watersheds in the Isle Pierre study area.

Discharge on the West Road River for the months of July, August, and September, are normally 45.7 m^3/s, 29.5 m^3/s and 22.6 m^3/s respectively. Discharge on the West Road River in July, August, and September of 1996 was 52.4 m^3/s, 19.3 m/s, and 22.1 m/s respectively.
Water discharge in the West Road River in 1996 was 15% above average in July, 35% lower in August and 2% above average in September. This increase in discharge from August which was 35% lower than normal to September which was slightly (2%) lower than normal indicates the large amounts of precipitation that fell in September of 1996.

4.2.3 Fish Species in the Study Area

The study area contained 10 species of fish which included:

1. Rainbow Trout - *Oncorhynchus mykiss* - RB
2. Kokanee - *Oncorhynchus nerka* - KO
3. Coho Salmon - *Oncorhynchus kisutch* - CO
4. Redside Shiner - *Richardsonius balteatus* - RSC
5. Lake Chub - *Couesius plumbeus* - LKC
6. Prickly Sculpin - *Cottus asper* - CAS
7. Peamouth - *Mylocheilus caurinus* - PCC
8. White Sucker - *Catostomus commersoni* - WSU
9. Longnose Sucker - *Catostomus catostomus* - LSU

10. Slimy Sculpin - *Cottus cognatus* - CCG

In the 16 sub-watersheds that were partially or completely surveyed, rainbow trout were the most common and the most abundant fish species.

4.3 Naltesby Lake Tributary (Grizzly Lake) - W.C. #180-0690-580

A review of existing studies revealed two lake reconnaissance surveys that also involved some assessment of streams in this sub-watershed. Both surveys, Grizzly Lake (Coombes, 1984) and Woodcock Lake (Coombes, 1984), encompassed watercourses in the immediate vicinity of the lakes. The measurements from the survey were not a duplication of the current fish and fish habitat survey although the observations and assessments were consistent. Presence of trout species and chub species were noted in the Grizzly Lake inlet and trout species were noted in the outlet. In the outlet of Woodcock Lake suitable spawning habitat for salmonids was noted but no fish were sampled or observed.

This sub-watershed unit drains an area of 7,439 ha. and includes six lakes. Grizzly Lake is the largest waterbody in the area. The system drains into the west side of Naltesby Lake and then flows through Butcherflats Creek to the Chilako River. A summary of the tributaries sampled within the watershed along with associated stream lengths, channel widths, sample site locations and sampling dates is provided in Table 3.1. A map indicating 20 sampling locations and corresponding watershed codes is shown in Figure 3.1.

4.3.1 Mainstem - W.C. #180-0690-580

The mainstem of this watercourse is 19.9 km in length and was divided into 9 reaches. It had a channel width of 4.7 m near the mouth. The gradient along the channel was consistently less than 1%. In addition, water quality at these sampling locations was relatively consistent indicating that the mainstem contains suitable water for fish:

- pH: 6.5 - 7.5
- dissolved oxygen: 5.0 - 9.0 ppm
- conductivity: 75 - 159 umhos
- alkalinity: 60 - 120 ppm
- total dissolved solids: 38 - 73 ppm

Six reach sample sites (RSS) were established along the mainstem. Fish and fish habitat features associated with the sampling locations are presented below.

Reach Number One

Reach Sample Site #1 (Channel Width 4.7 m)

Fish habitat in this RSS was comprised of 55% run, 41% riffle, and 4% pool. Fish cover (86%) was mostly provided by over-hanging bank vegetation (72%). Bed material was largely gravel (80%) with some sand/silt (20%). Three age classes of rainbow trout

ranging in length from 37 to 100 mm were sampled. Excellent spawning habitat was present within the RSS. Table 3.2, Figure 3.2 and Photo 3.1 provide a description of RSS #1.

Reach Number Two

Reach Sample Site #3 (Channel Width 4.4 m)

Fish habitat in this RSS was comprised of 61% run, 34% riffle and 5% pool. Fish cover (46%) was provided mostly by overhanging bank vegetation (50%). Bed material was largely comprised of sand/silt (60%) with some boulders (20%). This RSS contained numerous rainbow trout comprised of four age classes with lengths ranging between 30 and 210 mm. Table 3.3, Figure 3.3 and Photo 3.2 further describe the excellent rainbow trout habitat associated with this RSS.

Reach Number Seven

Reach Sample Site #10 (Channel Width 2.7 m)

Fish habitat in this RSS was comprised of 85% run and 15% pool. Fish cover (40%) was provided mostly by cutbanks (50%). Bed material was characterized by 60% sand/silt and 40% gravel. Numerous rainbow trout from three age classes ranging in length from 25 - 120 mm were present. This RSS also provided excellent rearing habitat for rainbow trout (Table 3.4, Figure 3.4, and Photo 3.3).

Reach Sample Site #11 (Channel Width 3.2 m)

Fish habitat in this RSS was comprised of 95% run and 5% pool. The site also contained 40% fish cover, 36% of which was provided by cutbanks. Bed material was comprised of 95% sand/silt and 5% cobble. No rainbow trout were present at this location but lake chub were present. A further description of the RSS is provided in Table 3.5, Figure 3.5, and Photo 3.4.

Reach Number Nine

Reach Sample Site #12 (Channel Width 1.5 m)

Fish habitat in this RSS was comprised of 67% run, 26% pool and 7% riffle. Thirty-five percent fish cover was present, 43% of which was comprised of the pool type. Rainbow trout were present and ranged in size from 25 to 115 mm. This RSS provided suitable rearing habitat for rainbow trout which is described further in Table 3.6, Figure 3.6 and Photo 3.5.

Reach Sample Site #13 (Channel Width 1.2 m)

Fish habitat in this RSS was comprised of 92% run, 3% pool and 5% riffle. Fish cover was assessed to be 91% of which 77% was characterized by over-hanging bank

vegetation. Bed material was comprised of 80% sand/silt and 15% cobble. No fish were present at this site even though electrofishing effort was doubled to include 200 m of channel and a minnow trap was in place for 4.5 hrs. A further description of the RSS is provided in Table 3.7, Figure 3.7, and Photo 3.6.

4.3.2 Tributaries of the Naltesby Lake Tributary (Grizzly Lake) - W.C. #180-0690-580

Watershed Code #180-0690-580-566 (Channel Width 2.2 m)

This tributary has a length of 5.1 km and originates at Woodcock Lake and contains five reaches. Reach one is represented by RSS #2, which had a habitat type consisting of 74% riffle, 23% run and 3% pool. Fish cover was assessed to be 67% of which 73% was overhanging vegetation. The bed was 55% sand/silt and 25% gravel. Numerous rainbow trout were sampled with sizes ranging from 30 to 70 mm. RSS #2 provides spawning and rearing habitat and is described in Table 3.8, Figure 3.8 and Photo 3.7.

Watershed Code #180-0690-580-769 (Channel Width 1.2 m)

This tributary drains directly into Grizzly Lake and is represented by RSS #8, #19 and #20. RSS #8 was located in reach three, upstream of Old Camp Lake, and had a channel width of 1.2 m and a length of 2.0 km. It was composed of 70% run and 30% pool habitat types and was assessed to have 65% fish cover largely made up of cutbanks (46%). The bed material was 100% sand/silt. Rainbow trout were present with sizes ranging between 19-76 mm. RSS #8 provides a good rearing habitat and is described in Table 3.9, Figure 3.9, and Photo 3.8.

Two tributaries that entered this watercourse were also sampled, represented by RSS #19 and #20, and enter reaches 4 and 5 of the watercourse, respectively. At RSS #19, a dry channel was observed, and no defined channel was present at RSS #20. Tables 3.10 to 3.13 provide a description of these sample sites.

Other Small Tributaries

Ten other small tributaries enter the Naltesby Lake Tributary (Grizzly Lake) #180-0690-580. No defined channels were observed at RSS #14, #22, #23 and #24, and are considered drainages. Two sites, RSS #16 and #17, are considered non-fish bearing and have been classified as S6 because of their steep gradients, limited flows and heavily overgrown channels. The remaining four sites, RSS #25, #26, #27 and #28, all had defined channels but have very low value as fish habitat. However, since there are no obvious barriers to downstream, fish-bearing reaches, these sites have been given preliminary fish-bearing classifications and are recommended for spring sampling. Stream survey information for all tributaries is provided in Tables 3.14 to 3.23 along with

the respective photos for each RSS (Photos 3.21 to 3.50).

4.3.3 Summary of Stream Survey Information for Naltesby Lake Tributary (Grizzly Lake)

Table 3.24 and Figure 3.1 provide a summary of selected information collected during the stream survey of 22 RSS's in the sub-watershed. The mainstem watercourse provides suitable fish habitat for rainbow trout of several age classes. Spawning and rearing habitats are available with good fish cover present. These waters are largely classified as S3 and S4.

Excellent fish habitat was found at two other sampling locations. Reach one of the tributary flowing out of Woodcock Lake (W.C.#180-0690-580-566) was classified as S3, and a watercourse flowing into Grizzly Lake (W.C.#180-1690-580-769) was assessed to be an S4 classification. Sampling efforts at both reaches found rainbow trout to be present. RSS's #25, #26, #27, and #28 were assigned a preliminary fish-bearing stream classifications and should be resampled in the spring. All the other tributaries were considered to have limitations as fish habitat. Spring sampling may verify some additional areas that rainbow trout use in the early part of the year.

Appendix 1 provides a listing of the various measurements recorded during the stream inventory survey for all watercourses within the Naltesby Lake Tributary (Grizzly Lake). Appendix 17 provides a summary of the ages of the key fish species within this sub-watershed.

4.4 Eulatazella Lake Tributary (West) (W.C.# 180-1913-655)

The Eulatazella Lake Tributary (West) sub-watershed unit drains an area of 1185.0 ha on the west side of Eulatazella Lake. This sub-watershed contains a mainstem stream and several smaller tributaries which drain into the mainstem. Only one of the tributaries to the mainstem was sampled, (Watershed Code #180-1913-655-201). Reach one of the mainstem channel was 5.8 km in length. Table 4.1 provides a list of the tributaries, stream lengths, channel widths, sample site locations and sampling dates. Figure 4.1 provides a map indicating the 3 sampling locations. This watershed was sampled in July, 1996.

RSS #1 located near the mouth of the mainstem, which contains only one reach, has a channel width of 1.1 m and the habitat types were 80% run, 19% pool and 1% riffle. The fish cover was assessed at 100% with 70% overhanging vegetation. The bed was 100% sand/silt and the water quality was suited for fish. Rainbow trout were present. A description of RSS #1 is provided in Table 4.2, Figure 4.2 and Photo 4.1.

RSS #2 is located upstream on the mainstem and had a channel width of 0.9 m. This site had 83% riffle and 17% pool habitat types and fish cover was assessed at 100% with 55% being large organic debris. The bed material was 50% cobble and 30% gravel. The water quality parameters measured indicated a suitable fish habitat, although dissolved oxygen levels were lower than those found in other locations in the study area. No fish were caught in the 200 m section of stream that was electrofished. RSS #2 is described in Table 4.3, Figure 4.3 and Photo 4.2.

The tributary #180-1913-655-201 is a short stream totaling 900 metres, and containing two reaches. RSS #4 is located on reach one, which totals only 70 metres in length. Channel width is 0.45 m, with only small pockets of water present at time of sampling. This watercourse may be used in the spring for spawning and is therefore recommended for spring sampling (Photos 4.3, 4.4 and 4.5).

4.4.1 Summary of Stream Survey for Eulatazella Lake Tributary (West)

Table 4.5 and Figure 4.1 provide a summary of selected information gathered and interpreted for the stream survey at 3 RSS's within the Eulatazella Lake Tributary (West) drainage, two RSS's along the first reach of the mainstem, and one RSS on tributary #180-1913-655-201. Rainbow trout were present in this drainage but only at RSS #1 (the lower portion of the reach one on the mainstem). The mainstem is classified as an S4, even though no fish were caught in the upper end of reach 1 (RSS #2). RSS#4 is classified as P-S4 since some spawning gravels were present in this reach and no obvious

barrier to downstream, fish bearing reach. Therefore, spring sampling is recommended in 1998.

Appendix 2 provides a detailed summary of the sampling results from 3 locations on Eulatazella Lake Tributary (West) and Appendix 17 provides the ages of the key fish species in this sub-watershed.

4.5 Eulatazella Lake East Tributaries (W.C.# 180-1913-683)

This sub-watershed unit drains an area of 2978.8 ha from an area east of Eulatazella Lake. The drainage area includes two lakes, numerous bogs, seepage channels and short tributaries. Table 5.1 provides a list of the tributaries, stream lengths, channel widths, sample site locations and sampling dates. This watershed was sampled in August, 1996 and Figure 5.1 provides a map indicating the 14 sampling locations.

4.5.1 Mainstem (W.C.# 180-1913-683)

Reach Number One

The mainstem of this watershed is 8.1 km in length, was divided into 5 reaches, and had a channel width of 2.4 m near its mouth. RSS #1 was located near the mouth of this watercourse and had habitat types of 85% riffle, 10% run and 5% pool. Fish cover was assessed at 55% with 36% large organic debris and 36% overhanging vegetation. The bed material was 50% gravel and 40% cobble. The water quality parameters that were measured indicated a suitable fish habitat. Rainbow trout were present with lengths ranging from 80-110 mm. RSS #1 provides a good spawning habitat and Table 5.2, Figure 5.2 and Photo 5.1 describe the site.

Reach Number Two

RSS #3 was also located on the mainstem and it had a channel width of 0.7 m. This site is comprised of 89% run, 10% pool and 1% riffle habitat types and fish cover was assessed at 92%, with 54% overhanging vegetation. The bed material was 100% sand/silt and the water quality parameters measured indicated a suitable fish habitat. Rainbow trout were sampled at RSS #3 and Table 5.3, Figure 5.3 and Photograph 5.2 describe the sampling site. The upper end reach break was located and marked on the maps.

4.5.2 Tributaries

One major tributary (W.C.# 180-1913-683-351) enters the mainstem and this is represented by RSS #2 in the lower reach, and RSS #5 and RSS #7 in the upper reach. RSS #2, #5 and #7 all contained water but the area was characterized by bogs and marshes. As a result, complete stream survey measurements were not possible. A fish was observed in RSS #2, but a minnow trap failed to capture any fish after 26 hours. Most of RSS #5 and #7 contained stagnant water and were clearly fish sensitive zones in the form of a wetland (marsh). The stream survey information for RSS #2, #5 and #7 are provided in Tables 5.4 to 5.6 (Photos 5.3 to 5.8). Because of the quality of fish habitat associated with these wetlands, all of the sites were classified as Fisheries Sensitive Zones (FSZs).

Nine other smaller tributaries were also associated with the watercourse (W.C. #180-1913-683), including: RSS #4 (Table 5.15, Photos 5.29 to 5.31), RSS #8 (Table 5.14, Figure 5.5 and Photo 5.28), RSS #11 (Table 5.7, Photos 5.9 to 5.11), RSS #12 (Table 5.8, Photos 5.12 to 5.14), RSS #13 (Table 5.9, Photos 5.15 to 5.17), RSS #14 (Table 5.10, Photos 5.18 to 5.20), RSS #15 (Table 5.11, Photo 5.21), RSS #16 (Table 5.12, Photos 5.22 to 5.24) and RSS #17 (Table 5.13, Photos 5.25 - 5.27).

Four of these tributaries, RSS #11, RSS #12, RSS #13 and RSS #16, are drainages. These sites were visited twice to confirm their status as "drainages", first on September 8, 1996 and second on July 11, 1997. Two visits were necessary because the observations during the first visit included conflicting comments regarding the status of these streams: drainage or intermittent stream? (please see site cards for more details). After visiting the sites a second time, it was determined that these sites are indeed drainages as shown in the photographs. Sections which appear to have a defined channel are often covered in moss and are found only in isolated pockets.

Three tributaries, RSS #14, RSS #15 and RSS #8 had defined channels. RSS #8 had a channel width of 0.83 m and had some measurable flow (.0005 m^3/s). This site had 70% riffle and 30% pool habitat types and the fish cover was assessed at 100% with 40% being large organic debris. The bed material was 50% gravel, 15% sand/silt, and 35% cobble/boulder and the water quality was suitable for fish. No fish were present with 200 m being electrofished and because of the suitable nature of the habitat, a spring survey is recommended.

RSS #15 has a channel width of 0.6 m but some of the channel was dry and the surface flow was low. The dissolved oxygen level (3.0 ppm) was also low and no fish were recorded after electrofishing 200 m and using a minnow trap for 3 hrs. For RSS #14, a reach break was added to this stream after field crews only found a defined channel along the first 100 metres upstream from the mouth. Past 100 metres, the channel disappeared into a marsh area with heavy coverage of willow and sedges. No sampling was conducted at RSS #14 due to low flows.

The last two tributaries in this watercourse, RSS #17 and RSS #4, are wetlands. Both these tributaries are not considered streams and therefore no channel width measurements were taken. Both reaches drain directly into W.C. #180-1913-683-351 (RSS #2, RSS #5, and RSS #7) and do not have any obstacles preventing the migration of fish from downstream reaches. Since downstream reaches are considered Fisheries Sensitive Zones, so are RSS #17 and RSS #4.

4.5.3 Summary of Stream Survey Information for Eulatazella Lake East Tributary

Table 5.1, Table 5.16 and Figure 5.1 provide a summary of selected information collected during the stream survey of 14 RSS's within the Eulatazella Lake Tributary (East) drainage. Rainbow trout were present in the lower reaches and spawning habitat was also present. The majority of the drainage was comprised of bogs, seepage areas and numerous undefined stream channels.

Based on this information, reaches 1 and 2 of the mainstem were classified as fish-bearing (S3 and S4, respectively). The major tributary to the mainstem (W.C. 180-1913-683-351) consisted mostly of wetlands and five reaches on this watercourse were classified as fisheries sensitive zones. One site was classified as a provisional fish bearing reach and was recommended for spring sampling. Finally, four of the sample sites turned out to be drainages. Appendix 3 provides a detailed summary of the sampling results from 14 locations on Eulatazella Lake Tributary (East) and Appendix 17 provides the age classes of the key fish species in this sub-watershed.

4.6 Little Bobtail Lake Tributaries (W.C. #180-0690-580-462-546)

A review of existing studies revealed one lake reconnaissance survey that also involved some assessment of streams in this sub-watershed. The Little Bobtail Lake survey (Coombes, 1984) provided some observations of the inlet and outlet streams near the lake. No fish sampling was undertaken and the inventory was not intensive and did not duplicate the 1996 fish and fish habitat survey.

This sub-watershed unit drains an area of 1,553.5 ha. east of Little Bobtail Lake. Table 6.1 provides a list of the tributaries, stream lengths, channel widths, sample site locations and sampling dates. This watershed was sampled in August, 1996 and Figure 6.1 provides a map indicating the 5 sampling locations.

4.6.1 Mainstem

The mainstem of this watershed is 6.1 km in length, was divided into 3 reaches, and had a channel width of 2.4 m near its mouth. Two locations were sampled on the mainstem at RSS #1 (reach one) and RSS #3 (reach two).

Reach Number One

RSS #1 was located near the mouth and it contained 46% run, 32% riffle and 22% pool habitat types. Fish cover was assessed at 95%, with cutbanks and overhanging vegetation contributing 36% each. The bed material was largely gravel (50%), with 30% cobble and the water quality was suitable as fish habitat. Rainbow trout were abundant with lengths ranging from 30-126 mm. Prickly sculpins and redside shiners were also present. RSS #1 provided an excellent spawning habitat and Table 6.2, Figure 6.2 and Photo 6.1 describe this sampling location.

Reach Number Two

RSS #3, also on the mainstem, had a channel width of 1.4 m. and a gradient of 4.0%. The habitat types consisted of 77% riffle, 12% pool and 11% run and the fish cover was assessed at 37%. The bed material was 60% cobble and 30% gravel and the water quality was suited for fish. Numerous rainbow trout ranging between 20 and 96 mm were sampled. Table 6.2, Figure 6.2 and Photo 6.2 provide a description of RSS #3.

4.6.2 Tributaries

One significant tributary (W.C. #180-0690-580-462-546-451) entered the mainstem and this channel was 1.3 m wide and had a slope of 3.0%. RSS #2 consisted of a 6:71:23 pool:riffle:run ratio and fish cover was assessed at 67% with 30% boulder cover. The bed material was 40% cobble and 45% gravel and the water quality was suitable for fish. Rainbow trout were present. Table 6.4, Figure 6.4 and Photo 6.3 provide a description of

RSS #2.

Sampling sites were also located at RSS #6 and RSS #7 but both of these were dry, although channels were distinct. All of these tributaries were considered as having limited fisheries value however, they did enter fish bearing reaches and as a result, were classified as S4. Tables 6.5 and 6.6 and Photos 6.4 to 6.9 describe RSS #6 and #7.

4.6.3 Summary of Stream Survey Information for Little Bobtail Lake Tributary (W.C. #180-0690-580-462-546)

Table 6.7 and Figure 6.1 provide a summary of selected information gathered and interpreted from the stream survey at 5 RSS's within the Little Bobtail Lake tributary drainage. Numerous rainbow trout were present in the lower reaches and spawning habitat was present. The mainstem portion of the tributary is either an S3 or S4 stream classification and the one significant tributary was also fish bearing at an S4 classification.

Appendix 4 provides a detailed summary of the sampling results from 5 locations on Little Bobtail Lake tributary and Appendix 17 provides the age classes of the key fish species in this sub-watershed.

4.7 Norman Lake Tributaries (W.C.# 180-0690-205-648)

This sub-watershed unit drains an area of 5206 ha. south of Norman Lake. Norman Lake drains into Dahl Creek which subsequently drains into the Chilako River. Table 7.1 provides a list of the tributaries, stream lengths, channel widths, sample site locations and sampling dates. This watershed was sampled in August, 1996 and Figure 7.1 provides a map indicating the 21 sampling locations.

4.7.1 Mainstem

The mainstem of this watershed is 12.3 km in length, was divided into 4 reaches, and had a channel width of 3.9 m near its mouth. Five locations were sampled on the mainstem at RSS #1 and #24 representing reach 1, RSS #3 representing reach 2, RSS #7 representing reach 3, and RSS #8 representing reach 4.

Reach Number One

RSS #1 was located near the mouth and it contained 82% run, 10% riffle and 8% pool habitat types. Fish cover was assessed at 29% with the majority being pool cover contributing 34%. The bed material was largely gravel (50%) and cobble (30%) and the water quality measurements indicated a suitable fish habitat. Rainbow trout were abundant with sizes ranging between 27 and 116 mm. Spawning and rearing habitat for salmonids was present. White suckers were also present. Table 7.2, Figure 7.2 and Photo 7.1 provide a description of the stream inventory for RSS #1.

RSS #24 was also located on the mainstem in reach 1 and it had a channel width of 3.5 m and a slope of 1.5%. The habitat types consisted of 49% run, 34% riffle and 17% pool and the fish cover was assessed at 90% of which cutbank cover and large organic debris each comprised 28%. The bed material was 50% gravel and 30% cobble and the water quality parameters indicated a suitable fish habitat. Numerous rainbow trout ranging in size from 33 to 102 mm were sampled. Excellent salmonid spawning habitat was observed. No other fish species were present and the stream inventory information for RSS #24 is provided in Table 7.3, Figure 7.3, and Photo 7.2.

Reach Number Two

RSS #3 had a channel width of 3.4 m and a gradient of 2% and was comprised of 55% run, 35% riffle and 10% pool habitat types. Fish cover was assessed at 55% with the majority occurring as cutbanks (73%). The bed material was composed of 50% gravel and 30% sand/silt and the water quality parameters indicated a suitable fish habitat. Numerous rainbow trout were sampled ranging in size from 30 to 65 mm. Spawning habitat was evident, however some of it had been covered with a layer of silt. No other fish species were present and the stream inventory details for RSS #3 are provided in

Table 7.4, Figure 7.4 and Photo 7.3.

Reach Number Three

RSS #7 is also located on the mainstem and it had a channel width of 3.1 m and a gradient of 2.0%. Habitat types consisted of 40% run, 30% riffle and 30% pool and the fish cover was assessed at 57% of which 45% was cutbank cover. The bed material was 40% gravel and 40% cobble and the water quality parameters indicated a suitable fish habitat. Numerous rainbow trout ranging in size from 20 to 110 mm were sampled. Spawning habitat was evident. No other fish species were present and the detailed inventory information for RSS #7 and provided in Table 7.5, Figure 7.5 and Photo 7.4.

Reach Number Four

RSS #8 located on the mainstem had a channel of 2.7 m and a slope of 2.0%. The habitat types consisted of 79% run, 15% pool and 6% riffle and the fish cover was assessed at 78% of which 39% was large organic debris. The bed material was largely sand/silt (70%) and gravel (25%) and the water quality parameters indicated a suitable fish habitat. Numerous rainbow trout ranging in size from 30 to 100 mm were sampled. No other fish species were present. Spawning and rearing habitats were evident. The detailed inventory information for RSS #8 is provided in Table 7.6, Figure 7.6 and Photo 7.5.

4.7.2 Tributaries (W.C.# 180-0690-205-648-304)

The first significant tributary (W.C.# 180-0690-205-648-304) was represented by RSS #2. RSS #2 had a channel width of 1.3 m and a slope of 1.0%. The habitat types were 80% riffle, 10% pool and 10% run and the fish cover was assessed at 85% of which 41% consisted of large organic debris and another 41% consisted of over hanging vegetation. The bed material was 50% gravel and 25% sand/silt and the water quality parameters indicated a suitable fish habitat. Several rainbow trout ranging in size from 30 to 74 mm were sampled. No other fish species were present. Spawning and rearing habitat were present. Table 7.7, Figure 7.7 and Photo 7.6 provide a description of the stream inventory information for RSS #2. The upper end reach break for this watercourse is described on the site card for RSS #2.

Two other smaller tributaries entered W.C.# 180-0690-205-648-304 and were represented by RSS's #4 and #23. Both of these stream channels were 0.6 m wide and flowed from bogs. They were very shallow wetlands with limited flow, although the areas were wet. Since these tributaries were extensions of fish bearing streams, they were classified as S4. The stream survey information is provided in Table 7.8 for RSS #4 and Table 7.9 and Photos 7.7 to 7.9 for RSS #23.

W.C.# 180-0690-205-648-680

This tributary was initially represented by RSS #9 but also includes several watercourses that enter it. The channel width for RSS #9 was 1.4 m and was composed of 67% riffle, 28% run and 5% pool habitat types. Fish cover was assessed at 98% with 40% consisting of overhanging vegetation type cover. The bed material consisted of 35% cobble and 30% sand/silt and the water quality parameters indicated a suitable fish habitat. No fish were present in 100 m of electrofishing and a minnow trap of 2 hr. The stream survey information for RSS #9 is provided in Table 7.10, Figure 7.8 and Photo 7.10.

Other tributaries of this watercourse were represented by RSS #13 and #14. RSS #13 (Table 7.11) had channel width of 0.6 m and had a gravel bed that was dry (no flow). RSS # 14 (Table 7.12 and Photos 7.11 to 7.13) had a defined channel of 0.7 m in width with low flow that originated from a nearby bog/marsh. Both of these tributaries were considered as having limited fisheries value throughout all seasons of the year and have been left unclassified.

W.C.# 180-0690-205-648-619

This tributary contains two reaches, the first reach represented by RSS #6, and the second reach represented by RSS #10. RSS #6 had a channel width of 2.8 m but the flows were unmeasurable in a beaverdam setting which formed a 100% pool habitat type. The fish cover was assessed at 55% with instream vegetation contributing 36% of the cover. The bed material was 100% sand/silt and the water quality parameters suggested limitations as a fish habitat with dissolved oxygen measured at 2.0 ppm. No fish were present. Table 7.19, Figure 7.10 and Photo 7.24 provide a description of the stream survey information for this site.

RSS #10 had a channel width of 0.6 m and a gradient of 1.0%. The habitat types consisted of 94% run, 3% pool and 3% riffle and fish cover was assessed at 96% most of which was overhanging vegetation cover at 92%. The bed material was 95% silt/sand and the water quality parameters indicated potential limitations to fish habitat with dissolved oxygen levels at 4.0 ppm. No fish were present in 200 m of electrofishing and with a minnow trap set for 3 hrs. Table 7.13, Figure 7.9 and Photo 7.14 provide a description of the stream survey information gathered for RSS #10.

Additional tributaries of this drainage were sampled at RSS's #15, #16, and #17. RSS #15 (Table 7.14) and RSS #16 (Table 7.15, Photos 7.15 to 7.17) were drainages with no definable channel. RSS #17 (Table 7.16) had a very short, 2.0 m wide channel that was opened into a bog/marsh area. Since this stream has characteristics of a wetland, a defined channel and there are no photographs, this site has been left unclassified.

W.C# 180-0690-205-648-530

RSS #19 was located on this stream and had a channel width of 0.6 m and a measurable flow of .0004 m^3/s. The habitat types were 76% run, 14% pool of 10% riffle and fish cover was assessed at 91% largely a result of overhanging vegetation at 88%. The bed material was 95% sand/silt and the water quality parameters indicated a suitable fish habitat. No fish were present in 200 m of electrofishing and with a 3 hr. minnow trap set. Table 7.20, Figure 7.11 and Photo 7.25 provide a description of the stream inventory for RSS #19.

Other Small Tributaries

Four other small tributaries represented by RSS's #18A, #18B, #20 and #22 were part of the drainage. RSS # 18A (Table 7.17, Photos 7.18 to 7.20) had a 0.3 m distinct channel and RSS #18B (Table 7.18, Photos 7.21 to 7.23) which was a marsh area. RSS #18A and RSS #18B may warrant some spring fish sampling as both appeared to have some fisheries value. As a result, RSS's #18A and #18B were classified as P-S4. RSS #20 was left unclassified (Table 7.21, Photos 7.26 to 7.28) and RSS #22 (Table 7.22, Photos 7.29 to 7.31) is a drainage since there was no distinct channel.

4.7.3 Summary of Stream Survey Information for Norman Lake Tributary (W.C.# 180-0690-205-648)

Table 7.23 and Figure 7.1 provide a summary of selected information gathered and interpreted from the stream survey at 21 RSS's within the Norman Lake Tributary drainage. Numerous rainbow trout were present in the mainstem and lower reaches of the tributaries. Some excellent salmonid spawning habitat was present. The watercourses that were inhabited by fish were either S3 or S4 streams and a number of the upper tributaries have limitations as fish habitat but may in some years provide some useable habitat.

The water quality measurements were very uniform except for dissolved oxygen with the following ranges being indicated:

- pH 6.5 - 7.5
- dissolved oxygen 2.0-11.0 ppm
- conductivity 139 - 219 umhos
- alkalinity 100 - 140 mg/l
- total dissolved solids 70-110 ppm

Dissolved oxygen at two locations were at a level that may have a bearing on the suitability of the fish habitat.

Appendix 5 provides a detailed summary of the sampling results from 21 locations on the

Norman Lake Tributary drainage and Appendix 17 provide the age classes of the key fish species in this sub-watershed.

4.8 Norman Creek (W.C.# 180-1913-284)

This sub-watershed drains an area of 6528.4 ha south of Cluculz Lake. It drains into Cluculz Lake which subsequently drains into the Nechako River. Table 8.1 provides a list of the tributaries, stream lengths, channel widths, sample site locations and sampling date. Nine of the 19 RSS's in the watershed were sampled in September, 1996 (Figure 8.1) while the remaining RSS's are to be sampled in 1997.

4.8.1 Mainstem (W.C. #180-1913-284)

The mainstem of this watershed is 18 km in length and is comprised of 10 reaches. At this stage of the inventory, only RSS #1 has been sampled. This RSS was located near the mouth of the mainstem and had a channel width of 3.3 m, and contained 70% run, 20% riffle and 10% pool habitat types. Fish cover was assessed at 25% of which 60% was overhanging vegetation. The bed material was mainly cobble (55%) and gravel (25%) and the water quality measurements indicated a suitable fish habitat. Numerous rainbow trout ranging in size from 44-118 mm were sampled and white suckers were present. Spawning and rearing habitats were present. Table 8.2, Figure 8.2 and Photo 8.1 describe the stream survey information in RSS #1.

At a road crossing near the upper end of the mainstem channel (reach 10), very low flows were recorded. Various characteristics of this location are described on the back of the stream survey report for RSS #1 - see comment CX4.

4.8.2 Tributaries (W.C.# 180-1913-284-106)

The first tributary (W.C.# 180-1913-284-106) entering the watercourse was represented by RSS #2 which had a channel width of 0.9 m and a gradient less that 1.0%. The habitat units consisted of 56% riffle and 44% run while the fish cover was assessed at 98% with the majority being cutbanks at 37%. The bed material included 55% cobble, 20% gravel and 20% sand/silt and the water quality measurements indicated a suitable fish habitat. Rainbow trout ranging in size from 43 to 52 mm were present and white suckers were captured. The stream survey information of RSS #2 is described in Table 8.3, Figure 8.3 and Photo 8.2. Characteristics of the upper end reach break was located and is described in the comments section of the stream survey report for RSS#2. Also, an 0.8 metre high beaver dam was noted just upstream of the sample site and has been mapped.

Two sample sites were measured upstream of RSS #2 and these were at RSS #7 (Table 8.6, Photos 8.6 to 8.8) and RSS #8 (Table 8.4). RSS #7 did not have a defined channel and it emerged from a bog. RSS #8 was characterized by a poorly defined channel and was also considered to be a drainage.

W.C.# 180-1913-284-058

One sample site was measured on this tributary at RSS #6 (Table 8.5, Photos8.3 to 8.5). This sample site had a channel width of 0.3 m and it emerged from a bog. Although this reach is considered to have limited fisheries value, however because RSS #6 has a defined channel and entered a fish bearing reach, this site as classified as S4.

Other Small Tributaries

Four sample sites were also measured on four small tributaries and were represented by RSS #11 (Table 8.7), RSS #12 (Table 8.8), RSS #13 (Table 8.9) and RSS #14 (Table 8.10, Photos 8.9 to 8.11). Two of these tributaries did not have defined channels and all emerged from boggy areas. All were considered to have limited fisheries value. However, since RSS #11 had a small defined channel that entered a fish bearing reach, it was classified as S4. RSS #12 was left unclassified because the channel was dry at the time of sampling and it is not known if RSS #12 drains into a fish bearing reach.

4.8.3 Summary Stream Survey Information for Norman Creek (W.C.#180-1913-284)

Table 8.11 and Figure 8.1 provide a summary of selected information collected during the stream survey of 9 RSS's within the Norman Creek sub-watershed. It should be noted that although all of the RSS's were not completed in 1996, rainbow trout and white suckers are present in the first reach of the mainstem and RSS #2. Some spawning habitat was identified in RSS #1. The first reach of the mainstem was classified as an S3 stream while RSS #2, #6, and #11 were all classified as S4. RSS #12 was left unclassified and the remaining tributaries were considered drainages that had little or no channel definition and little water flow.

There was little variation in water quality measurements indicating that suitable fish habitat exists. A detailed summary of the sampling results from 9 locations within the Norman Creek sub-watershed is presented in Appendix 6 while the age classes of the key fish species sampled in the sub-watershed is presented in Appendix 17.

4.9 Chuk Lake Tributaries (W.C.# 180-0690-205-604)

This sub-watershed drains an area of 2,818.2 ha. south of Norman Lake. Watercourses enter Chuk Lake and then drain to Norman Lake which subsequently drains to Dahl Creek and the Chilako River. Table 9.1 provides a list of the tributaries, stream lengths, channel widths, sample site locations and sampling dates. This watershed was sampled in September 1996 and Figure 9.1 provides a map indicating the location of the 9 RSS's.

4.9.1 Mainstem (W.C. #180-0690-205-604)

The mainstem of this watershed is 9.6 km in length, includes 4 reaches, and had a channel width of 3.2 m near its mouth. Three locations have been sampled on the mainstem at RSS #1 representing reach one, #3 representing reach three and #5 representing reach four.

Reach Number One

RSS #1 was located near the mouth and it connects Norman Lake with Chuk Lake. It contained 61% run, 38% riffle and 1% pool habitat types. Fish cover was assessed at 23% and the bed material was largely cobble (45%) and sand/silt (40%). The water quality measurements indicated a suitable fish habitat. Rainbow trout ranging in size from 93-120 mm were present along with sucker species fry. Table 9.2, Figure 9.2 and Photo 9.1 provide a description of the stream inventory for RSS #1. Reach number two was Chuk Lake.

Reach Number Three

RSS #3 also represents the mainstem but is located upstream of Chuk Lake and it has a channel width of 1.5 m and a gradient of 1.0%. It contains 96% run and 4% riffle habitat types and fish cover was assessed at 67% of which 40% was overhanging vegetation. The bed material consisted of 70% sand and 30% gravel and the water quality measurements indicated a suitable fish habitat. Rainbow trout ranging in size from 32 to 72 mm were present. Table 9.3, Figure 9.3 and Photo 9.2 provide a description of the stream inventory information gathered at RSS #3.

Reach Number Four

RSS #5 has a channel width of 0.8 m and a gradient of 1.0% and is located on the mainstem channel. The habitat types were 70% riffle, 24% run and 6% pool and the fish cover was assessed at 83% of which 91% was overhanging vegetation. The bed material was 60% sand/silt and 40% cobble and the water quality measurements indicated a suitable fish habitat. No fish were present in 100 m of electrofishing. Table 9.4, Figure 9.4 and Photo 9.3 provide a description of the stream survey information from RSS #5. It is recommended that fish sampling be repeated in the spring season as the habitat

appeared to be very suitable for fish and no obvious fish barriers were present.
The upper end reach break is a boggy area at the point where the channel becomes poorly defined and it is described in the site card.

4.9.2 Tributaries (W.C.# 180-0690-205-604-291)

The first reach on this tributary was sampled at RSS #2, which has a channel width of 0.7 m and a gradient of 1.0%. The habitat type consisted of 96% run and 4% riffle and the fish cover was assessed at 62% with overhanging vegetation contributing 65%. The bed material consisted of 50% sand/silt and 50% cobble and the water quality measurements indicated a suitable fish habitat. No fish were present in 200 m of electrofishing and a minnow trap set of 1.5 hrs. Table 9.5, Figure 9.5 and Photo 9.4 provide a description of the stream survey information for RSS #2.

W.C.# 180-0690-205-604-485

RSS#4 represents this tributary and has a channel width of 1.5 m and a gradient of 1.5%. The habitat types consist of 96% riffle and 4% run and the fish cover was assessed at 50% with cutbank contributing 40%. The bed material was largely cobble (35%) and gravel (30%) and the water quality measurement indicate a suitable fish habitat. Rainbow trout ranging in size from 45 to 72 mm were present but no other fish species were present. Table 9.6, Figure 9.6 and Photo 9.5 provide a description of the stream inventory information for RSS #4. The upper end reach break was noted.

RSS #11 is a tributary of W.C.# 180-690-205-604-485, and had a channel width of 0.4m. The reach is approximately 300 metres in length, with the upper limit of the reach emerging from a bog area (Table 9.7, Photos 9.6 to 9.8). Although this short channel had poor fish habitat, it was confluent with a fish bearing reach and does not have any barriers for fish migration. Therefore, this reach was classified as S4.

W.C.# 180-0690-205-604-526

This tributary enters the mainstem and was represented by RSS #6, #12 and #13. RSS #6 was located near the confluence of this watercourse and the mainstem, has a channel width of 1.4 m and a gradient of 1.0%. The habitat types consisted of 70% riffle, 20% run and 10% pool and the fish cover was assessed at 63% largely the result of overhanging vegetation at 48% and cutbanks at 48%. The bed material consisted of 60% gravel and 20% cobble and the water quality measurements indicated a suitable fish habitat. Rainbow trout ranging in size from 30 to 93 mm were present but no other fish species were found. Table 9.8, Figure 9.7 and Photo 9.9 provide a description of the stream inventory information for RSS #6.

RSS #12 (Table 9.8, Photos 9.10 to9.12) and RSS# 13 (Table 9.10, 9.13 to9.15) were generally limited fish habitats. RSS #12 had no distinctive channel and is considered a drainage. RSS #13 had a 0.2 m channel that emerged from a bog and represents poor fish habitat. RSS #13 has been left unclassified.

4.9.3 Summary of Stream Survey Information for Chuk lake Tributaries (W.C.# 180-0690-205-604)

Table 9.11 and Figure 9.1 provide a summary of selected information gathered and interpreted from the stream survey at 9 RSS's within the Chuck Lake Tributary drainage. Rainbow trout were present in much of the mainstem between Norman Lake and Chuk Lake and upstream of Chuk Lake. One of the tributaries entering the mainstem also contained rainbow trout and other tributaries seemed to have suitable fish habitat. Three reaches, represented by RSS #2, #5 and #13, are recommended for spring fish sampling and were classified as P-S4. Several parts of this drainage are classified as S3. Most of the tributaries entering the mainstem were drainages or intermittent streams, with several originating in bog areas.

The water quality measurements indicated suitable fish habitat with the following ranges in the results:

- pH 7.5 - 8.0
- dissolved oxygen 7-11 ppm
- conductivity 113-301 umhos
- alkalinity 120 - 160 ppm and,
- total dissolved solids 92 - 137 ppm

Appendix 7 provides a detailed summary of the sampling results from 9 locations in the Chuk Lake Tributary drainage and Appendix 17 provides the age classes of the key species in this sub-watershed.

4.10 Chilako River Tributary #1 - Dahl Creek (W.C.# 180-0690-205)

A review of existing studies revealed two stream survey reports associated with a survey of Norman Lake (MoELP, 1984) and of Dahl Lake (Coombes, 1984). The survey provided some general information on some biophysical features and some observations of fish presence. From this report, the lower reach contained sucker species, chub species, and northern squawfish. The information from these files do not duplicate the fish and fish habitat inventory in 1996.

This sub-watershed drains an area of 7562.8 ha east of Dahl Lake. The drainage originates from watercourses entering Norman Lake which subsequently flow to Dahl Lake and eventually to Dahl Creek (Tributary #1) and the Chilako River. Table 10.1 provides a list of the tributaries, stream lengths, channel width, sample site locations and sampling date. Figure 10.1 provides a map indication the location of the 13 RSS's that were sampled in September, 1996. The additional sampling will have to be completed in 1997.

4.10.1 Mainstem (W.C. #180-0690-205)

The mainstem of this watershed is 14.4 km in length and was divided into four reaches. It had a channel width of 6.0 m near its mouth. Two locations have been sampled on the mainstem at RSS #1, representing reach one, and RRS #2, representing reach two. Other sampling with be completed in 1997.

Reach Number One

RSS #1 was located near the mouth and had a channel width of 6.0 m and a gradient of 1.0%. The habitat types consisted of 54% riffle, 32% run and 14% pool and the fish cover was assessed at 69% with overhanging vegetation contributing 43%. The bed material was 60% cobble and 20% sand/silt and the water quality parameters indicated a suitable fish habitat. Numerous rainbow trout ranging in size from 62 to 207 mm were sampled. Also numerous coho salmon ranging in size from 67 to 85 mm were sampled. Other fish species present included white suckers and longnose suckers. The spawning habitat was considered excellent for salmonids as evidenced by the numerous rainbow trout and coho salmon fry. Table 10.2, Figure 10.2 and Photo 10.1 provide a description of the stream inventory information gathered from RSS #1.

Reach Number Two

RSS #2 also on the mainstem of Dahl Creek had a channel width of 6.1 m and a gradient of 2.0% the habitat types consisted of 46% riffle, 46% run and 8% pool and the fish cover was assessed at 38% of which 53% was boulder cover. The bed material was 35% cobble, 20% gravel and 20% boulder and the water quality measurements indicated a

suitable fish habitat. Rainbow trout ranging in size from 40 to 151 mm were present and the habitat was considered to include some spawning areas. Table 10.3, Figure 10.3 and Photo 10.2 provide a description of the stream inventory information gathered for RSS #2. Reaches three and four will be completed in 1997.

4.10.2 Tributaries (W.C.# 180-0690-205-076)

This tributary of Dahl Creek is a significant watercourse having a channel width of 3.4 m near its mouth and it was divided into 7 reaches. This tributary is also characterized by numerous smaller tributaries. Two RSS's (#3 and #5) characterize reach one and reach two, respectively. Reaches 3, 5 and 7 will be completed in 1997. RSS #3 had a channel width of 3.4 m and a gradient of 1.0%. The habitat types consisted of 62% riffle, 24% run and 14% pool and the fish cover was assessed at 60% with cutbanks contributing 51%. The bed material was 40% sand/silt, 34% cobble and 25% gravel and the water quality measurements indicated a suitable fish habitat. Numerous rainbow trout ranging in size from 35 to 82 mm were present. The sample site provided excellent spawning and rearing habitat in which a nursery area with large numbers of rainbow trout fry were observed. Table 10.4, Figure 10.4 and Photo 10.3 provide a description of the stream inventory information for RSS #3.

RSS #5 is located upstream on the tributary and it has a channel width of 2.7 m and a gradient of 1.0%. The habitat types consisted of 69% run, 24% riffle and 7% pool and the fish cover was assessed at 71% with overhanging vegetation contributing 35%. The bed material was 80% gravel and 15% sand/silt and the water quality measurements indicated a suitable fish habitat. Numerous rainbow trout ranging in size from 27 to 112 mm were sampled. The location contained large numbers of fry and the habitat was an excellent spawning and rearing area. Table 10.5, Figure 10.5 and Photo 10.4 provide a description of the stream inventory information for RSS #5.

Other smaller tributaries were represented by various RSS's. RSS #4 (W.C.# 180-0690-205-076-092) had a channel width of 0.9 m but had very low flows (Table 10.6, Photos 10.5 to 10.7) and had limited fish habitat. RSS #6 (W.C.# 180-0690-205-076-229) had a channel width of 1.5 m and a gradient of 1.0%. The habitat types consisted of 46% run, 33% riffle and 21% pool and fish cover was assessed at 68% with large organic debris contributing 44%. The bed material was 90% gravel and 5% cobble and the water quality measurements indicated a suitable fish habitat. Rainbow trout ranging in size from 25 to 65 mm were sampled. Spawning habitat for salmonids was evident but a 60 cm culvert at a defined road crossing had an overhanging end with a 65 cm drop and is likely a fish barrier. Cattle grazing was also evident along this watercourse. Table 10.7, Figure 10.6 and Photo 10.8 provide a description of the

stream inventory information for RSS #6.
RSS #7 (Table 10.8), RSS #8 (Table 10.9, Photos 10.9 to 10.11), RSS #9 (Table 10.10), RSS #25 (Table 10.11), and RSS #26 (Table 10.12) were other tributaries associated with W.C.# 180-0690-205-076-229. At RSS's #7, #9, #25 and #26, channels were not defined no flows were recorded and fish habitat was limited. At RSS #8 the channel was 0.9 m and had very low flows. RSS #8 did have a slight flow and some gravel bed materials were present. Also, fry were observed at the mouth of the channel and as a result, RSS #8 was as S4.

W.C.# 180-0690-205-213

This tributary was represented by RSS# 27 (Table 10.13), that had a dry channel and a width of 0.8 m. This site had limited value as fish habitat, however, because this channel entered a fish bearing stream, it was classified as S4.

W.C.# 180-0690-205-198

This small tributary represented by RSS #22 (Table 10.14) did not have a defined channel and had limited fish habitat value.

4.10.3 Summary of Stream Survey Information for Dahl Creek (Chilako River Tributary #1) W.C.# 180-0690-205

Table 10.15 and Figure 10.1 provide a summary of selected information collected during the stream survey of 14 RSS's within the Dahl Creek (Chilako River Tributary #1) drainage. Rainbow trout and coho salmon were present in the lowest reach while only rainbow trout were present in several upstream sampling sites. Two watercourses at RSS #8 (W.C.# 180-0690-205-076-229-446) and RSS #4 (W.C.# 180-0690-205-076-092) were recommended for spring sampling. The stream inventory of this subwatershed was only partly completed during the 1996 field program and the remainder is scheduled for 1997.

The first two reaches on the mainstem of Dahl Creek are classified as S2. The first major tributary, represented by RSS #3, is classified as S3. RSS #5 and RSS #6 were upstream from RSS #3, and were also classified S3. Numerous small tributaries were considered drainages due to the absence of a defined channel.

Water quality measurements indicated a suitable fish habitat with various parameters ranging as follows:

- pH 8.0
- dissolved oxygen 9-11 ppm
- conductivity 165-290 umhos

- alkalinity 100-180 ppm
- total dissolved solids 83-145 ppm

Appendix 8 provides a detailed summary of the sampling results from 13 locations on the Dahl Creek (Chilako River Tributary #1) drainage and Appendix 17 provides the age classes of the key species in this sub-watershed.

4.11 Chilako River Tributary #4 (W.C. #180-0690-231)

This sub-watershed drains an area of 880 ha. It is a small drainage that enters directly into the Chilako River. Table 11.1 provides a list of the tributaries, stream lengths, channel widths, sample site locations and a sampling dates. Figure 11.1 provides a map of the locations of the RSSs that were sampled in August, 1996.

4.11.1 Mainstem (W.C. #180-0690-231)

The mainstem of this watershed is 5.5 km in length and contained five reaches. Two locations were sampled on the mainstem at RSSs #1 on reach one, and RSS #4 on reach five.

RSS #1 was located near the mouth and had a channel width of 5.5 m and a gradient of 1.0%. The habitat types consisted of 80% beaverdam and 20% pool and the fish cover was assessed at 100% with pool cover contributing 80%. The bed material was 100% silt/sand and the water quality measurements indicated a suitable fish habitat although dissolved oxygen was at 5.0 ppm. Lake chub were the only fish sampled. Table 11.2, Figure 11.2 and Photo 11.1 provide a description of the stream survey information for RSS #1. Spring fish sampling is recommended and the channel width will be re-examined, but due to extensive beaver activity the measurements were considered representative of the reach. The stream classification was tentatively set at P-S2.

RSS #4 (Table 11.3) also located on the mainstem had a channel width of 0.3 m and limited flow. Fish habitat was considered to be poor at this location.

4.11.2 Tributary (W.C.# 180-0690-231-294)

This was the only tributary entering the mainstem which was sampled. It was represented by RSS #2 (Table 11.4, Photos 11.2 to 11.4) which had a channel width of 0.9 m. The value of this tributary as fish habitat was limited by the presence of a few stagnant pools of water in the channel. Because of these conditions, this site has been left unclassified.

4.11.3 Summary of Stream Survey Information for Chilako River Tributary #4 (W.C.# 180-0690-231)

Table 11.5 and Figure 11.1 provide a summary of selected information collected during the stream survey of 3 RSSs within the Chilako River Tributary #4 sub-watershed. Although only lake chub were sampled, some suitable fish habitat was documented and some additional spring fish sampling was recommended for RSS #1. Appendix 9 provides a detailed summary of the sampling results from 3 locations within the Chilako River Tributary #4 sub-watershed.

4.12 Chilako River Tributary #5 (W.C.# 180-0690-272)

This sub-watershed drains an area of 1380 ha. It is a small drainage that enters directly into the Chilako River. Table 12.1 provides a listing of the tributaries, stream lengths, channel widths, sample site locations and sampling dates. Figure 12.1 provides a map of the locations of the 5 RSS's that were sampled in August, 1996.

4.12.1 Mainstem (W.C.# 180-0690-272)

The mainstem of this watershed is 8.4 km in length, had one reach and had a channel width of 0.15 m. The channel was very narrow and was enclosed by clay banks at RSS #1. The very limited flow and general appearance indicated a limited fish habitat but spring sampling is recommended. A minnow trap was set for 6.0 hr. and no fish were sampled. Table 12.2 provides the stream survey information from RSS #1 (Photos 12.1 to 12.3).

RSS #3 (Table 12.3, Photos 12.4 to 12.6) was located on reach three of the mainstem and had a channel width of 1.3 m that was dry with a silt covered bed. A limited fish habitat was evident. The upper end reach break was located, described and marked.

4.12.2 Tributaries

Three other small tributaries entered the mainstem and were represented by RSS #2 (Table 12.4, Photos 12.7 to 12.9) RSS #6 (Table 12.5, Photos 12.10 to 12.12) and RSS #4 (Table 12.6, Photos 12.13 to 12.15). All of these had narrow defined channels with very low flows (a trickle) or no flow and all were considered to have limited value as a fish habitat. Spring sampling was recommended for RSS #2. RSS #4 and #6 have been left unclassified.

4.12.3 Summary of Stream Survey Information for Chilako River Tributary #5 (W.C.# 180-0690-272)

Table 12.7 and Figure 12.1 provide a summary of selected information gathered and interpreted from the stream survey at 5 RSS's within the Chilako River Tributary #5 drainage. Some suitable fish habitat was identified but it may be useful to examine the lowest reach RSS #1 and RSS #2 in the spring season to confirm the absence of fish. It is recommended that RSS #1 and #2 be resampled in the spring.

4.13 Lumpy Lake Tributary (Upper End) Chilako River Tributary #8 (W.C.# 180-0690-580-191)

A review of existing studies revealed one stream survey report that included Lumpy Creek (Smith and Kingston, 1977). This survey involved some biophysical measurements and some fish sampling. The results indicated the presence of mountain whitefish, burbot, suckers, chinook salmon, and rainbow trout in locations downstream of Lumpy Lake. Observations indicate a high spawning potential in the inlet streams to Lumpy Lake. No significant duplication of effort was noted.

This sub-watershed unit drains an area of 4063 ha. from an area north and west of Lumpy Lake which ultimately drains to Butcherflats Creek and the Chilako River via Tributary #8. Table 13.1 provides a list of the tributaries, stream lengths, channel widths, sample site locations and sampling dates. Figure 13.1 provides a map of the locations of the 19 RSS's that were sampled in August, 1996. It should be noted that the fish habitat inventory program was not completed in 1996 and as such, will be completed at a later date.

4.13.1 Mainstem W.C.# 180-0690-580-191

The mainstem of this watershed that was upstream of Lumpy Lake is 9.7 km in length, contained 9 reaches, and had a channel width of 4.1 m near the mouth. Five locations have been sampled on the mainstem at RSS #1 representing reach five, RSS #8 and #13 representing reach six, RSS #14 representing reach seven, and RSS #15 representing reach eight.

Reach Number Five

RSS #1 was located near the mouth and had a channel width of 4.1 m and a gradient of 1.0%. The habitat types consisted of 70% run, 17% pool and 13% riffle and the fish cover was assessed at 82% with large organic debris contributing 35%. The bed material was 40% cobble and 30% gravel and the water quality measurements indicated a suitable fish habitat. Numerous rainbow trout ranging in size from 63 to 170 mm were sampled. Also, redside shiners, slimy sculpins, and white suckers were present. Table 13.2, Figure 13.2 and Photo 13.1 provide a description of the stream inventory information for RSS #1.

Reach Number Six

RSS #8 was located on the mainstem and had a channel width of 5.2 m and a gradient of 2.0%. The habitat types consisted of 67% run, 24% pool and 9% riffle and the fish cover was assessed at 70% with cutbank cover contributing 50%. The bed material was 85% gravel and 10% cobble and the water quality parameters indicated a suitable fish habitat. Numerous rainbow trout ranging in size from 40-93 mm were sampled along with slimy

sculpins. The habitat was considered excellent for salmonid spawning and rearing. Table 13.3, Figure 13.3 and Photo 13.2 provide a description of the stream inventory information for RSS #8.

RSS #13 was also located on the mainstem and it had a channel width of 4.7 m and a gradient of 1.5 %. The habitat types consisted of 68% riffle, 17% run and 15% pool and the fish cover was assessed at 45% with large organic debris contributing 33%. The bed material was 40% cobble and 35% gravel and the water quality measurements indicated a suitable fish habitat. Numerous rainbow trout ranging in size from 31 to 107 mm were sampled and no other fish species were present. The habitat was considered important for spawning and rearing of salmonids. Table 13.4, Figure 13.4 and Photo 13.3 provide a description of the stream information for RSS #13.

Reach Number Seven

RSS #14 was located on the mainstem and it had a channel width of 4.6 m and a gradient of 1.0%. The habitat types consisted of 70% riffle, 24% pool and 6% run and the fish cover was assessed at 56% with boulder habitat contributing 30%. The bed material was 45% cobble and 25% boulder and the water quality measurements indicated a suitable fish habitat. Numerous rainbow trout ranging in size from 38 to 117 mm were sampled and no other fish species were present. The habitat was considered excellent for salmonid spawning and rearing. Table 13.5, Figure 13.5 and Photo 13.4 provide a description of the stream survey information for RSS #14.

Reach Number Eight

RSS #15 was located on the mainstem and it had a channel width of 5.4 m and a gradient of 3.0%. The fish habitat types consisted of 69% riffle, 28% run and 3% pool and the fish cover was assessed at 44% with cutbank cover contributing 32%. The bed material was 75% cobble and 10% boulder and the water quality measurements indicated a suitable fish habitat. Numerous rainbow trout ranging in size from 40 to 140 mm were sampled and no other fish species were present. This site provided a very suitable rearing habitat. Table 13.6, Figure 13.6 and Photo 13.5 provide a description of the stream survey information at RSS #15.

4.13.2 Tributaries (W.C. #180-0690-580-191-454)

The second reach of this tributary, represented by RSS #2, had a channel width of 1.4 m and a gradient of 1.0%. The habitat types consisted of 69% riffle, 20% run and 11% pool and the fish cover was assessed at 77% with large organic debris contributing 42%. The

bed material was 65% gravel and 19% cobble and the water quality measurements indicated a suitable fish habitat. Numerous rainbow trout ranging in size from 31-95mm were sampled and no other fish species were present. Salmonid spawning and rearing habitats were documented. Table 13.7, Figure 13.7 and Photo 13.6 provide a description of the stream survey information for RSS #2. RSS #6 represented the fourth reach and had a channel width of 1.5 m. Stagnant or very slow moving water was observed. The fish cover was assessed at 35% with large organic debris contributing 71%. The bed material was 100% sand/silt. The water quality measurements indicated low dissolved oxygen level at 1.4 ppm, which would likely result in unsuitable fish habitat. Additional sampling in the spring is recommended for RSS #6 and thus it was classified as a P-S3 (Table 13.8, Figure 13.8, Photo 13.7).

Four other tributaries were examined with 5 sampling sites including RSS #3 (Table 13.09, Photos 13.08 to 13.10), RSS #4 (Table 13.10, Photos 13.11 to 13.13), RSS #5 (Table 13.11, Photos 13.14 to13.16), and RSS #7 (Table 13.12, Photos 13.17 to 13.19). RSS #3 had no distinct channel, while RSS #4, RSS #5 and RSS #7 had 0.9 m, 0.3 m and 0.7 m channel widths that had very little flow (i.e., a trickle), indicating that there was limited fish habitat present at these sites. RSS #4 and RSS #7 had severe limitations and were classified as S6.

W.C. #180-0690-580-191-662

This tributary was represented by RSS #23 which had a channel width of 3.3 m and a gradient of 1.0%. The habitat types consisted of 74% riffle, 21% run and 5% pool and fish cover was assessed at 74% with boulder cover contributing 81%. The bed material was 40% boulder and 30% cobble and the water quality measurements indicated a suitable fish habitat. No fish were sampled in 240 m of electrofishing nor in the minnow trap set for 3 hours. Several waterfalls could be fish barriers along this tributary. Table 13.13, Figure 13.9 and Photo 13.20 provide a description of the stream survey information for RSS #23. Other sampling sites will be completed along this tributary during the 1997 fish habitat inventory program.

W.C. #180-0690-580-191-838

This tributary was represented by RSS #18 and #19. RSS #18 had a channel width of 2.1 m and a gradient of 4.0%. The habitat types consisted of 74% riffle, 20% run and 6% pool and the fish cover was assessed at 48% with large organic debris contributing 42%. The bed material was 40% gravel and 30% cobble and the water quality measurements indicated a suitable fish habitat. No fish were sampled in 200 m of electrofishing and a minnow trap set for 3 hrs. The fish habitat appeared suitable but fish were absent after extensive sampling. Table 13.14, Figure 13.10 and Photo 13.21 provide a description of

the stream information for RSS #18.

RSS #19 (Table 13.15, Photos 13.22 to 13.24) had a channel width of 0.9 m but very low flows with an 8.0% gradient. Limited fish habitat was documented and this has been left unclassified.

Small Tributaries

Five small tributaries were also assessed and were represented by RSS #9 (Table 13.16, Photos 13.25 to 13.27), RSS #10 (Table 13.17, Photos 13.28 to 13.30), RSS #11 (Table 13.18, Photos 13.31 to 13.33), RSS #12 (Table 13.19, Photos 13.34 to 13.36), and RSS #16 (Table 13.20, Photos 13.37 to 13.39). All of these channels were either non-distinctive or very narrow and had little or no flow, resulting in limited habitat for fish. The tributary represented by RSS #10 (W.C. #180-0690-580-191-624) was recommended for fish sampling in the spring season. RSS #12 was classified as S6 because it entered a reach which also has severe fish habitat limitations.

4.13.3 Summary of Stream Survey Information for Lumpy Lake Tributary (Upper End), Chilako River Tributary #8 (W.C. #180-0690-580-191) Drainage.

Table 13.21 and Figure 13.1 provide a summary of selected information gathered and interpreted from the stream survey at 19 RSS's within the Lumpy Lake (Upper End) drainage. Rainbow trout were present in much of the mainstem and the habitat provided excellent spawning and rearing for salmonids. Most of the mainstem was classified as S3 and S2.

One of the tributaries (RSS #2) also was inhabited by rainbow trout and two other tributaries appeared to have a suitable fish habitat but fish were absent. Three other reaches at RSS #10, RSS #18 and RSS #6 were recommended for fish sampling during the spring season and were classified as P-S3 or P-S4. Several of the smaller tributaries were left unclassified and had limited fish habitat.

The water quality measurements indicated suitable fish habitat with the following ranges in the results:

- pH 7.0-8.0 ppm
- dissolved oxygen 7-11 ppm (one location had 1.4 ppm)
- conductivity 120-274 umhos
- alkalinity 100-180 ppm
- total dissolved solids 58-138 ppm

At one location (RSS #6), the dissolved oxygen levels would limit the suitability as a fish habitat. The total amount of suitable fish habitat was +16.1 km in length, which is 39.8% of the mapped watercourses that have been assessed thus far.

Appendix 11 provides a detailed summary of the sampling results from 19 locations in the Lumpy Lake Tributary drainage and Appendix 17 provides the age classes of the key fish species in the sub-watershed.

4.14 Chilako River Tributary #9 (W.C. #180-0690-636)

This sub-watershed unit drains an area of 3508 ha from an area that includes six small lakes and numerous bog and marsh areas in a southeasterly direction to the Chilako River. Table 14.1 provides a list of the tributaries, stream lengths, channel widths, sample site locations and sampling dates. Figure 14.1 provides a map of the locations of the 14 RSSs that were sampled in August 1996.

4.14.1 Mainstem (W.C. #180-0690-636)

The mainstem of this watershed is 13.2 km in length, contained 8 reaches, and had a channel width of 2.0 m near the mouth. Four locations were sampled on the mainstem at RSS #1 representing reach one, RSS #3 representing reach three, RSS #4 representing reach five, and RSS #9 representing reach seven.

Reach Number One

RSS #1 had a channel width of 2.0 m and a gradient of 1.2%. The habitat types consisted of 82% riffle, 13% run and 5% pool and the fish cover was assessed at 70% with large organic debris contributing 43%. The bed material was 50% cobble and 30% boulder and the water quality measurements indicated a suitable fish habitat. No fish were present in 200 m of electrofishing and a minnow trap set for 2.0 hrs. Table 14.2, Figure 14.2 and Photo 14.1 provide descriptions of the stream survey information for RSS #1.

Reach Number Three

RSS #3 had a channel width of 1.9 m and a gradient of 1.0%. The habitat types consisted of 55% riffle, 32% run and 13% pool and the fish cover was assessed at 68% with overhanging vegetation contributing 38%. The bed material was 35% cobble, and 30% gravel and 25% sand/silt. The water quality measurements indicated some limitations to fish habitat in that the dissolved oxygen levels were 3.0 ppm. Peamouth were the only fish sampled and they are a species more tolerant to lower dissolved oxygen levels than are the salmonid species. Table 14.3, Figure 14.3 and Photo 14.2 provide a description of the stream survey information for RSS #3.

Reach Number Five

RSS #4 was also located on the mainstem channel and it had a channel width of 0.9 m and a gradient of 1.0%. The habitat types consisted of 97% run and 3% pool and the fish cover was assessed at 100% with overhanging vegetation accounting for 75%. The bed material was 100% sand/silt. The water quality measurements indicated a suitable fish habitat, although the dissolved oxygen levels were at 5.0 ppm. No fish were sampled when 200 m of stream was electrofished and a minnow trap set for 2 hrs. Table 14.4, Figure 14.4 and Photo 14.3 provide a description of the stream survey information for

RSS #4.

Reach Number Seven

RSS #9 was also on the mainstem in reach number three and it had a channel width of 0.6 m but it had pockets of standing water and the fish habitat was limited (Table 14.5, Photos 14.4 to 14.6). No distinct channel was present at the upper end reach break.

4.14.2 Tributaries (W.C. #180-0690-636-380)

RSS #2 represented one of the larger tributaries associated with Chilako River tributary #9. It had a channel width of 1.0 m and a gradient of 1.0 %. The habitat types consisted of 67% run, 18% pool and 14% riffle and the fish cover was assessed at 34% with overhanging vegetation contributing 44%. The bed material was 70% sand/silt and 20% cobble. The water quality measurements indicated some limitations to the suitability as a fish habitat in that the dissolved oxygen levels were only 2.0 ppm. No fish were present in 200 m of electrofishing and a minnow trap set for 3.0 hrs. Table 14.6, Figure 14.5 and Photo 14.7 provide a description of the stream survey information for RSS #2.

RSS #16 (Table 14.9, Photos 14.14 to 14.16) represented reach three of this tributary and is a deep marsh joining two small lakes. This reach could not be sampled because the marsh was too big and deep to wade into.

Three other site measurements of this watercourse were taken at RSS #14 (Table 14.7, Photos 14.8 to 14.10), RSS #15 (Table 14.8, Photos 14.11 to 14.13) and RSS #17 (Table 14.15, Photos 14.32 to 14.34). RSS #14 and #15 had no defined channels and were not considered suitable fish habitats. RSS #17 had a small defined channel of 0.7 m, but was blocked by debris. A white sucker was observed and hence is recommended that fish sampling proceed in the spring season.

Other Small Tributaries.

Five other small tributaries were represented by 5 RSSs at RSS #5 (Table 14.10, Photos 14.17 to 14.19), RSS #6 (Table 14.11, Photos 14.20 to 14.22), RSS #10 (Table 14.12, Photos 14.23 to 14.25), RSS #11 (Table 14.13 to Photos 14.26 to 14.28) and RSS #12 (Table 14.14, Photos 14.29 to 14.31). All of these sites have limitations as a fish habitat in that they are poorly defined channels either dry or in a bog setting.

4.14.3 Summary of Stream Survey Information for Chilako River Tributary #9 (W.C. #180-0690-636)

Table 14.16 and Figure 14.1 provide a summary of selected information gathered and interpreted from the stream survey at 17 RSSs within the Chilako River Tributary #9

subwatershed. No sport or game fish were present at any of the sampling sites in the sub-watershed. Peamouth were sampled at one location and white sucker fry were observed at another site. Some suitable fish habitat was available but there were a number significant limitations at other locations. Additional fish sampling is recommended for the spring season at RSS #17 and fish sampling should be repeated in the spring at RSS #1 at the lower end of the sub-watershed.

RSS's #5 and #6 were left unclassified due to inconsistencies in the site card regarding the presence / absence of defiend channels.

Water quality measurements indicated some limitations for fish habitat, particularly in relation to dissolved oxygen levels. The range of measures of the various parameters include:

- pH 7.5 - 8.0
- dissolved oxygen 2 - 8 ppm
- conductivity 281 - 303 umhos
- alkalinity 140 - 200 ppm
- total dissolved solids 87 - 156 ppm

Appendix 12 provides a detailed summary of the sampling results from 14 locations in the Chilako River Tributary #9 sub-watershed (W.C. # 180-0690-636).

4.15 Chilako River Tributary #14 (W.C. #180-0690-752)

The fish and fish habitat inventory of this drainage along with a complete analysis and sampling design will be completed in 1997. The information collected during the 1996 inventory is preliminary. This sub-watershed unit drains in a southeasterly direction to the Chilako River. Table 15.1 provides a list of the tributaries, stream lengths, channel widths, sample site locations and sampling dates for those sites that were sampled in 1996. Figure 15.1 shows the locations of the two RSSs that were sampled in August, 1996.

4.15.1 Mainstem (W.C. #180-0690-752)

The mainstem of this watershed is 34.5 km in length. The survey of this watershed has been initiated but most of the sampling sites will be completed in 1997. Only one location in the mainstem was surveyed, that being RSS #1 which represented reach #19, where the channel width was 7.7 m and the gradient was 1.0%. The habitat types consisted of 57% run, 23% riffle, 4% pool and 16% beaver pond. The fish cover was assessed at 86% with overhanging vegetation contributing 50% and large organic debris contributing 31%. The bed material was 45% sand/silt and 30% gravel and the water quality measurements indicated a suitable fish habitat. Numerous rainbow trout ranging in size from 30 - 182 mm were sampled and no other fish species were present. Salmonid spawning and rearing habitats were documented at this location. Table 15.2, Figure 15.2 and Photo 15.1 provide a description of the stream survey information for RSS #1. Other sampling will be required on the mainstem to complete the inventory for this watershed.

4.15.2 Tributaries (W.C. #180-0690-752-584)

Only one location was examined in 1996 on this tributary located at RSS #2. This location had a channel width of 1.4 m and a gradient less than 1.0%. The habitat type consisted of 90% pool and 10% run and the fish cover was assessed at 100% with the pool cover accounting for 95%. The bed material was 100% sand/silt. The water quality measurements indicated a deficiency of dissolved oxygen (1.4 ppm), thus resulting in some limitations to the suitability of fish habitat. No fish were present with 200 m of electrofishing and a minnow trap set for 1.5 hrs. Table 15.3, Figure 15.3 and Photo 15.2 provide a description of the stream survey information for RSS #2.

4.15.3 Summary of Stream Survey Information for Chilako River Tributary #14 Drainage (W.C. #180- 0690-752)

Table 15.4, Figure 15.1 and Appendix 13 provide the preliminary information from the first two sample sites in this watershed. The survey will be completed in 1997.

4.16 Chilako River Tributary #17 (W.C. #180-0690-849)

The fish and fish habitat inventory of this drainage along with a complete analysis and sampling design will be completed in 1997. The information provided from the 1996 inventory is very preliminary. This watershed unit drains in a southeasterly direction to the Chilako River. Table 16.1 provides a list of the tributaries, stream lengths, channel widths, sample sites and sampling dates for those sites that were surveyed in 1996.

4.16.1 Mainstem (W.C. #180-0690-849)

The mainstem of this watershed is 22.3 km in length. Two RSSs were completed in 1996 but others will be surveyed in 1997. RSS #3, representing reach six, had a channel width of 4.0 m and a gradient of 2.0%. The habitat types consisted of 65% pool, 33% run and 2% riffle and the fish cover was assessed at 92% with pool cover contributing 60% and overhanging vegetation contributing 18%. The bed material was 95% sand/silt and the water quality measurements indicated a suitable fish habitat. Rainbow trout ranging in size from 20 to 112 mm were sampled and no other fish species were present. Table 16.2, Figure 16.2 and Photograph 16.1 provide a description of the stream survey information for RSS #3.

RSS #4, representing reach two, was also located on the mainstem and had a channel width of 2.6 m and a gradient of 1.0%. The habitat types consisted of 58% riffle and 42% pool and the fish cover was assessed at 75% with large organic debris contributing 37% and pool cover 20%. The bed material was 55% cobble and 20% boulder and water quality measurements indicated a suitable fish habitat. Rainbow trout ranging in size from 85 to 159 mm were sampled but no other fish species were present. Table 16.3, Figure 16.3 and Photo 16.2 provide a description of the stream survey information for RSS #14.

4.16.2 Summary of Stream Survey Information for Chilako River Tributary #17 (W.C. #180-0690-849)

Table 16.5, Figure 16.1 and Appendix 14 provide the preliminary information from the first two sample sites in this watershed. The survey will be completed in 1997.

4.17 Chilako River Tributary #18 (W.C. #180-0690-883)

This sub-watershed unit drains an area of 4978 ha. in a southeasterly direction to the Chilako River. Table 17.1 provides a list of the tributaries, stream lengths, channel widths, sample site locations and sampling dates. Figure 17.1 provides a map of the locations of the 10 RSSs that were sampled in September, 1996.

4.17.1 Mainstem (W.C. #180-0690-883)

The mainstem of this watershed is 18.5 km in length, contained 13 reaches, and had a channel width of 2.8 m near its mouth. Three locations were sampled on the mainstem at RSS #1 representing reach one, RSS #4 representing reach nine, and RSS #13 representing reach 13.

Reach Number One

RSS #1 was located near the mouth and had a channel width of 2.8 m and a gradient of 1.0%. The habitat types consisted of 45% run, 42% riffle and 13% pool and the fish cover was assessed at 56% with boulder cover contributing 36% and large organic debris contributing 27%. The bed material was 45% cobble and 25% gravel and the water quality measurements indicated a suitable fish habitat. Numerous rainbow trout ranging in size from 68 - 135 mm were sampled but no other fish species were present. A potential barrier was present in this area but rainbow trout were present upstream and downstream. Table 17.2, Figure 17.2 and Photo 17.1 provide a description of the stream survey information for RSS #1.

Reach Number Nine

RSS #4 had a channel width of 3.4 m and a gradient of 2.0%. The habitat types consisted of 53% run, 43% riffle and 4% pool and the fish cover was assessed at 97% with boulder cover contributing 75%. The bed material was 75% boulder and 20% sand/silt and the water quality measurements indicated a suitable fish habitat. Rainbow trout ranging in size from 50 - 142 mm were present but no other fish species were present. Table 17.3, Figure 17.3 and Photo 17.2 provide a description of the stream survey information for RSS #4.

RSS #13 was also located on the mainstem and it had a channel width of 1.5 m and a gradient of 2.0%. The habitat types consisted of 60% riffle, 28% run and 12% pool and the fish cover was assessed at 67%, with boulder cover contributing 45%. The bed material was 40% gravel and 30% boulder and the water quality measurements indicated a suitable fish habitat but with low productivity and conductivity. No fish were present in 200 m of electrofishing and with a minnow trap set for 2.0 hrs. Table 17.4, Figure 17.4 and Photo 17.3 provide a description of the stream survey information for RSS #13.

4.17.2 Tributaries

W.C. #180-0690-883-073

This tributary was represented by RSS #2 and it had a channel width of 0.6 m and a gradient of 1.0%. The habitat types consisted of 83% riffle and 17% run and the fish cover was assessed at 100% with large organic debris accounting for 47%. The bed material was 45% cobble and 25% sand/silt and the water quality measurements indicated a suitable fish habitat. No fish were present in 200 m of electrofishing and a minnow trap set for 1.5 hrs. The upper end reach break of the tributary was also located. Table 17.5, Figure 17.5 and Photo 17.5 provide a description of the stream survey information in RSS #2. This site is recommended for spring sampling in 1997, and therefore, the stream was classified as P-S4.

RSS #5 (Table 17.6, Photos 17.6 to 17.8), RSS #6 (Table 17.7, Photos 17.9 to 17.11), and RSS #7 (Table 17.8, Photos 17.12 to 17.14) were located on sites that had no distinct channels. As a result, there was no fish habitat present in these tributaries.

W.C. #180-0690-883-606

This tributary was represented by RSS #3, and #12. RSS #3 had a channel width of 2.1 m and a gradient of 1.0%. This habitat type consisted of 27% run, 46% pool and 26% riffle and the fish cover was assessed at 67%, with cutbank cover contributing 76%. The bed material was 70% gravel and 20% cobble and the water quality measurements indicated a suitable fish habitat. Rainbow trout ranging in size from 40 - 123 mm were present but no other fish species were present. Table 17.9, Figure 17.6 and Photo 7.15 provide a description of the stream survey information for RSS #3.

RSS #12 was located on tributary #180-0690-883-606 and it had a channel width of 1.3 m and a gradient of 1.0%. Habitat types were comprised of 75% run, 15% riffle and 10% pool and fish cover was assessed at 100% with overhanging vegetation accounting for 70% and cutbank cover contributing 20%. Bed material consisted of 50% sand/silt and 48% gravel. Water quality measurements indicated that suitable fish habitat was present, however, conductivity and productivity were quite low. Rainbow trout ranging in size from 100 - 127 mm were sampled but no other fish species were present. Salmonid spawning habitat was documented, however some spawning habitat was silt covered. Table 17.10, Figure 7.7 and Photo 7.16 provide descriptions of the stream characteristics for RSS #12.

The upper end reach break of tributary #180-0690-883-606 was located and because there

was no defined channel, fish habitat was limited. Similarly, tributary W.C.# 180-0690-883-734 was also sampled at RSS #9 and because the channel was not defined, fish habitat was limited (Table 17.11, Photos 17.17 to 17.19).

4.17.3 Summary of Stream Survey Information for Chilako River Tributary #18 (W.C. #180-0690-883) Sub-watershed

Table 17.12 and Figure 17.1 provide a summary of selected information gathered and interpreted from the stream survey at 10 RSSs within the Chilako River Tributary #18 sub-watershed. Rainbow trout was the only species present in the mainstem and in one tributary (W.C. #180-0690-883-606), represented by RSS #3 and #12. Most of the mainstem was classified as either S3 or S4.

Water quality measurements indicated suitable fish habitat was present:

- pH 7 - 7.5
- dissolved oxygen 7 - 8 ppm
- conductivity 41 - 220 umhos
- alkalinity 40 - 140 ppm
- total dissolved solids 20 - 109 ppm

The two sampling sites in the upper end of the mainstem had very low conductivity, alkalinity and total dissolved solids when compared with the lower reaches. Appendix 15 provides a detailed summary of the sampling results from 10 locations in the Chilako River Tributary #18 (W.C. #180-0690-883) sub-watershed. Age classes of the key fish species sampled in the sub-watershed are presented in Appendix 17.

4.18 Cluculz Creek Upstream of Eulatazella Lake (W.C. #180-1913)

A review of existing studies revealed some general information on fish presence (MoELP files). Most of this information was associated with Cluculz Creek downstream of Eulatazella Lake. The 1996 survey focused on the watershed upstream of Eulatazella Lake. Nonetheless, the existing information will not meet the requirements of the fish and fish habitat inventory.

This sub-watershed unit drains an area of 14,420 ha from an area west of Eulatazella Lake. It drains in an easterly direction and the drainage includes three small lakes and numerous bogs. Table 18.1 provides a list of the tributaries, stream lengths, channel widths, sample site locations and sample dates. Figure 18.1 provides a map of the locations of the 58 RSSs that were sampled during September, 1996.

4.18.1 Mainstem (W.C. #180-1913)

The mainstem is 25.8 km in length, is comprised of 11 reaches, and has a channel width of 6.7 metres near the mouth, which enters Eulatazella Lake. Four locations were sampled on the mainstem at RSSs #1 and #13 representing Reach 11, RSS #2 representing Reach 15, and RSS #3 representing Reach 16. Two additional reaches will be sampled during the 1997 inventory program.

Reach Number Eleven

RSS #1 was located near the mouth and had a channel width of 6.7 m and a gradient of 3.0%. Habitat types were comprised of 61% riffle, 37% run and 2% pool and fish cover was assessed at 78%, with large organic debris contributing 45% and boulder cover contributing 26%. Bed material was characterized by 40% cobble, 25% boulder and 20% sand/silt and water quality measurements indicated that suitable fish habitat was present. Rainbow trout, kokanee, redside shiners and slimy sculpins were sampled at this site. The rainbow trout ranged in size from 31 - 115 mm. Table 18.2, Figure 18.2 and Photo 18.1 provide descriptions of the fish and fish habitat characteristics of RSS #1.

RSS #13 was also located on the mainstem and it had a channel width of 6.1 m and a gradient of 2.0%. Habitat types were comprised of 65% run and 35% pool and fish cover was assessed to be 87% with cutbanks, boulder cover and overhanging vegetation contributing 40%, 17% and 17% respectively. Bed material was 40% cobble and 30% boulder and water quality measurements indicated that suitable fish habitat was present. Rainbow trout ranging in size from 33 - 178 mm were abundant but no other fish species were present. Salmonid spawning and rearing habitats were also documented. Table 18.3, Figure 18.3 and Photo 18.2 provide descriptions of the stream survey information for RSS #13.

Reach Number Fifteen

RSS #2 had a channel width of 5.7 m and a gradient of 1.0%. The habitat types consisted of 53% riffle, 44% run and 3% pool and the fish cover was assessed at 55%, with cutbank cover accounting for 78% and large organic debris contributing 18%. The bed material was 40% gravel, 30% sand/silt and 30% cobble. The water quality measurements indicated a suitable fish habitat. Rainbow trout ranging in size from 40 - 120 mm were abundant but no other fish species were present. Salmonid spawning and rearing habitats were documented. Table 18.4, Figure 18.4 and Photo 18.3 provide descriptions of the stream survey information for RSS #2.

Reach Number Thirteen

RSS #3 was located on the mainstem and it had a channel width of 5.3 m and a gradient of 1.0%. The habitat types consisted of 100% run and the fish cover was assessed at 37%, with instream vegetation contributing 81% and large organic debris 14%. The bed material was 75% sand/silt and 25% gravel and the water quality measurements indicated a suitable fish habitat. Rainbow trout ranging in size from 30 to 105 mm were present but no other fish species were present. Table 18.5, Figure 18.5 and Photo 18.4 provide a description of the stream survey information for RSS #3.

4.18.2 Tributaries

W.C. #180-1913-752

Reach one of this tributary was represented by RSS #6, which had a channel width of 1.9 m and a gradient of 1.0%. The habitat types consisted of 53% riffle, 25% pool and 22% run and the fish cover was assessed at 71%, with cutbanks and overhanging vegetation contributing 39% and 28% respectively. The bed material was 50% gravel and 35% sand/silt and the water quality measurements indicated a suitable fish habitat. Rainbow trout ranging in size from 40 to 117 mm were abundant but no other fish species were present. Table 18.6, Figure 18.6 and Photo 18.5 provide a description of the stream survey information for RSS #6.

RSS #8 represented reach three in this tributary (W.C. #180-1913-752) and it had a channel width of 1.5 m and a gradient of 1.0%. The habitat type was 100% run and the fish cover was assessed at 39% with cutbanks, overhanging vegetation and instream vegetation contributing 38%, 26% and 26% respectively. The bed material was 70% sand/silt and 30% gravel and the water quality measurements indicated a suitable fish habitat. Rainbow trout ranging in size from 48 - 98 mm were present and no other fish species were present. Several beaverdams were noted in the area but fish were sampled upstream and downstream of the dams. Table 18.7, Figure 18.7 and Photo 18.6 provide a

description of the stream survey information for RSS #8.

RSS #7 (Table 18.8, Photos 18.7 to 18.9) represented another tributary entering W.C. #180-1913-752 and it had a channel width of 1.2 m. This site had very low flows but exhibited good fish habitat substrate. Although this site has already been visited twice, another visit is recommended in the spring because higher flows would make this stream suitable spawning habitat.

Six smaller tributaries enter this watercourse and are represented by 6 sampling sites at RSS #19 (Table 18.9, Photo 18.10), RSS #20 (Table 18.10, Photos 8.11 to 8.13), RSS #21 (Table 18.11, Photos 18.14 to 18.16), RSS #22 (Table 18.12, Photos 18.17 to 18.19), RSS #24 (Table 18.13, Photos 18.20 to 18.22), and RSS #25 (Table 18.14, Photos 18.23 to 18.25). All of these tributaries had either very narrow channels or non-distinct channels and all of the tributaries were classified as either intermittent streams or drainages.

W.C. #180-1913-798

This tributary was represented by RSS #9 (reach one) and #11 (reach seven) on the main watercourse. RSS #9 had a channel width of 3.5 m and a gradient of 1.0%. The habitat types consisted of 56% run, 36% riffle and 8% pool and fish cover was assessed at 62% with cutbanks, large organic debris and pool habitat contributing 81%, 8% and 8% respectively. Bed material was largely gravel (90%) and water quality measurements indicated that suitable fish habitat was present. Although numerous rainbow trout ranging in size from 40 - 110 mm were present, no other fish species were sampled. Table 18.15, Figure 18.8 and Photo 18.26 provide a description of the stream survey information for RSS #9.

RSS #11 was upstream in reach seven on the main watercourse (W.C. #180-1913-798) and had a channel width of 2.1 m and a gradient of 2.0%. Habitat types were comprised of 77% riffle, 18% run and 5% pool and fish cover was assessed at 80% with instream vegetation, overhanging vegetation and cutbanks contributing 31%, 25% and 21%, respectively. Bed material was 60% gravel and 35% cobble and water quality measurements indicated that suitable fish habitat was present. Rainbow trout ranging in size from 62 - 66 mm were present, however, no other fish species were sampled. Table 18.16, Figure 18.9 and Photo 18.27 provide descriptions of the stream survey information for RSS #11.

Fifteen tributaries enter W.C. #180-1913-798. Most of them are very narrow or non-defined channels, with no flow, bog-like terrain and sub-surface flow. Most of these

tributaries had limited fish habitat value but there was some channel definition in four of the reaches. These sites are listed below:

- RSS #53 - Table 18.17, Photos 18.28 to 18.29,
- RSS #54 - Table 18.18, Photos 18.30 to 18.32,
- RSS #56 - Table 18.19, Photos 18.33 to 18.35,
- RSS #57 - Table 18.20, Photos 18.36 to 18.38,
- RSS #58 - Table 18.21, Photos 18.39 to 18.41: Small defined channel which enters a fish bearing reach - classified S4,
- RSS #59 - Table 18.22, Photos 18.42 to 18.44: Small defined channel which enters a fish bearing reach - classified S4,
- RSS #60 - Table 18.23, Photos 18.45 to 18.47,
- RSS #61 - Table 18.24, Photos 18.48 to 18.50,
- RSS #62 - Table 18.25, Photos 18.51 to 18.54,
- RSS #63 - Table 18.26, Photos 18.55 to 18.57: Small defined channel which enters a fish bearing reach - classified P-S4,
- RSS #64 - Table 18.27, Photos 18.58 to 18.60,
- RSS #65 - Table 18.28, Photos 18.61 to 18.63,
- RSS #66 - Table 18.29, Photos 18.64 to 18.66, and
- RSS #67 - Table 18.30. Photos 18.67 to 18.69.

The only tributary entering watercourse #180-1913-798 where fish were captured was RSS #10. This site had some flow, with a channel width of 0.8 m and a gradient of 4.5%. The habitat type was comprised of 100% riffle and fish cover was assessed to be 80% with large organic debris, cutbanks and overhanging vegetation contributing 38%, 37% and 25%, respectively. Bed material was 60% gravel, 20% cobble and 20% sand/silt and water quality measurements indicated that suitable fish habitat was present. Although rainbow trout ranging in size from 36 - 49 mm were present, no other fish species were sampled. Table 18.31, Figure 18.10 and Photo 18.70 provide descriptions of the stream survey information for RSS #10.

W.C. #180-1913-784

This tributary was represented by RSS #27 and had a channel width of 2.0 m and a gradient of 1.0%. Habitat types were comprised of 34% run, 8% pool and 4% riffle and 54% beaver pond while fish cover was assessed to be 69% with overhanging vegetation, instream vegetation and large organic debris contributing 44%, 29% and 14%, respectively. Bed material was 85% gravel, 10% sand/silt and 5% cobble and water quality measurements indicated that suitable fish habitat was present. Rainbow trout

ranging in size from 35 - 94 mm were present but no other fish species were sampled. Table 18.32, Figure 18.11 and Photo 18.71 summarize the fish and fish habitat characteristics for RSS #27.

W.C. #180-1913-881 and W.C. #180-1913-812

Two tributaries represented by RSS #12 and RSS #31 had characteristics that suggested spring fish sampling would be required. RSS #12 (Table 18.33, Photos 18.72 to 18.74) had a channel width of 0.4 m and was connected to a large marsh area. RSS #31 (Table 18.34, Photos 18.75 to 18.77) had a channel width of 1.2 m and no fish barriers were evident which might prevent fish from accessing this area.

Other Small Tributaries

Twenty-eight smaller tributaries were sampled and most of them were characterized by non-defined channels, no banks, and no water flow, seepage areas, stagnant pools. In fact, many of these tributaries were dry. Because of these habitat characteristics, most of them were considered to have limited value as fish habitat. A summary of the habitat characteristics is provided for the following RSSs:

- RSS #5 - Table 18.35, Photos 18.78 to 18.80,
- RSS #14 - Table 18.36, Photos 18.81 to 18.83,
- RSS #15 - Table 18.37, Photo 18.84 to 18.87: Small defined channel, but left unclassified because channel loses definition approx. 200 metres from main channel (mapwheel estimate),
- RSS #16 - Table 18.38, Photos 18.88 to 18.90: Small defined channel, but left unclassified because upstream of RSS #15,
- RSS #17 - Table 18.39, Photos 18.91 to 18.93,
- RSS #28 - Table 18.40, Photos 18.94 to 18.96,
- RSS #29 - Table 18.41, Photos 18.97 to 18.99,
- RSS #30 - Table 18.42, Photos 18.100 to 18.102,
- RSS #32 - Table 18.43, Photos 18.103 to 18.105,
- RSS #33 - Table 18.44, Photos 18.106 to 18.108,
- RSS #34 - Table 18.45, Photos 18.109 to 18.111,
- RSS #35 - Table 18.46, Photos 18.112 to 18.113,
- RSS #36 - Table 18.47, Photos 18.114 to 18.116,
- RSS #37 - Table 18.48, Photos 18.117 to 18.119,
- RSS #38 - Table 18.49, Photos 18.120 to 18.122,
- RSS #40 - Table 18.50, Photos 18.123 to 18.125,
- RSS #41 - Table 18.51, Photos 18.126 to 18.128,

- RSS #42 - Table 18.52, Photos 18.129 to 18.131,
- RSS #43 - Table 18.53, Photos 18.132 to 18.134,
- RSS #44 - Table 18.54, Photos 18.135 to 18.137,
- RSS #47 - Table 18.55, Photos 18.138 to 18.140,
- RSS #48 - Table 18.56, Photos 18.141 to 18.143,
- RSS #50 - Table 18.57, Photos 18.144 to 18.146,
- RSS #51 - Table 18.58, Photos 18.147 to 18.149,
- RSS #45 - Table 18.59, Photos 18.150 to 18.152.

It should be noted that a significant fish barrier (hanging culvert, Photo 18.76) was located at RSS #15. Very little water flow was observed on the day (September 5, 1996) this RSS was sampled. As stated above, this site has been left unclassified.

4.18.3 Summary of Stream Survey Information for Cluculz Creek Sub-watershed (Upstream of Eulatazella Lake) W.C. #180-1913

Table 18.60 and Figure 18.1 provide a summary of selected information collected during the stream survey of 58 RSSs within the Cluculz Creek sub-watershed, upstream of Eulatazella Lake. Rainbow trout was the only species of fish sampled throughout the drainage except for the fish sampling site near the mouth of Cluculz Creek at Eulatazella Lake where Kokanee, redside shiners and slimy sculpins were observed. The mainstem of this sub-watershed provides excellent habitat for rainbow trout and contains numerous spawning areas. Four tributaries flowing into the mainstem were inhabited by rainbow trout.

Based on the information collected during the fish and fish habitat inventory of this sub-watershed, the mainstem was classified as S2 and the tributaries bearing fish were classified as S3 or S4. Most of the remaining tributaries in the sub-watershed were characterized by poorly or non-defined channels with no banks and little or no water flow. In many instances, the tributaries did not contain any water at all. However, four locations (RSS #7, RSS #12, RSS #31, and RSS #63) were identified which require additional sampling to be conducted in spring, including those sites that were not completed prior to the end of the 1996 field season.

Water quality measurements indicated that suitable fish habitat was present in all of the sites that were sampled:

- pH 7.0 - 8.0
- dissolved oxygen 7 - 11 ppm

- conductivity 99 - 208 umhos
- alkalinity 60 - 140 ppm
- total dissolved solids 50 - 102 ppm

Appendix 16 provides a detailed summary of the sampling results from 58 locations in the Cluculz Creek sub-watershed, upstream of Eulatazella Lake, W.C. #180-1913. Age classes of key fish species sampled in the sub-watershed is presented in Appendix 17.

5.0 DISCUSSION

5.1 Stream Inventory Summary

During the 1996 field program, 167 watercourses representing 500 km of stream length were sampled within 16 sub-watersheds of the Isle Pierre study area (Table 19.1). Within these tributaries, 211 reach sample sites were established. Not all of the watercourses within each sub-watershed were sampled during the 1996 field program, however, additional sampling will be undertaken in 1997 to complete the reconnaissance fish and fish habitat inventory. The watercourses within the sub-watersheds ranged in length from 9.6 km for Tributary #4 to almost 143.5 km for Cluculz Creek, upstream of Eulatazella Lake (Table 19.1). Channel widths at the mouths of mainstem streams were typically less than 5.0 m with the exception of Dahl Creek, Tributary #14 and Cluculz Creek which were 6.0, 7.7 and 6.7 m wide, respectively.

Most watercourses in the Isle Pierre study area were characterized by relatively low gradients and frequently originated from seepage areas or bogs. Relatively short tributaries (<< 2.0 km) generally had poorly defined channels with little of no water flow during August and September, 1996. These watercourses were often drainages or occasionally intermittent streams. Poor channel definition was a major criterion for determining upper reach breaks or locations along tributaries where no further fish and fish habitat surveys would be undertaken. However, these short, poorly defined channels form a network of watercourses which appears to be significant in ensuring appropriate water flows to support fish in important downstream habitats. The importance of these seepage or drainage areas for fish and fish habitat in downstream areas should not be under estimated.

The dominant habitat unit in most of the sub-watersheds of the Isle Pierre study area was the run while fish cover was generally rated as very good. Gravel and sand/silt were the predominant bed materials recorded in most tributaries however, several tributaries characterized by steeper gradients exhibited larger bed materials. Many watercourses in the study area contained bed materials suitable for salmonid spawning habitat.

Water quality measurements indicated that suitable fish habitat exists throughout the Isle Pierre study area. However, low dissolved oxygen levels were recorded in several tributaries, limiting the value of these areas as fish habitat. The range of variation recorded for some of the water quality parameters in the Isle Pierre study area is summarized below:

- Conductivity: 41 - 303 umhos
- Alkalinity: 40 - 200 mg/l
- Total dissolved solids: 20 - 152 ppm
- pH: 6.5 - 8.0
- Dissolved oxygen: 1.4 - 11.0 ppm

- 5.2 Suitability of Fish Habitat

Watercourses that did not provide suitable habitat for fish were essentially characterized by poor channel definition and very low water flows. Mainstem channels typically provided excellent spawning habitat for salmonids and several tributaries in the study area were confirmed as spawning areas. Based on field observations, a number of salmonid rearing habitats were also identified throughout the study area.

5.3 Fish Presence

Rainbow trout was the predominant game fish species in the Isle Pierre study area, occurring in all but three sub-watersheds (e.g., Tributaries 4, 5 and 9) of the Chilako River (Table 19.1). Although no salmonids were recorded in Tributaries 4 and 9, lake chub was sampled in Tributary #4 and peamouth was found in Tributary #9. No fish were recorded in Tributary #5. Based on the results of the 1996 field program, spring sampling is recommended for some of the reach sample sites to confirm fish presence or absence in Tributaries, 4, 5 and 9. The only other game fish species encountered in the study area during the 1996 field program were kokanee (found in Cluculz Creek) and coho salmon (found in Tributary #1) (Table 19.1).

5.4 Stream Classification

The specific stream classifications for each of the tributaries in the 16 sub-watersheds are listed in the summary section of each sub-watershed. Most of the reaches sampled during the 1996 field program were classified as S3 and S4 when game fish were present. All of the reaches in the study area that did not contain game fish and showed limited fish habitat potential were unclassified. Those reaches that were assessed to have some fish potential and should have fish during high water levels were classified as P-S3 or P-S4 and reflected a need to resample.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The reconnaissance fish and fish habitat inventory of CANFOR's Isle Pierre operating area was partially completed between July and September, 1996. The 1996 field program resulted in the assessment of approximately one-third of the watercourses in the operating area. Based on the results of this field program, a number of recommendations can be made:

Completion of the Inventory - During the 1996 field program, approximately one-third of the inventory was completed despite the initiation of the project later in the field season. Although sampling was undertaken in each of the 16 sub-watersheds, large gaps in fish and fish habitat inventory data still exist throughout the Isle Pierre study area. For this reason,

additional sampling should be undertaken as outlined in the initial inventory plan developed in July, 1996.

Absence of Fish - The absence of game fish in three of the sub-watersheds warrants some further sampling during the spring and summer periods. These areas appear to contain suitable fish habitat but no fish were sampled. By undertaking a spring sampling program, seasonal use of these habitats by various fish species could be determined.

Spring Sampling - In addition to three sub-watersheds identified above, Table 19.1 identifies other tributaries for which a spring sampling program is also recommended. The need for additional sampling during different seasons was based on the following considerations:

Some of the sub-watersheds contained well-defined channels but during the 1996 field program, which was conducted between mid-summer and fall, water flows were minimal. During the spring period when water flows are higher, these channels may provide suitable habitat for fish.

Some of the sub-watersheds contained suitable fish habitat but no fish were sampled.
Based on these considerations, 31 reach sample sites were initially identified as locations where spring sampling should be undertaken in 1997. A split sampling approach may provide more effective sampling on a seasonal basis while at the same time ensuring that the fish and fish habitat inventory is conducted in an efficient and cost-effective manner.

Inventory Planning - During the 1996 field program, it became apparent that there were some difficulties in identifying and locating tributaries for sampling based on existing maps and air photos. For this reason, a comprehensive pre-survey plan should be developed prior to the initiation of field surveys. In addition, some flexibility in adjusting the sampling program based on field observations by field crews should be incorporated into the overall sampling program.

Inventory Information - One of the problems encountered during the 1996 field program was related to recording the appropriate fish and fish habitat information on the stream survey cards. For some of the parameters measured by the field crews there was not sufficient space present on the stream survey forms. It is recommended that the stream survey card be redesigned to include the following parameters as required by the Resources Inventory Committee:

- Alkalinity

- Total dissolved solids
- Aquatic vegetation
- Wildlife observations
- Air temperature, and a
- Comments section.

It would also be desirable to have a specific stream survey card which would be used for recording the necessary information for measurement points. This reduced stream survey form would only include the following information:

- Reason for termination
- GPS location
- Channel description, and
- Reason for additional sampling if recommended.

7.0 LITERATURE CITED

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