CANFOR - FORT ST. JOHN
1998
RECONNAISSANCE LAKE INVENTORY
OF
ROD LAKE*

WSC: 235-304300-30300

Prepared for:
Canadian Forest Products Ltd.
Fort St. John/Taylor Division
RR#1, Comp 2, Site 13
Fort St. John, B.C.
V1J 4M6

Prepared by:
Diversified Environmental Services
Box 6263
Fort St. John, B.C.
V1J 4H7

Approved by:

Brad Culling

MARCH 1999

Project Reference Information

MoELP Ministry Number	Canfor-Peace
FRBC Work Plan Number	OPM98803
FDIS Project Number	07-LHAF-0000-0001-1999
FRBC Region	Prince George Region
MELP Region	07B
MELP District	Fort St. John District
FW Management Unit	7-36
Forest Region	Prince George
Forest District	Fort St. John Forest District
Forest Licensee and Tenure #	Canadian Forest Products Ltd. TSA A18154

Watershed Information

Watershed Group	Lower Halfway River
Watershed Code	235-304300-30300
Waterbody Identifier	00744LHAF
UTM at Lake Outlet	10.510620.6241408
Order at Lake Outlet	3rd
Number of Tributaries	4 (TRIM)
Drainage Area	859.2 ha
Magnitude	4
Elevation	990m
NTS Map	94 B/07
TRIM Map	094B.036
BEC Zone	ESSF
Air Photos	30BC80026: No. 180 (June 7, 1980) Scale: 1:20,000

Lake Sampling Summary

Lake Survey Type	Primary
Water Surface Area	9.3 ha
Max. Depth	11.2m
Mean Depth	6.1m
Secchi Depth	3.9m
Volume	502,300 m^3
Area Above 6m Contour	5.18 ha
Shoreline Perimeter	2420m
Lake Length	1150m
Number of Islands	0
Species Present in Lake	LKC, LSU

Contractor Information

Project Manager	B. Culling, Diversified Environmental Services Box 6263, Fort St. John, B.C. V1J 4H7 (250) 787-9101
Field Crew	D. Culling, B.Culling
Data Entry by:	K. Newsholme
Report prepared by:	D. Culling, B. Culling
Report edited by:	K. Newsholme
Maps prepared by:	Waberski-Darrow Survey Group 10720-100 Avenue, Fort St. John, B.C. (250) 787-0300
Water Chemistry conducted by:	CanTest Ltd. 1523 West 3rd Ave., Vancouver , B.C. V6 1JB (604) 734-7276

Disclaimer

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

Acknowledgments

Funding for Canfor-Fort St. John's 1998 Reconnaissance 1:20k Fish and Fish Habitat Inventory program was provided by Forest Renewable BC.

The authors wish to thank Scott Gordon, Forestry Administrator, Canfor-Fort St. John, and Jeff Burrows, Fisheries Habitat Inventory Biologist, B.C. Environment - Fisheries Branch, Fort St. John, for their invaluable support throughout this project.

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1.0 INTRODUCTION

1.1 Project Scope and Objectives

During the summer of 1998, Canfor-Fort St. John, in partnership with BC Environment, undertook Year 3 of a Fish and Fish Habitat Inventory Program, which began in 1996. The purpose of the project is to collect basic fish habitat and fish distribution data within the Fort St. John Timber Supply Area (TSA).

This reconnaissance lake survey was undertaken in conjunction with Reconnaissance 1:20,000 Fish and Fish Habitat Inventory within the Graham River Tributaries project area. Information gathered on fish distribution and biophysical habitat will be used in both forest development planning and general fisheries management.

A review of TRIM mapping and aerial photography indicated only one primary lake within the Graham River Tributaries project area. Several semi-permanent beaver impoundments occur downstream of the lake, and two secondary lakes occur upstream. At the time of the 1980 aerial photography both upstream secondary lakes were dry.

Although this primary lake is ungazetted, it is locally referred to as either "Moose" or "Rod" Lake. Fisheries personnel in Fort St. John indicate there is a profusion of "Moose Lakes" in the region, so for the purposes of this survey it will be referred to as "Rod Lake."

1.2 Location

Rod Lake* is located in the eastern foothills of the Rocky Mountains, approximately 125 km west of Fort St. John. The lake is situated within the Engelmann Spruce-Subalpine Fir biogeoclimatic zone of the Peace Foothills Ecosection.

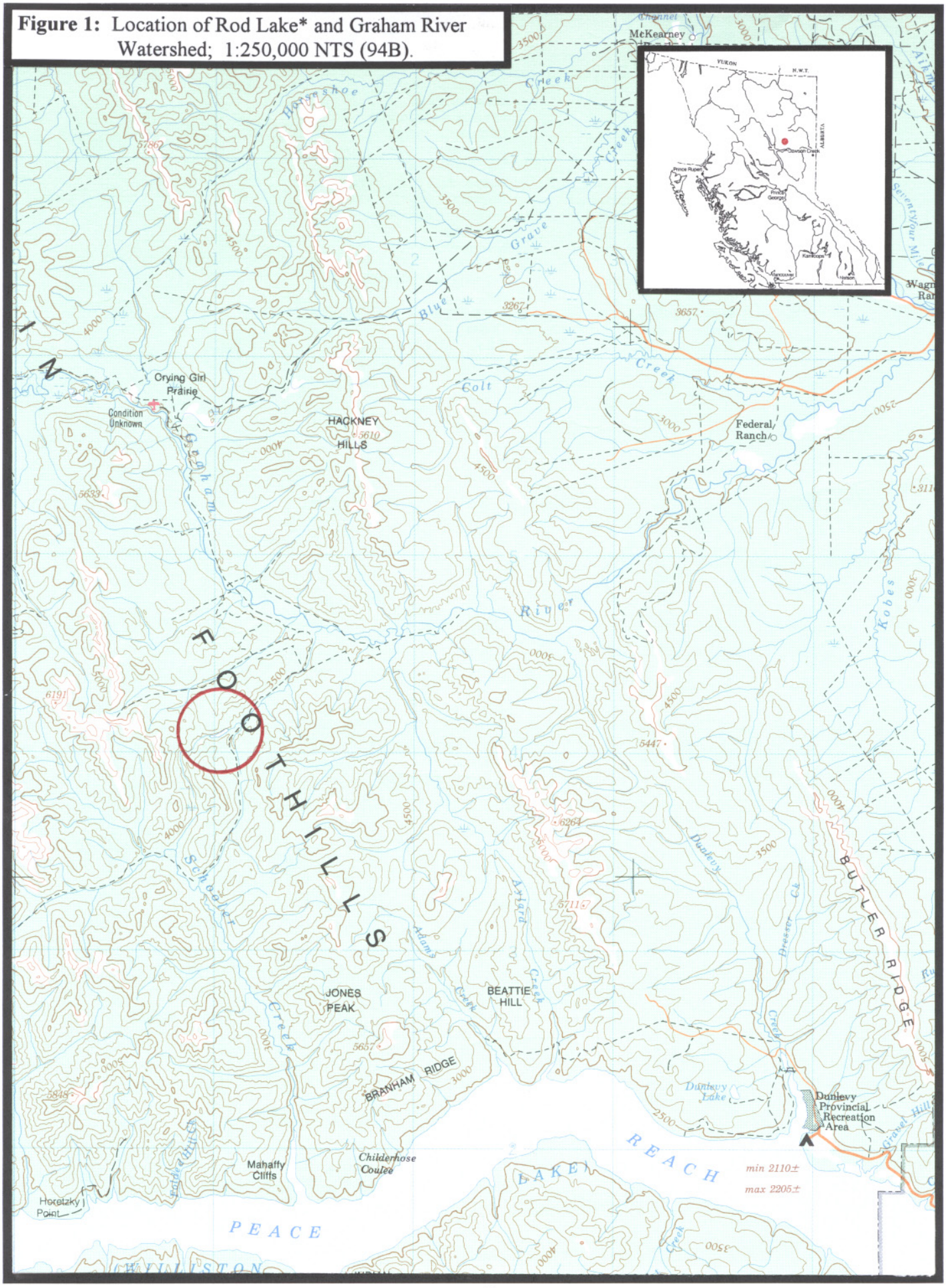
The lake is located on the upper portion of an unnamed tributary (WCS 235- 304300-30300) to the Graham River. The tributary enters the Graham River approximately 45 km upstream of its confluence with the Halfway River, a sub-basin of the Peace River drainage system (Figure 1).

1.2.1 Access

Rod Lake* is located in a remote wilderness area and is not accessible by road. The lake is approximately one hour's flight west of Fort St. John by helicopter. A traditional, unmarked pack trail, originating at Crying Girl Prairie on the Graham mainstem, runs along the lake, and over the height of land, to the Schooler Creek Drainage.

Directions from Fort St. John to Crying Girl Prairie are as follows: travel north to Milepost 95 (km 151.5) of the Alaska Highway, turn left onto the Upper Halfway Road (Rd # 117). Proceed to km 56 of the Upper Halfway Road and turn left onto the Halfway-Graham Forest Service Road. Stay right at the junction with the Wet Creek Road at km 66, stay left at the junction with the Horseshoe Creek Road at km 86 and proceed to Crying Girl Prairie

Figure 1: Location of Rod Lake* and Graham River Watershed; 1:250,000 NTS (94B).



at km 102. For the purpose of this survey, equipment was transported by road to Heyer's Camp, then slung by helicopter to the lake. Heyer's Camp is located by following the directions described above, to km 66 of the Halfway-Graham Forest Service Road and turning left onto the Wet Creek Road.

Access to the lake by fixed-wing aircraft is possible, but landing and take-off room in the narrow, steep-walled valley is tight. Evidence that the location calls for a skilled pilot may be found hanging in a tree at the east end of the lake. A bent propeller is a reminder of a fatal crash which occurred some years ago.

2.0 RESOURCE INFORMATION

2.1 First Nations Issues and Interests

Rod Lake* falls within the traditional use area of both the Halfway River and West Moberly First Nations.

2.2 Development and Land Use

Industrial disturbance within the project area is confined to past seismic exploration as evidenced by occasional winter-cut seismic lines and heli-pads. An intensive heli-seismic program was underway within the project area at the time of the survey. Depending on the results of this seismic exploration, it may be assumed that natural gas development, including drilling activities and pipeline gathering systems, will also occur.

This portion of the Graham River drainage is part of Canadian Forest Product's operating area within the Fort St. John Timber Supply Area. Forest harvesting activities are proposed downstream of the lake, adjacent to the lower reaches of the unnamed Graham River tributary, over the next five years, as per Canfor's Graham River development plan. This plan includes access construction and harvesting associated with cutting permit 321.

Although the area does not fall within the Access Management Area (AMA), the intention of the LRMP was that similar vehicle restrictions would apply. Currently there is no legislation in place to restrict motorized traffic.

Rod Lake* occurs within the guide-outfitting territory of Ottertail River Outfitters, based at Crying Girl Prairie. A Forest Service recreation site is located immediately downstream of Crying Girl Prairie, at the end of the nearest road access. The rec site is the closest public recreational facility and is a 22 kilometre walk or horseback ride from the lake.

Although there are no established recreational facilities at the lake, a firepit and wall tent frame near the outlet indicate limited use by the local guide/outfitter. A dilapidated and unusable trapper's cabin, approximately forty to fifty years old, also sits at the east end of the lake, adjacent to the outlet.

2.3 Wildlife Values

Large mammals which frequent the area include: moose, caribou, wolf, grizzly bear and black bear. Critical elk and mule deer winter range may be found downstream, on south-facing Graham River valley breaks. Furbearers common in the mature coniferous ESSF forests surrounding the lake include coyote, lynx, fisher, marten, wolverine, red squirrel and snowshoe hare. Moose were frequently observed feeding in shallows at the west end of the lake throughout the field season. Beaver were observed in the vicinity of a beaver lodge on the north shore of the lake and a belted kingfisher was seen actively fishing.

2.4 Historical Fisheries and Water Quality Information

No formal fisheries or water quality surveys had been undertaken at the lake prior to this assessment. No historical fisheries data exists. Anecdotal information from Gary Heyer, of Heyer's Camp, suggests local residents may have fished for bull trout in the lake in the past, but none have been caught in the last ten years. No bull trout were captured during this lake survey, and there is currently no access from the Graham River due to subsurface flow at the outlet and numerous barriers downstream. It is possible that bull trout may have gained access to the lake during a period of exceptionally high water, however, a more likely explanation is that any fish which may have been present in the lake were the result of unauthorized stocking and were eventually fished out.

2.5 Tributary Information

The lake is reach 5 of an unnamed tributary (WSC 235-304300-30300) to the Graham River. Sites were surveyed on the reaches immediately up and downstream of the lake. Site cards and site photographs for the inlet and outlet are found in Appendices II and III.

The source of the inlet (Site 235) was found to be a series of springs flowing from the adjacent slopes. A well-defined channel exists for approximately 150 metres upstream of the lake inlet. Upstream of this point there is no visible channel and no evidence of surface flow. Surface flow in the lower 150 metres was intermittent at the time of the survey. The substrate at the inlet consists of soft silt, shifting to a mixture of gravels and fines above the lake high water mark. Low flows would likely preclude use by fall spawning species. Habitat potential for spring spawners may be marginally higher, however, low flow and low water temperature are severely limiting.

In addition to the west-end inlet, three first-order tributaries appear on TRIM mapping. No visible channel and no evidence of surface flow was noted at any of these drainages.

There is no discernible outlet channel immediately downstream of the lake. Water draining from the lake apparently flows underground and re-surfaces along the north valley wall, approximately 150 metres downstream of the lake's east end. A minor tributary flows into the outlet channel from the south, approximately 240 metres downstream of the lake. At the time of the survey, no surface flow was present in the outlet channel upstream of this secondary tributary confluence.

3.0 METHODS

The lake survey was conducted in accordance to *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Standards and Procedures, Version 1.1 (April 1998).* The survey of Rod Lake* comprised a minor part of a broader reconnaissance inventory program undertaken within the Graham River Tributaries project area as a whole. Planning of the lake survey and related stream surveys was completed as part of the overall project plan for the Graham River Tributaries project area which included five unnamed Graham River tributaries. Both the outlet and inlet streams (reaches 4 and 6, respectively) were selected for random sample sites during the reach planning phase of the project.

3.1 Sampling Equipment and Methodologies

The survey of Rod Lake* was undertaken on July 30-31, 1998. The survey was conducted from a 3m inflatable Zodiac with 15hp outboard which was slung into the lake with a Bell 206B helicopter from road access 25 km away.

General and specific features were noted during an initial shoreline reconnaissance. The lake level benchmark was established by driving in a length of 10mm rebar at a recognizable location. The upper portion of the rebar stake was painted red to aid in future relocation.

Lake bathymetry data was collected with a Lowrance X-15A sounder. One lake-length e-line transect and nine cross-basin transects and were recorded at boat speeds of approximately 1.8 m/s.

Raw transect data was used to establish the limnology station where maximum lake depth was confirmed and recorded. A YSI Model 51B oxygen meter with YSI 5739 probe and 15 meter cable was used to record dissolved oxygen and water temperature at 0.5 metre intervals from surface to bottom. Secchi depth, water colour, surface and bottom pH and surface and bottom conductivity were also recorded.

The collection of surface and bottom water samples for laboratory analysis and metals package had to be delayed until August 26, 1998 due to logistical constraints relating to field schedule and sample transportation options. Laboratory water samples were collected at the established limnology station using a Kemmerer Model 1540 vertical sampler operated from a one-person, inflatable life boat. Samples were packaged and labeled as per laboratory requirements and shipped from Fort St. John to Cantest Labs in Vancouver.

Fish sampling was conducted using a Coffelt Mark X gas-generator, backpack electro-fisher, 2 Gee minnow traps and one 300-foot experimental sinking gill-net. Refer to Figures 2 and 3 for sampling locations. Species, total number and size range were recorded for all fish captured. Fork length, weight, sex and maturity were recorded for a minimum of 30 of each “non-sport” species. No aging structures were collected.

Stream sample sites were evaluated on the inlet at the west end of the lake (Site 235) and on the outlet at the east end of the lake (Site 237), as per *Stream Inventory Standards and*

Procedures (RIC - April 1998). No sample sites were assessed on additional first-order TRIM tributaries due to absence of fisheries potential.

Appropriate photodocumentation was collected including lake panoramas, shoreline characteristics, benchmark, fish and inlet and outlet sample sites. Table 1 lists equipment used during the course of the lake survey, as well as surveys of inlet and outlet streams.

Table 1: List of field equipment.

EQUIPMENT	PARAMETER	MAKE AND MODEL
Gill-net	fish species present	300' 6-panel experimental sinking
Electro-fisher	fish species present	Coffelt Mark X
Minnow trap	fish species present	-
Depth sounder	bathymetric profile	Lowrance X-15A
Boat and motor	-	3m Zodiac with 15 hp outboard
Water column sampler	water samples from depth	Kemmerer Model #1540
Field pH meter	water pH	Hanna Instruments Model pHep-1
DO meter	dissolved O_2 and temp at depth	YSI Model 51B
GPS receiver	field geo-referencing	Garmin GPS II PLUS
Camera	photodocumentation	Pentax ME-Super 35mm with variable 35-70 mm lens
Abney level	site gradient	Can-measure 5X
Meter stick	channel and wetted width, impasse height, pool depth	2-metre folding
Thermometer	water temperature	Fisher mercury
Range finders	channel and wetted width	Ranging 120, Ranging 620
Conductivity meter	water conductivity	Hanna Instruments HI 8033
Hip chain	site length	Chainman II

The most recent aerial photograph was taken at a scale of 1:20,000 in June 1980. Water levels of both Rod Lake* and the adjacent secondary lakes were approximately 2 meters lower at that time, resulting in large areas being completely dewatered. As this photograph did not accurately reflect conditions found during the 1998 survey and the large scale did not provide clear resolution when enlarged, lake outlines and bathymetric mapping were based on a 35mm photograph taken from 1140 metres above the lake just prior to the survey (Figure 2).

Bathymetric profile data was transcribed as per *Bathymetric Standards for Lake Inventories, RIC (1996)* and a suitable CAD program was used to produce a standard bathymetric map of the lake and calculate bathymetric statistics. The lake outline and contours, statistical data and survey information were merged with the Ministry bathymetric map template to produce a final product.

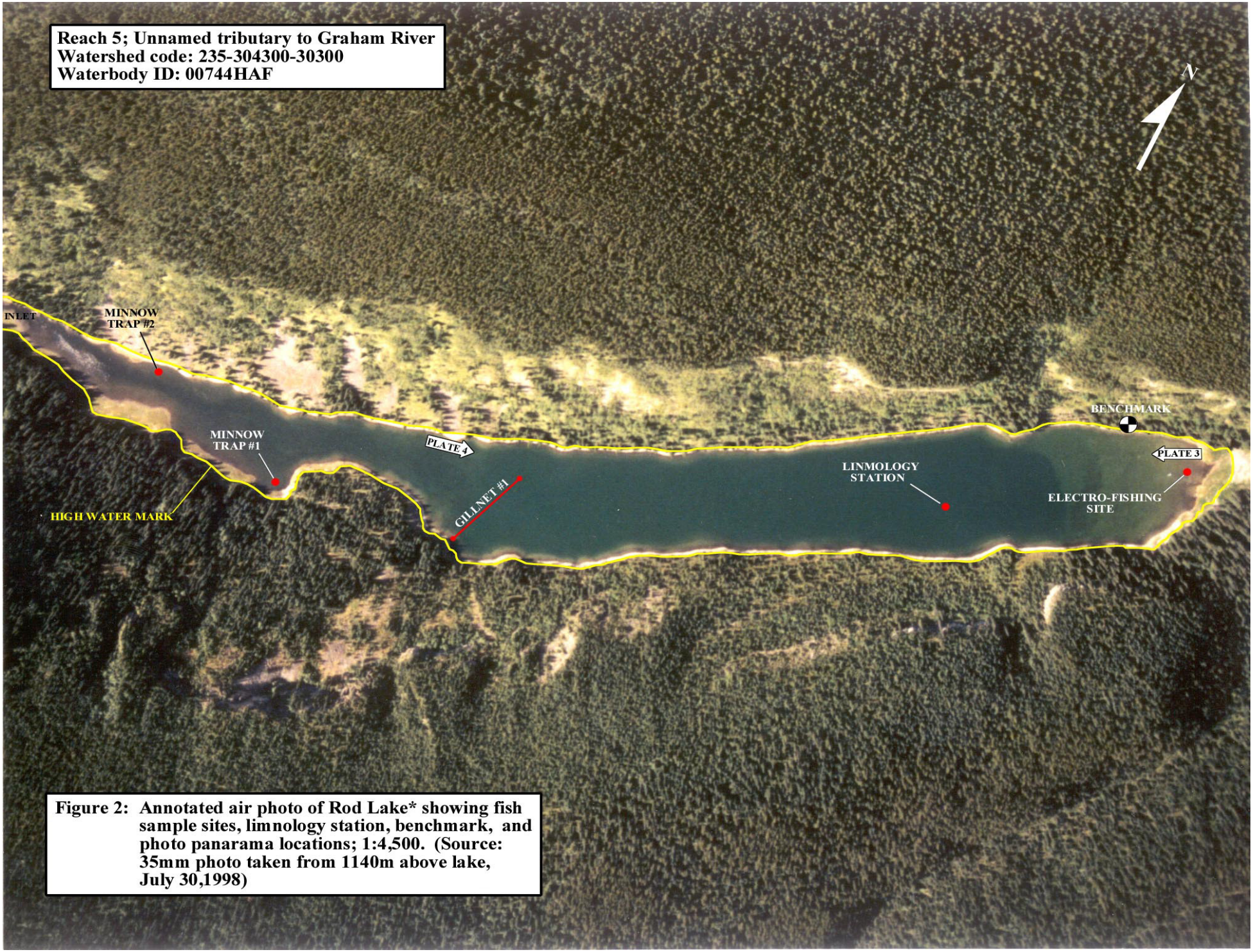


Figure 2: Annotated air photo of Rod Lake* showing fish sample sites, limnology station, benchmark, and photo panarama locations; 1:4,500. (Source: 35mm photo taken from 1140m above lake, July 30,1998)

4.0 RESULTS AND DISCUSSION

All plates referred to in this section may be found in Appendix I.

4.1 Logistics

The main logistical difficulties in surveying Rod Lake* were related to access. All gear, including the inflatable boat, had to be slung in by helicopter. Heyer's Camp, on the Graham River mainstem, was used as a staging area to ferry equipment and field crew from the vehicle to the lake.

Although the survey was conducted on July 30-31, 1998, surface and bottom water samples for laboratory analysis could not be collected until August 26, due to field scheduling and sample transportation option constraints.

4.2 Benchmark

The lake level benchmark was established on the north side of the lake, 120 metres from the east end (Plate 1). A length of 10mm rebar, painted red, was driven in at the base of a 30cm dbh hybrid spruce just above the high-water mark (Plate 2). The base of the tree was de-limbed and a blaze was cut at an elevation matching the top of the rebar, from which point measurements were taken. Benchmark elevation was .81 metres above the recognizable high-water mark and 3.04 metres above the current lake level.

4.3 Immediate Shoreline

Plates 3 and 4 show a panoramic views of Rod Lake* as seen from the east end and the midpoint of the north shore, respectively. With the exception of the areas immediately adjacent to the inlet and outlet (Plates 5 and 6) the valley walls rise steeply from the water's edge and the lake bottom drops off equally as steeply. Significant shallows occur at both ends of the lake, where substrates shift to soft fines and beds of Hippuris vulgaris and Myriophyllum sp. are common (Plate 7 and 8). Shallows at the east end of the lake are defined by a steep drop-off from 2 metres to 8 metres depth. Lake bottom gradient at the west end is more moderate.

Mature coniferous forest grows within a few metres of the water's edge. These otherwise homogenous timbered slopes are punctuated by numerous talus cones and bedrock outcroppings, particularly on the north slope (Plate 9). The shoreline is characterized by angular rubble and cobble, with scattered patches of rooted vegetation (Plate 10). There is little to no available cover along the shoreline perimeter.

The understory adjacent to the inlet and outlet is heavily carpeted with various species of mosses, ferns, horsetail, grasses and sedges, with large patches of cow-parsnip (Appendices II and III).

4.4 Surrounding Country

The lake is situated in a narrow, steep, east-west oriented valley, near the transition between the ESSF and BWBS biogeoclimatic zones. Adjacent topography consists of steeply-sloped ridges, dominated by hybrid spruce and subalpine fir, with a minor component of aspen on south aspects. The understory is comprised of shrub and herb species typical of the ESSF biogeoclimatic zone, including huckleberry, gooseberry and thimbleberry. Slopes are punctuated by occasional sedimentary outcrops and vegetated by species common to the subalpine fir-huckleberry-feathermoss site association. Higher elevation alpine complexes occur to the west and south, but are not visible from the lake.

4.5 Summary of Data Collection

4.5.1 Mapping Summary

A summary of photograph locations, gill-net location, minnow trap locations, electro-fishing sites, limnological station, benchmark and lake inlet and outlet can be found on the lake outline map (Figure 3).

Figure 4 represents the final bathymetric map of the lake including benchmark location, bathymetric statistics and survey information, in 11" x 17" format. Table 2 shows CAD generated surface areas and calculated lake volumes per contour interval based on:

$$VOLUME = \frac{1}{2}\sum_{i=1}^{k}\left[\left(A_i + A_{i+1}\right)\left(D_{i+1} - D_i\right)\right]$$

"D" size hard copy bathymetric maps also accompany this report. *Lake Inventory Standards and Procedures* specify "E" size plots, however, these were considered too large to be of practical use and too wide to be stored in MELP's regional bathymetric map collection.

Table 2: Volume calculations for Rod Lake* by contour interval.

Contour Level	Area	Volume
Surface	93,300 m²	-
2m	58,300 m²	151,600 m³
4m	47,100 m²	105,400 m³
6m	41,500 m²	88,600 m³
8m	36,400 m²	77,900 m³
10m	26,500 m²	62,900 m³
below 10m	-	15,900 m³
	Total Volume	502,300 m³

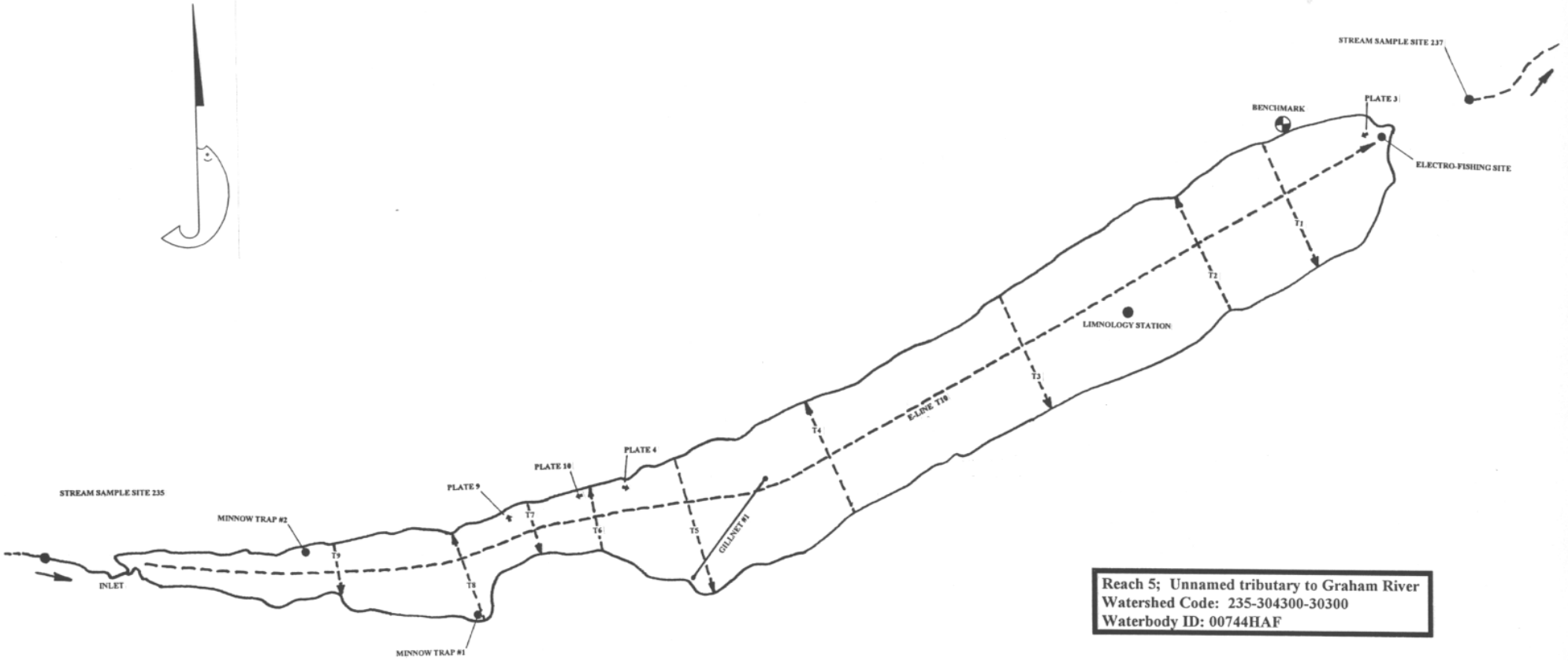
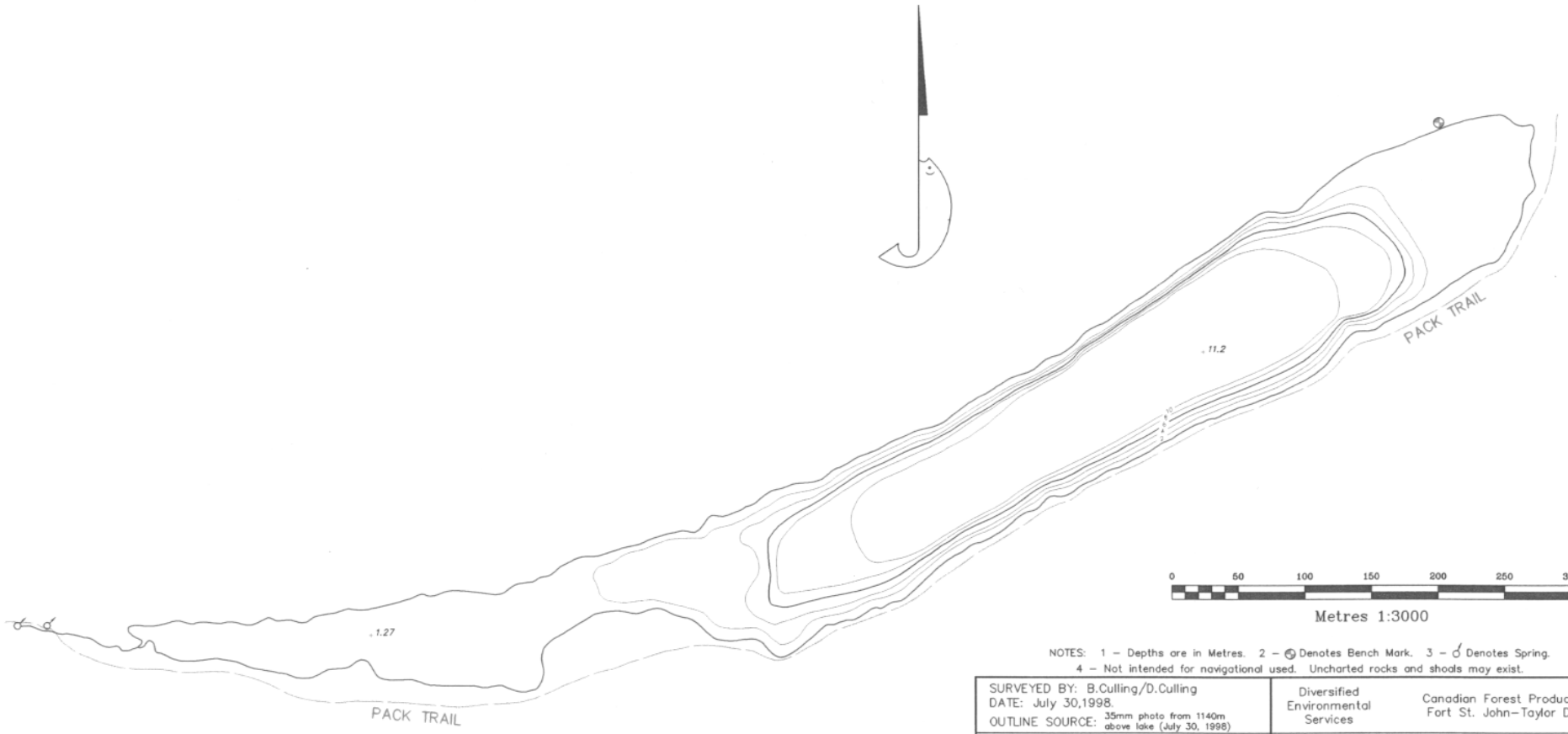


Figure 3: Outline of Rod Lake* showing fish sample sites, stream sample sites, limnology station, benchmark, photograph locations and bathymetric transects; 1:3,000 scale. (Source: 35mm photo taken from 1,140m above lake, July 30, 1998).



0 50 100 150 200 250 300

Metres 1:3000

NOTES: 1 – Depths are in Metres. 2 – ⊕ Denotes Bench Mark. 3 – ♂ Denotes Spring.
4 – Not intended for navigational used. Uncharted rocks and shoals may exist.

SURVEYED BY: B.Culling/D.Culling
DATE: July 30,1998.
OUTLINE SOURCE: 35mm photo from 1140m above lake (July 30, 1998)

Diversified Environmental Services

Canadian Forest Products Ltd
Fort St. John–Taylor Division

STATISTICS AT TIME OF SURVEY

Elevation	990	m ±
Surface Area	93,300	sq. m
Area above 6m contour	51,800	sq. m
Volume	502,300	cu. m
Mean Depth	5.4	m
Maximum Depth	11.2	m
Perimeter, Main Shore	2420	m
Bench Mark	3.04	m

ROD LAKE*

WATERSHED CODE: 235–304300–30300		LAKE SEQUENCE NO:
WATERBODY ID: 00744LHAF		UTM COORDINATE: 10.510620.6241406
MU: 7–36	DATE: March 31, 1999	SCALE: 1:3000
DIGITIZED:	REVISION DATE:	
CONTOURS: B.A.C.	APPROVED:	NTS NO: 94B/7
TECH. CHECK: B.A.C.		TRIM NO: 094B.036

4.5.2 FDIS Lake Summary

An FDIS Lake Summary printout containing data transcribed from the Lake Survey Form and individual fish data appears in Appendix IV.

4.5.3 Limnology Summary

A summary of the limnology station sampling conditions and results appear in Table 3. Dissolved oxygen and temperature profiles are represented in Figure 5. Tabular DO and temperature data is recorded in Appendix IV; values used in profiles are an average of descending and ascending readings.

Table 3: Limnology Station # 1: field sampling conditions and results.

Date	1998/07/30	Cloud cover	Overcast
Time	13:45 hrs.	Water surface	Calm
Air temperature	+26• C	Water color	Colourless (NC)
Wind direction	-	Secchi depth	3.9 metres
Wind velocity:	Calm		

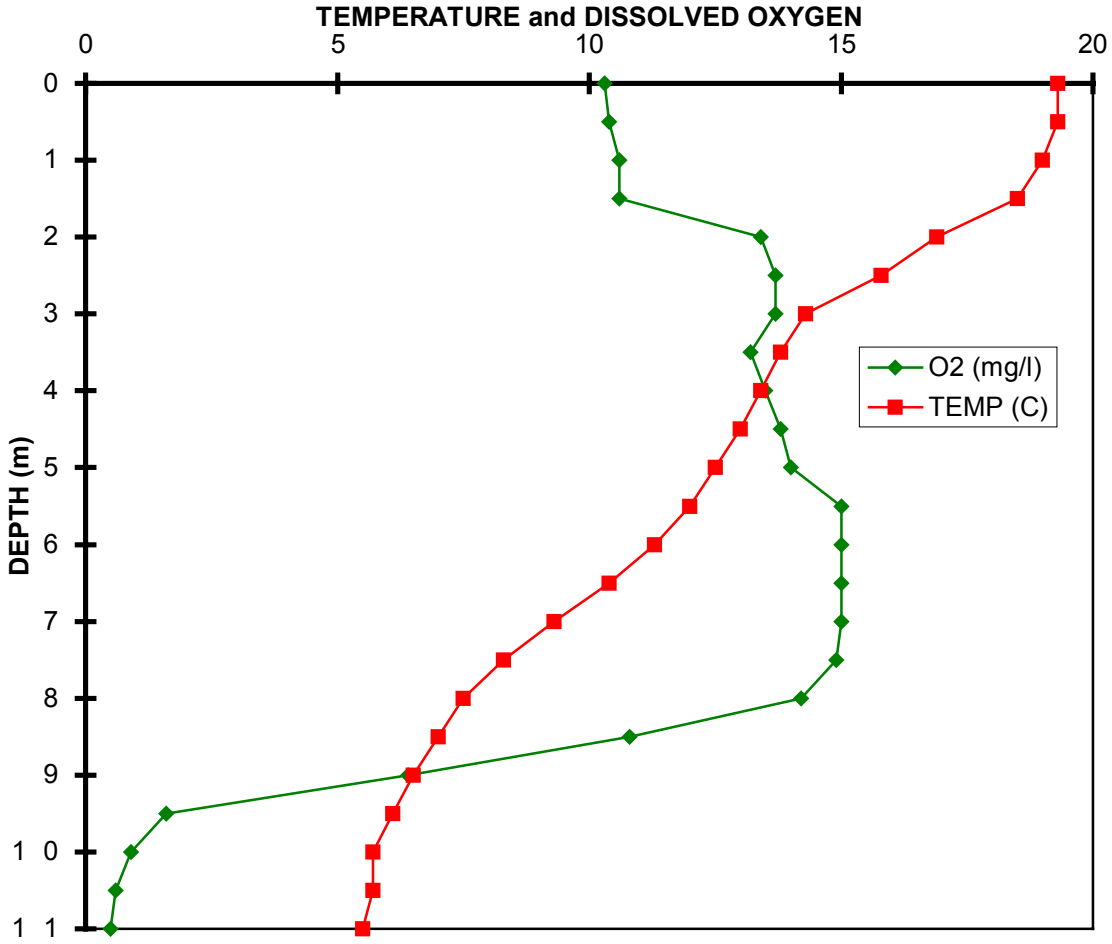
Water Quality Parameter	Surface (0.5 m)	Bottom (10.5 m)
Temperature* (•c)	19.3	5.5
Dissolved oxygen* (mg/l)	10.3	0.5
ph	8.15	7.90
Conductivity (ohms/cm)	352	439
Colour	NC	NC

* Descending and ascending temperature and dissolved oxygen values averaged.

There was no sharply defined thermal stratification of the lake at the time of the survey, although a weak thermocline is indicated at 2 to 3 metres depth. Dissolved oxygen readings suggest that the lower two metres of the water column is relatively oxygen-poor, with the remainder of the lake volume appearing capable of over-summering fish. Anoxic conditions evident below approximately 9 metres accounted for 9.4% of the lake volume.

No evidence of hydrogen sulfide was noted and conditions contributing to its production and accumulation appear absent. Laboratory results suggest no other water chemistry or water quality issues currently limiting fisheries habitat potential. Results of laboratory analysis of water samples from surface and bottom can be found in Appendix V.

Figure 5: Temperature and dissolved oxygen profiles for Rod Lake* on July 30, 1998



4.5.4 Fish Sampling Summary

Rod Lake* was found to support large resident populations of longnose sucker and lake chub. Large mixed schools of lake chub and juvenile longnose sucker were observed in shallows along the shoreline at the east end of the lake (Plate 11). A sub-sample was electro-fished for confirmation of species.

A 20-hour overnight experimental gill-net set yielded 76 lake chub (Plate 12) and 639 longnose suckers. Two baited, overnight Gee minnow trap sets yielded 8 lake chub and 3 lake chub and one longnose sucker, respectively. Length ranges for the combined sample were 108 to 225 mm for longnose sucker and 55 to 127 mm for lake chub (Appendix IV).

Of 56 longnose suckers examined, 75% were found to have heavy to extreme abdominal tapeworm loads (Plates 13 and 14). Similar parasite loads were not found in lake chub. During the processing of the gill-net catch, schools of lake chub assembled to feed on fish remains.

No additional fish species were captured or observed during the survey.

Table 4: Fish sampling summary for Rod Lake*, including inlet and outlet stream sites.

Fish Sampling Summary						
		Set		Pull		
Site No.	Method	Date	Time	Date	Time	Species
GN#1	Sinking gillnet	July 30	15:35	July 31	11:50	LSU,LKC
MT#1	Minnow trap	July 30	16:00	July 31	10:45	LKC
MT#2	Minnow Trap	July 30	16:00	July 31	10:45	LSU, LKC
EL#1	Electro-fisher	July 30	10:00	-	-	LSU, LKC
235	Electro-fisher	July 24	15:11	-	-	NFC
237	No sampling	July 24	16:40	-	-	-

Stream Sampling Information						
Watershed code	Site #	Inlet/Outlet	Reach #	Site Length	Method	Species caught
235 304300-30300	235	Inlet	6	200m	Electro-fisher	No fish caught
235-304300-30300	237	Outlet	4	200m	Not sampled	-

4.6 Fish Age, Growth and Life History

No analysis of age and growth was undertaken for either lake chub or longnose sucker. Both species are widespread and abundant throughout the Peace sub-region. General size and growth characteristics of sampled lake chub appeared normal, however, the longnose sucker population appeared stunted in form. This was assumed to be due to a combination of genetic isolation and extreme cestode infestations.

4.7 Significant Features and Fisheries Observations

Despite anecdotal information suggesting bull trout were once present in Rod Lake*, no "sport-fish" species were captured during the 1998 lake survey. Mixed schools of lake chub and juvenile longnose suckers were visible throughout the shallows at the outlet in sufficient numbers to make the water surface appear to boil. As large numbers of both species were also captured in gill-net sets in the central portion of the lake, it may be assumed that they survive at high densities throughout the waterbody. Rod Lake* is isolated from the Graham River mainstem by the absence of both stream channel and surface flow at the outlet end. Extensive beaver activity downstream, at the confluence with the Graham River, also presents impediments to upstream migration. These barriers are apparently not impassable at high flows, as one bull trout was captured in reach 2 - Site 234 (D.E.S. 1999).

4.8 Habitat Concerns

Fisheries values in the Graham River watershed, as a whole, are considered high. Reaches 1, 2 and 3 of Graham tributary 235-304300-30300, downstream of Rod Lake*, are considered fish-bearing due to the presence of high-quality, seasonal, bull trout rearing habitat, although access from the Graham mainstem is currently restricted by beaver activity.

It is conceivable that bull trout can gain entry into the lake during flood events, however, once isolated, would have no access to suitable spawning habitat.

Rod Lake* has high visual and esthetic values, and the lack of access for motorized vehicles has maintained the pristine character of the valley. As it is possible to reach the lake on foot or on horseback, there may be limited potential for a remote lake stocking program for recreational purposes.

4.8.1 Restoration and Rehabilitation Opportunities

No restoration or rehabilitation opportunities currently exist.

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APPENDICES

APPENDIX I

PLATES

Plate 1: View of benchmark from center of lake. (Roll 12/Frame 20)

Plate 2: Close-up view of benchmark. Note the 10 mm rebar stake of the right of the blazed spruce. (Roll 12/Frame 19)

Plate 3: Panoramic view west from east end of lake. (Roll 13/Frames 0A-2A)

Plate 4: Panoramic view southeast from north shore of lake. (Roll 13/Frame 7A-9A)

Plate 5: Vie west to inlet from centre of lake. (Roll 12/Frame 25)

Plate 6: View east through area of subsurface flow at outlet
. (Roll 9/Frame 24)

Plate 7: *Hippuris vulgaris* specimen collected at Rod Lake*
(Roll 13/Frame 17A)

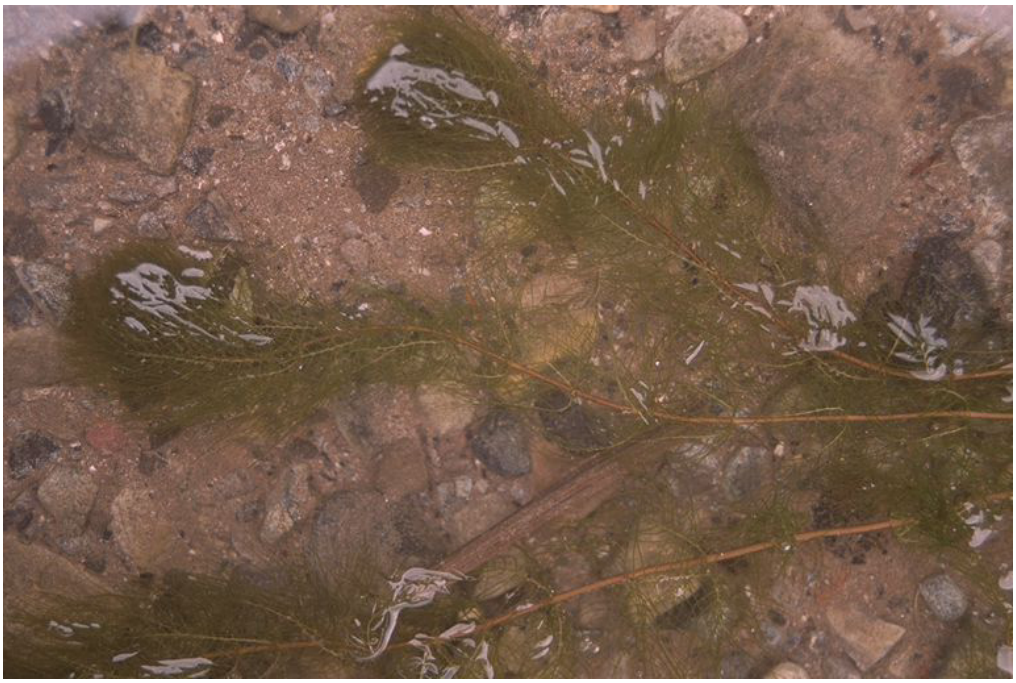

Plate 8: Myriophyllum sp. specimen collected at Rod Lake*
(Roll 13/Frame 19A)

Plate 9: An example of the numerous talus cones along the steep slopes above Rod Lake* - view north. (Roll 13/Frame 00A)

Plate 10: An example of typical cobble and rubble shoreline - view west from north shoreline. (Roll 12/Frame 24

Plate 11: Large mixed schools of lake chub and juvenile longnose sucker along east end of lake. (Roll 12/Frame 18)

Plate 12: Lake chub captured in gill-net set on Rod Lake* on July 31, 1998. (Roll 13/Frame 15A)

Plate 13: Longnose sucker (212mm/116gm) caught in gill-net set on Rod Lake* - July 31, 1998. (Roll 13/Frame 10A)

Plate 14: Tapeworms found in longnose sucker (212mm/116gm). (Roll 13/Frame 11A)

APPENDIX V

WATER CHEMISTRY ANALYSIS FOR ROD LAKE*

Analysis Report

CanTest Ltd

Professional
Analytical
Services

1523 West 3rd Ave
Vancouver, BC
V6J 1J8

Fax: 604 731 2386

Tel: 604 734 7276

1 800 665 8566

REPORT ON: Analysis of Water Samples

REPORTED TO: Diversified Environmental Services
Box 6263
Fort St. John, B.C.
V1J 4H7

Att'n: Mr. Brad Culling

CHAIN OF CUSTODY: 38716
PROJECT NAME: FRBC Fish Inventory
PROJECT NUMBER: CF06

NUMBER OF SAMPLES: 2

REPORT DATE: September 16, 1998

DATE SUBMITTED: August 31, 1998

GROUP NUMBER: 8083133

SAMPLE TYPE: Water

TEST METHODS:

pH, Laboratory - pH analysis was performed in the laboratory using a pH meter. It must be recognized that the B.C. Ministry of Environment and other regulatory agencies recommend that pH be analyzed immediately upon sample collection. In light of this, pH measurements should be performed in the field.

Conventional Parameters - analyses were performed using procedures based on those described in "British Columbia Environmental Laboratory Manual For the Analysis of Water, Wastewater, Sediment and Biological Materials" (1994 Edition), Province of British Columbia and "Standard Methods for the Examination of Water and Wastewater" 19th Edition, (1995) and 17th Edition (1989), published by the American Public Health Association.

Mercury in Water - analysis was performed using procedures based on U. S. EPA Method 1631, oxidative digestion using bromination, and analysis using Cold Vapour Atomic Fluorescence Spectroscopy.

Metals in Water - analysis was performed using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP), Inductively Coupled Plasma-Mass Spectroscopy (ICP/MS) or Graphite Furnace Atomic Absorption Spectrophotometry.

TEST RESULTS:

(See following pages)

CAN TEST LTD.

Walter Brandl, B.Sc.
Coordinator, Trace Metals Department

REPORTED TO: Diversified Environmental Services

REPORT DATE: September 16, 1998

GROUP NUMBER: 8083133

CANTEST

Conventional Parameters in Water

CLIENT SAMPLE IDENTIFICATION:		00744LHAF-S Rod Lake	00744LHAF-B Rod Lake	DETECTION LIMIT	UNITS
DATE SAMPLED:		Aug 26/98	Aug 26/98		
CAN TEST ID:		808310128	808310140		
pH, Laboratory		8.13	7.84	0.01	pH units
Conductivity		384	470	1	µS/cm
Hardness (Total)	CaCO3	215	269	1	mg/L
Total Dissolved Solids		220	285	10	mg/L
Total Alkalinity	CaCO3	184	236	0.5	mg/L
Total Acidity		1.6	7.1	0.5	mg/L
Nitrate and Nitrite	N	<	<	0.02	mg/L
Total Phosphorus	P	<	0.04	0.02	mg/L
Sulphide	S	<	<	0.05	mg/L

µS/cm = microsiemens per centimeter
mg/L = milligrams per liter
< = Less than detection limit

REPORTED TO: Diversified Environmental Services

REPORT DATE: September 16, 1998

GROUP NUMBER: 8083133

CANTEST

Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		00744LHAF-S Rod Lake	00744LHAF-B Rod Lake	DETECTION LIMIT	UNITS
SAMPLE PREPARATION:		TOTAL	TOTAL		
DATE SAMPLED:		Aug 26/98	Aug 26/98		
CAN TEST ID:		808310128	808310140		
Aluminum	Al	0.014	0.032	0.005	mg/L
Antimony	Sb	<	<	0.001	mg/L
Arsenic	As	<	<	0.001	mg/L
Barium	Ba	0.24	0.30	0.001	mg/L
Beryllium	Be	<	<	0.001	mg/L
Boron	B	<	<	0.05	mg/L
Cadmium	Cd	<	<	0.0002	mg/L
Calcium	Ca	56.5	76.0	0.05	mg/L
Chromium	Cr	<	0.004	0.001	mg/L
Cobalt	Co	<	<	0.001	mg/L
Copper	Cu	0.004	0.041	0.001	mg/L
Iron	Fe	0.12	0.21	0.05	mg/L
Lead	Pb	<	<	0.001	mg/L
Magnesium	Mg	17.9	19.1	0.05	mg/L
Manganese	Mn	<	0.010	0.001	mg/L
Mercury	Hg	<	<	0.05	µg/L
Molybdenum	Mo	0.014	0.010	0.001	mg/L
Nickel	Ni	0.002	0.003	0.001	mg/L
Phosphorus	PO4	0.10	0.24	0.01	mg/L
Potassium	K	0.41	0.80	0.01	mg/L
Selenium	Se	<	<	0.002	mg/L
Silicon	SiO2	4.14	12.6	0.05	mg/L
Silver	Ag	<	<	0.0001	mg/L
Sodium	Na	1.55	1.88	0.05	mg/L
Strontium	Sr	0.31	0.35	0.001	mg/L
Tellurium	Te	<	<	0.001	mg/L
Thallium	Tl	<	<	0.0001	mg/L
Thorium	Th	<	<	0.0005	mg/L
Tin	Sn	<	<	0.001	mg/L
Titanium	Ti	<	0.002	0.001	mg/L
Uranium	U	0.0018	0.0015	0.0005	mg/L

(Continued on next page)

REPORTED TO: Diversified Environmental Services

REPORT DATE: September 16, 1998

GROUP NUMBER: 8083133

CANTEST

Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		00744LHAF-S Rod Lake	00744LHAF-B Rod Lake	DETECTION LIMIT	UNITS
SAMPLE PREPARATION:		TOTAL	TOTAL		
DATE SAMPLED:		Aug 26/98	Aug 26/98		
CAN TEST ID:		808310128	808310140		
Vanadium	V	0.004	0.003	0.001	mg/L
Zinc	Zn	0.007	0.027	0.005	mg/L
Zirconium	Zr	<	<	0.001	mg/L

mg/L = milligrams per liter
μg/L = micrograms per liter
< = Less than detection limit

APPENDIX VI

PHOTODOCUMENTATION INDEX

PHOTODOCUMENTATION INDEX

ROLL #	FRAME #	CD #	IMAGE #	SITE	REACH	VIEW...	WATERSHED
13	3A	8	1	Rod* Lk	5	aerial view of Rod* Lake	Trib to Graham R
13	4A	8	2	Rod* Lk	5	aerial view of Rod* Lake	Trib to Graham R
12	21	8	3	Rod* Lk	5	east from centre of lake	Trib to Graham R
12	22	8	4	Rod* Lk	5	west from centre of lake	Trib to Graham R
12	23	8	5	Rod* Lk	5	east from north side of lake	Trib to Graham R
12	24	8	6	Rod* Lk	5	west to inlet at west end	Trib to Graham R
12	E	8	7	Rod* Lk	5	west to inlet from centre	Trib to Graham R
13	0A	8	8	Rod* Lk	5	panoramic west from east end of lake	Trib to Graham R
13	1A	8	9	Rod* Lk	5	panoramic west from east end of lake	Trib to Graham R
12	20	8	10	Rod* Lk	5	lake survey benchmark at shoreline	Trib to Graham R
13	00A	8	11	Rod* Lk	5	talus slope on north side of lake	Trib to Graham R
13	2A	8	12	Rod* Lk	5	panoramic west from east end of lake	Trib to Graham R
13	5A	8	13	Rod* Lk	5	panoramic from north side	Trib to Graham R
13	6A	8	14	Rod* Lk	5	panoramic from north side	Trib to Graham R
13	7A	8	15	Rod* Lk	5	panoramic from north side	Trib to Graham R
13	8A	8	16	Rod* Lk	5	panoramic from north side	Trib to Graham R
13	9A	8	17	Rod* Lk	5	panoramic from north side	Trib to Graham R
12	19	8	18	Rod* Lk	5	lake survey benchmark	Trib to Graham R
13	18A	8	19	Rod* Lk	5	aquatic macrophytes from Rod* Lake	Trib to Graham R
13	19A	8	20	Rod* Lk	5	aquatic macrophytes from Rod* Lake	Trib to Graham R
12	17	8	21	Rod* Lk	5	schools of LSU & LKC at outlet area	Trib to Graham R
12	18	8	22	Rod* Lk	5	schools of LSU & LKC at outlet area	Trib to Graham R
13	10A	8	23	Rod* Lk	5	LSU from Rod* Lake	Trib to Graham R
13	13A	8	24	Rod* Lk	5	LSU from Rod* Lake	Trib to Graham R
13	12A	8	25	Rod* Lk	5	adult LSU with typical nematode load	Trib to Graham R
13	11A	8	26	Rod* Lk	5	adult LSU with typical nematode load	Trib to Graham R
13	14A	8	27	Rod* Lk	5	adult LSU with typical nematode load	Trib to Graham R
13	16A	8	28	Rod* Lk	5	LKC from Rod* Lake	Trib to Graham R
13	15A	8	29	Rod* Lk	5	LKC from Rod* Lake	Trib to Graham R
9	24	8	30	237	4	d/s thru LWD at outlet	Trib to Graham R
9	20	8	31	237	4	u/s from middle	Trib to Graham R
9	21	8	32	237	4	u/s from bottom	Trib to Graham R
9	22	8	33	237	4	u/s from confluence - trib at bottom	Trib to Graham R
9	23	8	34	237	4	d/s from top	Trib to Graham R
9	8	8	35	235	6	u/s from confluence at lake	Trib to Graham R
9	9	8	36	235	6	u/s from bottom	Trib to Graham R
9	10	8	37	235	6	u/s from middle	Trib to Graham R
9	11	8	38	235	6	u/s near top (source of spring)	Trib to Graham R
9	12	8	39	235	6	u/s from top	Trib to Graham R
9	13	8	40	235	6	aerial of site and inlet	Trib to Graham R
9	14	8	41	235	6	aerial of site and inlet	Trib to Graham R
13	17A	X	X	Rod* Lk	5	aquatic macrophytes from Rod* Lake	Trib to Graham R
13	20A	X	X	Rod* Lk	5	aquatic macrophytes from Rod* Lake	Trib to Graham R