Reconnaissance (1:20,000) Fish and Fish Habitat Inventory

of the

Barriere River Watershed

WSC: 129-190100

Prepared for:

Tolko Industries Ltd.

Louis Creek, BC
V0E 1E0

Prepared by:

ARC Environmental Ltd.

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&

North Thompson Indian Band
Box 220
Barriere, B.C.
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Approved by:

_____

Harry Goldberg, M.Sc., R.P.Bio.

JUNE 2000

PROJECT REFERENCE INFORMATION

FRBC Project Number	TOM-98-108
FRBC Activity Number	10492b
FDIS Project Number	03-LNTH-200000001-1999
FRBC Region	Thompson-Okanagan Region
MELP Region	Southern Interior Region - 03
MELP District	N/A
FW Management Unit	3-38
Fisheries Planning Unit	N/A
DFO Sub-District	29J Clearwater
Forest Region	01 Kamloops Forest Region
Forest District	Kamloops
Forest Licensee	Tolko Industries Ltd.
First Nations Claim Area	North Thompson Indian Band

WATERSHED INFORMATION

Watershed Group	LNTH Group
Watershed Name	Barriere River
Watershed Code	129-190100
UTM at Mouth	10.700100.5672750
Watershed Area	1140 km^2
Total of All Stream Lengths	1617.9 km
Stream Order	6th order
NTS Maps	82M/4, 82M/5, 82M/12, 92P/1, 92P/8
TRIM Maps	082M.011, 082M.012, 082M.021, 082M.022 082M.023, 082M.031, 082M.032, 082M.033, 082M.041, 082M.042, 082M.043, 082M.051, 082M.052, 092P.020, 092P.030, 092P.040
BEC Zones	IDFxh1, IDFmw2, ESSFdc2, ICHmk1, ICHmw3, ICHwk1, AT-ESSF
Air Photos	30 BCC95008: 29 – 84 30 BCC95010: 60 - 95, 130 - 172, 173 - 193 30 BCC95022: 42 - 50 30 BCC95036: 30 - 55, 100 - 152 30 BCC95046: 71 - 85, 140 - 168 30 BCC95047: 20 - 35, 90 - 118 30 BCC950101: 102 - 115 30 BCC950103: 80 - 125 30 BCC950115: 140 - 145, 159 - 170 30 BCC950116: 145 - 155 30 BCC950117: 27 -50, 120 - 140 30 BCC950118: 10 - 30, 110 - 120

SAMPLING DESIGN SUMMARY

	Initial Plan	**Added Reaches**	**1998/1999 Sampling**	**1999/2000 Sampling**	**Final Plan**
Total Number of Reaches	1589	304	Not applicable	Not applicable	1893
Random Sampling Sites	141	NA	54	76	130
Biased Sampling Sites	24	NA	22	15	37
Total Sample Sites	165	NA	76	91	167
Field Sampling Dates	Not applicable	NA	July 28 – August 31, 1998	September 7 – October 14, 1999	Not applicable

CONTRACTOR INFORMATION

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Data Entry by:	*Names:*	P. Skinner, A. Morris
Report prepared by:	*Name*	A. Morris
Report edited by:	*Name*	B. Rublee, R.P. Bio., H. Goldberg, R.P. Bio.
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	Phone:	(250) 374-6754

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 this inventory was provided by Forest Renewal British Columbia through Tolko Industries Ltd. Integrated Woods Services provided GIS support and Hamaguchi Fish Aging Services provided fish scale analysis.

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1.0 Introduction

1.1 Project Scope and Objectives

Tolko Industries Ltd., in partnership with the North Thompson Indian Band, retained ARC Environmental Ltd. to conduct a Reconnaissance (1:20,000) Fish and Fish Habitat Inventory Program (FFHIP) within the Barriere River watershed through funding provided by Forest Renewal British Columbia (FRBC). The project also included the fish stream identification option to describe fish presence in specific stream reaches potentially affected by planned forest harvesting activities. This information is used during the development of Silviculture Prescriptions and Road Layout and Designs under the Forest Practices Code.

This report will cover the Phase IV – VI work for the 167 sites completed for the project. Phases I and II of the project were completed in 1997 (ARC Environmental Ltd. 1997). Phase III was started in 1997 and finalized in 1998/1999 and 1999/2000 and Phases IV through VI were completed for 76 sites in 1998/1999 and 91 sites in 1999/2000. The study area for the project encompassed Reaches 1 through 12 of the Barriere River mainstem and its tributaries to the northwest and southeast, including; Slate Creek, Deadfall Creek, John Creek, Vermelin Creek, Leonie Creek, Dixon Creek and Delta Creek. The completion of the 167 sites ultimately met the following objectives of the Reconnaissance Inventory:

i) To provide the essential fish and fish habitat information required for resource planning and/or decision making that may affect fisheries resources.

ii) Describe watershed-wide fish distributions and habitat characteristics.

iii) Provide information to meet British Columbia Forest Practices Code (BC FPC) stream classification requirements at sites sampled within the Barriere River watershed. This involves the establishment of stream classifications recommended by contractors, which are then vetted by appropriate agency staff. The Forest District Manager ultimately approves stream classifications.

1.2 Location

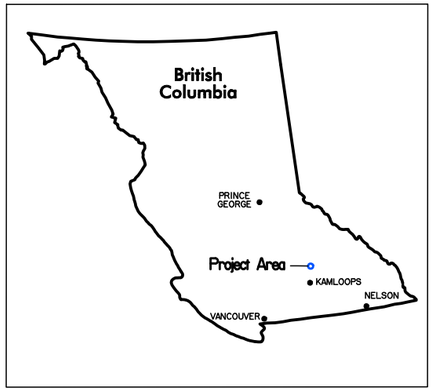
The Barriere River watershed encompasses an area of approximately 114,000 ha and is within the Ministry of Environment, Lands, and Parks (MoELP) Southern Interior Region and the Kamloops District of the Kamloops Forest Region. The Barriere River (WSC-129-190100, UTM-10.700100.5672750) is a 6th order tributary of the North Thompson River. It is approximately 73 km in length and drains southwest, entering the North Thompson River near the community of Barriere (Figure 1).

The Barriere River watershed is diverse in terms of physiography, climate, soil and vegetation. The watershed lies within seven biogeoclimatic zones and sub-zones; Interior Douglas-fir zones, very hot dry (IDFxh1) and moist warm (IDFmw2), Engelmann Spruce-Subalpine fir zone, dry cold (ESSFdc2), Interior Cedar Hemlock zones, moist cool (ICHmk1), moist warm (ICHmw3); and wet cool (ICHwk1); and Alpine Tundra-Engelmann Spruce-Subalpine Fir zone, wet cold (AT-ESSF). (Biogeoclimatic Units of the Kamloops Forest Region 1989). The headwaters of the watershed, at the higher elevations (EL 1,524 – 1,676 m) are within biogeoclimatic zones ICHwk1 and AT-ESSF to the north. The drainage then descends through the ICHmw3 and ICHmk1, into the ESSFdc2, and finally through the IDFmw2 and IDFxh1 (EL 400 m) before draining into the North Thompson River.

Figure 1:
OVERVIEW MAP

Barriere River Watershed
FFHIP 1998 & 1999

Project Code: 03-LNTH-30000001-1999
Date: June 15, 2000
Inventory Company: ARC Environmental Ltd.
Printed in Canada by: Integrated Woods Services



Scale 1:225,000

0 1 2 3 4 5 10 kilometres

- Streams
- Lakes
- Watershed Boundary
- Sub-Basin Boundary
- Secondary Road
- Logging Roads
- Trails
- 12 Sample Sites

ARC Environmental Ltd

BASE: TR **STR SYM:** INV
LOC: FDE **LK SYM:** NA
HAB: INV **FISH:** INVG
INV MGNT: OTH
DATE INV: July 28, 1998 - Aug. 31, 1998 & Sept. 7, 1999 - Oct. 14, 1999

Prepared By:
Integrated Woods Services Ltd.

J:\FRBC-99\ARC_ENV\BARRIERE\OVERVIEW99.DGN

1.2.1 Access

The reaches of the Barriere River watershed are accessible approximately 75 km north of Kamloops on Highway No. 5 at the community of Barriere. The Barriere Lakes Road originates at the highway and runs northeast to the intersection with North Barriere Lake Road, at which point it becomes the East Barriere Lake Road and continues northeast past East Barriere Lake. The Leonie Creek Road, North Barriere Lake Road, South Barriere Lake Road and Saskum Lake Road, as well as, numerous secondary logging roads, split off from the East Barriere Lake Road and provide access to the majority of the watershed. In areas not accessible by road, a helicopter was required. Access was determined by a review of Forest Cover maps (1:30,000) provided by Tolko Industries Ltd., as well as, through dialogue with Norm Fennell and Jennifer Fraser of Tolko Industries Ltd. Additional access information was determined by a review of the British Columbia Recreational Atlas, airphotos, and previous studies conducted in the area.

2.0 Resource Use

i) First Nations

The Barriere River watershed is included in, but not limited to the traditional territories of the North Thompson Indian Band (NTIB) of the Secwepemc (Shuswap) Nation (Union of BC Indian Chiefs 1993). Currently, approximately 500 Simpcw people live on the North Thompson Indian Reserve at Chu Chua, north of Barriere. The NTIB administration, governed by the band council, oversees the social, educational, and economic development of their people and is actively involved with the management of the resources within the Barriere River watershed.

ii) Development and Land Use

The Barriere River watershed is subject to a variety of resource uses. The principal resource activities in the watershed are agriculture, recreation, and timber harvesting by Tolko Industries Ltd. Substantial residential development and private land is present within the watershed, primarily along the lower portion of the Barriere River mainstem, up to East Barriere Lake, along the East Barriere River, and surrounding North Barriere Lake. Leonie Creek, a tributary to the Barriere River (confluence within the community of Barriere), is the only portion of the watershed with a Community Watershed designation (Kamloops Land and Resource Management Plan (KLRMP) 1996). Harper Creek, another tributary to the Barriere River, runs along the eastern boundary of the Dunn Protection Resource Management Zone, but is not part of the zone itself (KLRMP 1996).

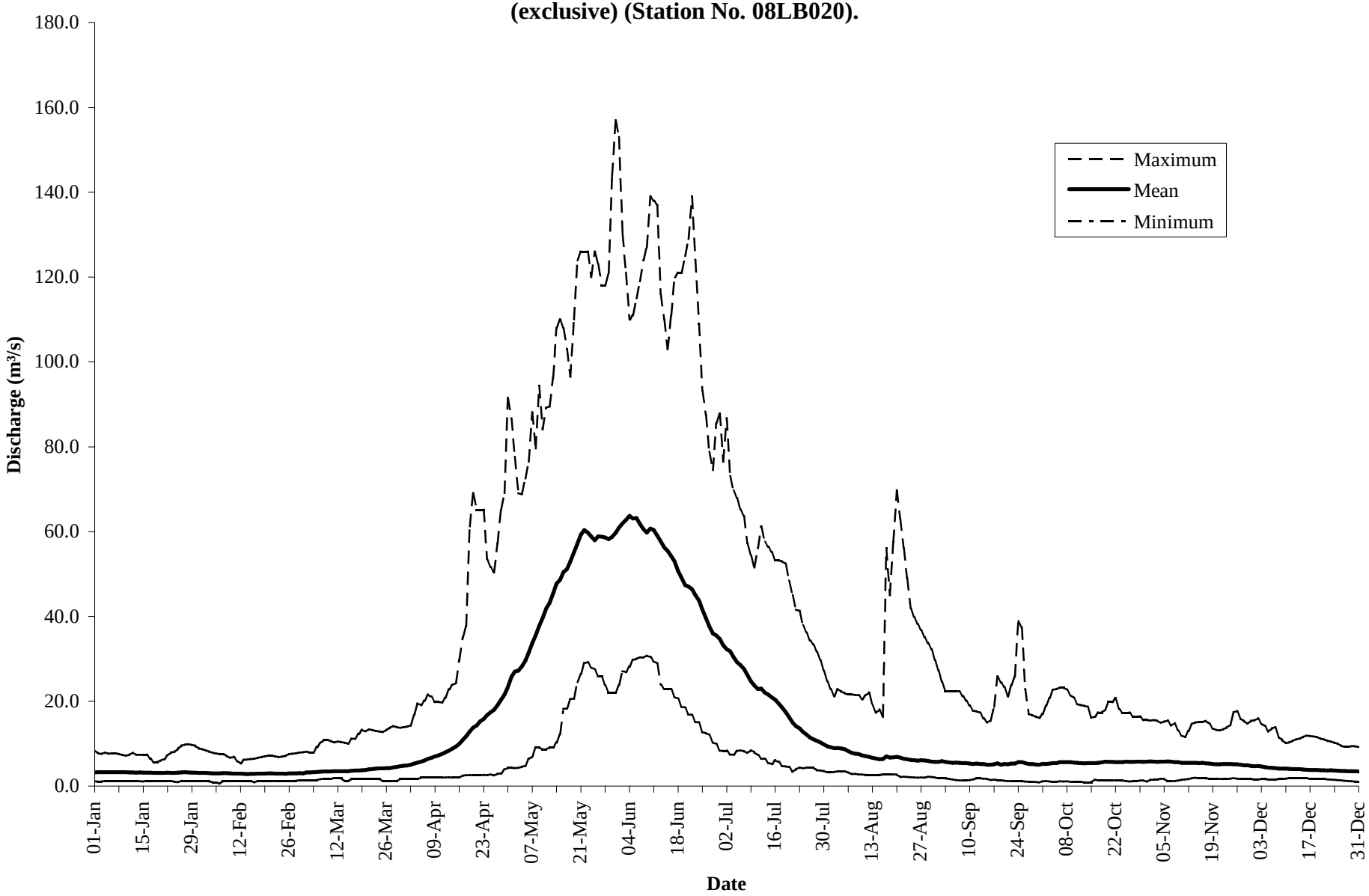
iii) Other Developments, Concerns or Points of Interest

Recreational opportunities within the watershed are available at BC Forest Recreation Sites, including; North, South and East Barriere Lakes, Vermelin Creek and Saskum Lake recreation sites (Forest Recreation Map 1993). North and East Barriere Lakes have privately owned resort facilities. The Barriere River watershed is used extensively for low impact recreational activities, including fishing and hunting.

iv) Water Use

Historical hydrograph data gathered for Barriere River (Station No. 08LB020) demonstrates that, on average, mean daily discharge begins to increase at the beginning of April from approximately 5.0 m^3/s to peak flows of approximately 63.0 m^3/s in early June (Figure 2). This indicates that discharge in the Barriere River system is primarily driven by snowmelt.

Figure 2. Barrier River: Mean, maximum, and minimum daily discharge for the period of record 1915 to 1995 (exclusive) (Station No. 08LB020).



By early July mean discharge has decreased significantly (approximately 33.0 m^3/s) and low flows are established by late August (approximately 6.0 m^3/s). However, increases in discharge due to rain events are possible, though infrequent, through late August to early October (up to approximately 50.0 m^3/s).

v) Existing Fisheries Information

The Barriere River watershed supports a diversity of fish species, including non-anadromous and anadromous salmonids, as well as, non-salmonid species.

Non-anadromous salmonid species include rainbow trout (*Oncorhynchus mykiss*), bull trout (*Salvelinus confluentus*), mountain whitefish (*Prosopium williamsoni*) and kokanee (*O. nerka*). Rainbow trout and bull trout are documented in all the larger streams in the watershed, including; the Barriere River, Haggard Creek, Harper Creek, Fennell Creek, and Birk Creek (Grinton 1994, Fish Habitat Inventory and Information Program 1992, McGregor 1993). Rainbow trout are also present in the East Barriere River and Leonie Creek Community Watershed, but there is no documentation of bull trout in either of these streams (Fish Habitat Inventory and Information Program 1992). Bull trout have been anecdotally reported in ILP 100, 82M.042 a small tributary to the Barriere River (near reach 11) (personal communication; P. Holman, Forest Ecosystem Specialist, BC Environment, Kamloops District).

Rainbow trout, bull trout, kokanee and mountain whitefish are documented in North and East Barriere Lakes (Bison 1995 and Harding et al. 1994). Wild populations of rainbow trout are also found in Dixon and Little Dixon Lakes (Harding et al. 1994). Bull trout and rainbow trout are documented in Saskum Lake (Grinton 1994 and Harding et al 1994). Rainbow trout in Saskum Lake were originally stocked in 1976 (Release Records Database 1997), but have since become a naturalized population (Harding et al. 1994). Three lakes in the Leonie Creek Community Watershed were surveyed in the fall 1999; Lake ILP 52 (Silvatech Consulting Ltd. 1999a) and Lake ILP 22 52 (Silvatech Consulting

Ltd. 1999b) located on map 92P.030 do not support fish populations. Lake ILP 26 on map 92P.030 supports rainbow trout, but it is believed that the lake was stocked by members of the public as no record of stocking exists (Silvatech Consulting Ltd., 1999c)

Anadromous salmonid species in the Barriere River watershed include sockeye *(O. nerka*), coho (*O. kisutch*), chinook (*O. tshawytscha*) and pink (*O. gorbuscha*) salmon (Stewart et al. 1983, Fish Habitat Inventory and Information Program 1992 and Harding et al. 1994).

Sockeye salmon spawning occurs above North Barriere Lake, in Fennel Creek, and just below North Barriere Lake in the mainstem Barriere River, (Harding et al. 1994), as well as, in Reach 1 of Harper Creek (Fish Habitat Inventory and Information Program 1992). Fennell Creek sockeye rear in North Barriere Lake and sockeye from the Barriere River migrate downstream and rear in Kamloops Lake (Harding et al. 1994).

Coho salmon are known to spawn and rear in the Barriere River, the East Barriere River, Haggard Creek and Fennell Creek (Harding et al. 1994). Additional rearing for coho is documented in Leonie Creek (ARC Environmental Ltd. 1998).

Chinook salmon spawn and rear in the mainstem Barriere River below North Barriere Lake. Additional rearing for chinook is documented in Leonie Creek and Birk Creek (ARC Environmental Ltd. 1998, ARC Environmental Ltd. and the North Thompson Indian Band 1999a).

Pink salmon presence has been noted in the lower Barriere River (Harding et al. 1994). There is normally no return of pink salmon to the North Thompson drainage, except in odd years when there are large returns to the Fraser–Thompson system (Harding et al. 1994).

Escapement records for the Barriere River are available for sockeye, chinook and coho salmon for the period of 1953 to 1997 and pink and chum salmon for the period of 1953

to 1989 (Galesloot 1997, Fish Habitat Inventory and Information Program 1992). For the period of record, sockeye escapements range from 0 to 1168 fish, coho escapements range from 25 to 1500 fish, and chinook escapements range from 0 to 400 fish. Returns for sockeye, coho and chinook salmon fluctuate significantly, with increases and decreases noted from year to year (Table 1). There is no clear pattern of increase or decrease in numbers for these species. For the period of record there has been no Section 16 information on pink or chum salmon, and steelhead numbers are unknown.

Non-salmonid species documented in the watershed include sculpins (*Cottus* spp.), northern pike minnow (*Ptycheilus oregonensis*), redside shiners (*Richardsonius balteatus*), largescale sucker (*Catostomus macrocheilus*), longnose dace (*Rhinicthys cataractae*) and bridgelip sucker (*C. columbianus*) (Grinton 1994, ARC Environmental Ltd. and the North Thompson Indian Band 1999a and 1999b).

Table 1. Escapement records for the Barriere River Watershed.

	Barriere River Escapement						E. Barriere River Escapement						Haggard Creek Escapement						Fennell Creek Escapement						Harper Creek Escapement
Year	Sockeye	Coho	Chinook	Pink	Chum	Steelhead	Sockeye	Coho	Chinook	Pink	Chum	Steelhead	Sockeye	Coho	Chinook	Pink	Chum	Steelhead	Sockeye	Coho	Chinook	Pink	Chum	Steelhead	Sockeye
1953	0	750	400	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK
1954	0	200	25	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK
1955	97	1500	400	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK
1956	2	750	N/O	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK
1957	38	25	25	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK
1958	0	750	25	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	5	UNK	UNK	UNK	UNK	UNK	UNK
1959	203	750	200	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	27	UNK	UNK	UNK	UNK	UNK	UNK
1960	23	200	25	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK
1961	335	750	25	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK
1962	14	750	75	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK
1963	92	75	75	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	439	N/O	0	0	0	UNK	UNK
1964	85	400	200	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	146	N/O	0	0	0	UNK	UNK
1965	104	1500	400	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	N/O	750	0	0	0	UNK	UNK
1966	4	400	25	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	25	0	0	0	UNK	UNK
1967	16	200	N/O	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	920	0	0	0	0	UNK	UNK
1968	275	400	N/O	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	954	200	0	0	0	UNK	UNK
1969	40	750	50	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	52	200	0	0	0	UNK	UNK
1970	2	750	25	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	9	1500	0	0	0	UNK	UNK
1971	5	463	10	0	0	UNK	0	191	0	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	1300	432	0	0	0	UNK	UNK
1972	94	400	50	0	0	UNK	0	75	0	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	1931	750	0	0	0	UNK	UNK
1973	22	350	0	0	0	UNK	0	65	0	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	205	120	0	0	0	UNK	UNK
1974	4	620	10	0	0	UNK	0	40	0	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	243	290	0	0	0	UNK	UNK
1975	75	300	10	0	0	UNK	0	60	0	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	4127	90	0	0	0	UNK	UNK
1976	85	300	75	0	0	UNK	UNK	25	0	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	4090	75	0	0	0	UNK	UNK
1977	16	420	10	0	0	UNK	0	18	0	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	355	380	0	0	0	UNK	UNK
1978	N/O	400	10	0	0	UNK	0	110	0	0	0	UNK	UNK	UNK	UNK	UNK	UNK	UNK	675	300	0	0	0	UNK	UNK
1979	40	400	15	0	0	UNK	0	120	0	0	0	UNK	0	30	0	0	0	UNK	15590	600	0	0	0	UNK	UNK
1980	133	60	15	0	0	UNK	0	25	0	0	0	UNK	0	5	0	0	0	UNK	8437	40	0	0	0	UNK	UNK
1981	UNK	350	100	0	0	UNK	0	60	0	0	0	UNK	0	N/O	0	0	0	UNK	2113	100	0	0	0	UNK	UNK
1982	0	450	0	0	0	UNK	0	75	0	0	0	UNK	0	25	0	0	0	UNK	1139	450	0	0	0	UNK	UNK
1983	0	250	65	0	0	UNK	0	100	0	0	0	UNK	0	0	0	0	0	UNK	5018	496	0	0	0	UNK	UNK
1984	86	714	75	0	0	UNK	0	239	0	0	0	UNK	0	1	0	0	0	UNK	11021	607	0	0	0	UNK	UNK
1985	40	360	50	0	0	UNK	0	180	0	0	0	UNK	0	UNK	0	0	0	UNK	1620	534	0	0	0	UNK	UNK
1986	20	100	5	UNK	UNK	UNK	0	250	UNK	UNK	UNK	UNK	0	5	UNK	UNK	UNK	UNK	6120	1250	UNK	UNK	UNK	UNK	UNK
1987	75	500	50	0	0	UNK	0	N/O	0	0	0	UNK	0	N/O	0	0	0	UNK	16871	500	0	0	0	UNK	UNK
1988	277	600	100	0	0	UNK	0	225	0	0	0	UNK	0	0	0	0	0	UNK	26932	800	0	0	0	UNK	UNK
1989	2707	175	260	UNK	UNK	UNK	UNK	160	UNK	UNK	UNK	UNK	UNK	4	UNK	UNK	UNK	UNK	4037	60	UNK	UNK	UNK	UNK	UNK
1990	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	200	UNK	UNK	UNK	UNK	UNK
1991	20442	UNK	70	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK
1992	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	10	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK
1993	5527	UNK	34	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK
1994	6082	UNK	41	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	0	UNK	UNK	UNK	UNK	UNK	50	UNK	UNK	UNK	UNK	UNK
1995	113	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	0	UNK	UNK	UNK	UNK	11251	0	UNK	UNK	UNK	UNK	4
1996	1168	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	0	UNK	UNK	UNK	UNK	32316	1	UNK	UNK	UNK	UNK	441
1997	112	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	UNK	9000	0	UNK	UNK	UNK	UNK	110

UNK - Stream not inspected or not inspected for species indicated or species present but no estimate made.
N/O - Stream inspected, no fish observed.

3.0 Methods

The 1998/1999 and 1999/2000 Barriere River watershed Operational Inventory project involved four phases;

Phase III: Sampling Design and Project Plan,
Phase IV: Field Data Collection,
Phase V: Data Compilation,
Phase VI: Report Preparation and Mapping.

3.1 Phase III: Sampling Design and Project Plan

The objective of Phase III was to finalize the field plan and allow for the collection of field data. A project plan was developed, including; site finalization, the budget, and logistics. The plan was proposed to describe the watershed-wide fish species presence and distribution, and habitat characteristics.

A final consultation was held with Tolko Industries Ltd. (N. Fennell and J. Fraser) to determine the field sampling sites for the project. Due to time and budget constraints the total plan could not be completed in one year. Therefore, certain sites were selected for 1998/1999 in order to address the harvesting plans of Tolko Industries Ltd. for next season and due to the desire to have a complete sampling of a selected area. The remaining sites selected for the project were completed in 1999/2000.

3.2 Phase IV: Field Data Collection

The *Field Data Collection* phase for the selected stream sampling sites involved fish sampling, habitat description, water quality, wildlife observations, and photographic documentation. In addition to sampling the identified stream reaches for inventory purposes, the sampling also included protocols to satisfy fish stream classification (BC Forest Practices Code (FPC) 1998).

The field data was collected for 76 sites within 76 reaches from July 28 – August 31, 1998 (MoELP Sampling Permit No. 99-30-0373; DFO Sampling Permit: License 99.157) and for 91 sites within 91 reaches from September 7 – October 14, 1999 (MoELP Sampling Permit No. 99-30-0374; DFO Sampling Permit: License 99.156.1).

During field sampling, 11 random sampling sites in the Barriere River watershed were found to have known fish populations or to be inaccessible or too close to previously sampled sites. These random sites were relocated to similar but accessible reaches. Three additional biased sampling sites were surveyed in the Barriere River watershed in addition to the number of sites identified in the sampling plan.

MoELP Site Cards, Fish Collection Forms, and Individual Fish Data forms were completed, where appropriate, at each sample site (Attachment II). Fish aging structures were also taken from a selection of fish captured (Attachment III). Photo Survey Form 1 (Equipment Details) was completed for the project and is included in Attachment IV. Methodologies followed those provided in Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Standards and Procedures (Resource Inventory Committee (RIC) 1998a), Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Data Forms and User Notes (RIC 1998b), Fish Collection Methods and Standards (RIC 1997), Fish-stream Identification Guidebook (BC FPC 1998), and A Guide to Photodocumentation for Aquatic Inventory (RIC 1996). A list of field sampling equipment used is presented in Table 2.

Table 2. Field sampling equipment list.

Habitat Sampling Equipment

- Hip Chain and Spare Thread
- Measuring Tape (50m)
- Clinometer
- Compass
- Meter Stick
- Camera, Film and Water Proof Case
- Field notebook with waterproof paper and MoELP Site Cards and Fish Collection Forms
- Alcohol Thermometer
- pH Meter
- Conductivity Meter

Fish Sampling Equipment

- Electrofisher
- Electrofishing Gloves
- Chest Waders
- Minnow Traps and Bait
- Pole Seine
- Fish Collection Permits
- Buckets
- Fish Anaesthetic
- Measuring Board
- Weighing Scale
- Scale Envelopes and Slides
- Scalpel and Scissors
- Field Fish Identification Guidebook

Miscellaneous Equipment

- First Aid Kit (WCB Approved)
- Tool Kit
- Twine and Flagging Tape
- Radios
- Survival Kit

Table 2. Field sampling equipment list. (Cont.)

Miscellaneous Equipment (Cont.)

- Location Maps (1:50,000 and 1:20,000 scale)
- Spare Batteries (AA)
- Global Position System (GPS)

3.2.1 Fish Sampling

Fish sampling focused on defining the overall distribution of all fish species in the study area through absence/presence sampling using electrofishing, minnow trapping, pole seining, and visual observation (RIC 1997). When fish sampling, minimum sample lengths were the greater of 100 m or 10 times the bankfull width. This varied and depended on whether fish were captured and/or to ensure that all habitat types were sampled in all sections of the primary, secondary and off-channel stream zones.

In order to meet stream classification standards (BC FPC 1998), fish sampling was conducted in all habitats, using two methods (electrofishing and minnow traps, or electrofishing and pole-seining), within 100 linear meters, or 10 times bankfull width, whichever was greater. If no fish were captured within the original site, a second site that was equal in distance to the first was electrofished covering all habitat units. If no fish were captured after sampling the second site, an additional 500 linear meters of stream were sampled. Sampling beyond the initial site ended when any of the following criteria were met; fish were captured, crews sampled to the end of the reach, 700 m of the reach was sampled, or the crew leader confirmed that sampling effort was sufficient to ensure a non-fish bearing status.

Fish Collection Forms were completed at each site where fishing was attempted. Individual Fish Data forms were completed where fish were sampled, and the following data was collected:

i) all species were identified and enumerated, life stage determined, fork length (mm) and wetted weight (g) measured, and

ii) non-destructive aging structures (scales) were taken from samples of Freshwater Game Species of a representative range of lengths, and analyzed by Hamaguchi Fish Aging Services of Kamloops, BC.

3.2.2 Habitat Description

Specific habitat characteristics were collected during field surveys from at least one site per reach. Site length was the greater of 100 m or 10 times the bankfull width. Site length varied depending on total reach length, and/or the variability of reach characteristics. Site length was increased to adequately capture habitat sequences and to meet the requirements for stream classification.

The information collected was consistent with the MoELP Site Cards and all fields on the forms were completed with the exception of; 1) Req. No. (pertaining to water analysis) and 2) Environmental Monitoring System number (EMS). Gradient was measured using a Suunto clinometer. An average gradient was determined from at least three sightings, where the distance was maximized (60 to 100 m) as much as possible. Channel and wetted widths were measured with a measuring tape, measuring stick, or hip chain. A minimum of six channel and wetted widths were taken from within a reach section, 100 m in length or greater, where the distance between measurements was at least 20 m apart within the reach (BC FPC 1998).

3.2.3 Water Quality

Water quality information was recorded on the MoELP Site Cards and Fish Collection Forms. Water temperature was measured with an alcohol thermometer, pH was measured

with an Oakton pHTestr 2, and conductivity was measured with an Oakton TDSTestr 3 recording meter. Both pH and conductivity meters were calibrated on a daily basis. Turbidity was visually estimated.

3.2.4 Wildlife Observations

Wildlife observations were recorded on the MoELP Site Cards with specific reference to rare, threatened, and endangered species as listed by the British Columbia Conservation Data Center (BC CDC 1999).

3.2.5 Photographic Documentation

Photographs (35 mm) were taken of the stream reach sampling sites, fish species captured, all major features (e.g. fish passage barriers and obstructions, such as cascades, falls, beaver dams, slides, road crossings, and any other features affecting fish values), and any obvious fish habitat limitations or restoration opportunities. A record of photographs was documented on the MoELP Site Cards and Fish Collection Forms (Attachment II), and followed standards provided in A Guide to Photodocumentation for Aquatic Inventory (RIC 1996).

3.3 Phase V: Data Compilation

The objective of the *Data Compilation* phase was to organize the information collected. The information from completed Site Cards, Fish Collection Forms and Individual Fish sheets was entered into the Field Data Information System (FDIS) database, version 7.2 (Attachment V). Photographs were labeled, referenced and arranged in a binder (Attachment II), and placed in a Kodak Photo CD format with an index along with Photo Survey Form 1 and indexed negatives (Attachment IV). In addition, FISS information

was updated using 1:50,000 NTS maps and FISS Stream Forms. These were submitted to MoELP in Victoria via the Contract Monitor.

3.4 Phase VI: Report Preparation and Mapping

Three types of 1:20,000 TRIM based maps were prepared; the *Overview Map* (Figure 1), the *Project Map,* and the *Interpretive Map* (Appendix II). For the study area, 16 TRIM map sheets were digitized and used to create the appropriate maps according to MoELP standards (RIC 1998c).

The *Overview Map* provides a reference of the Barriere River watershed, for presentation in the final report.

The information on the *Project Maps* and the attached ARC/INFO database includes, but is not limited to, field sampling data, sample site locations, reach breaks, ILPs, site features, and historical fisheries information.

The *Interpretive Maps* includes stream classifications, fish distribution information and historical fisheries information. Stream classifications were assigned to those reaches where sampling occurred. Where sampling occurred in the Leonie Creek Community Watershed stream classifications were assigned S1 to S4 classifications based on channel width and their location within a Community Watershed. Fish distribution information on the *Interpretive Map* is based on interpretations and conclusions from the synthesis of data collected during Phase I and Phase IV (review of existing data and field sampling). The interpretation of fish presence/absence is generally based on the following:

i) known fish bearing reaches (solid red line) are assigned on the basis of historical information or sampling results,

ii) suspected fish bearing reaches (dotted red line) are assigned on the basis that, the reach is contiguous with a known fish bearing reach, that biological judgement would suggest so, or if sampling was considered to be insufficient to classify the reach as non-fish bearing,

iii) non-fish bearing reaches (solid blue line) are assigned on the basis of historical information or sampling results, and

iv) suspected non-fish bearing reaches (dotted blue line) are assigned on the basis that, the reach is contiguous with a non-fish bearing stream, or biological judgement would suggests so.

When using biological judgement, factors such as, known fish distribution, fish behavior, barriers, gradient, habitat quality, and the presence/absence of headwater lakes are considered.

4.0 Results and Discussion

In total, 167 sites within 167 reaches were sampled within the Barriere River watershed in the 1998/1999 and 1999/2000 field seasons. The initial Sampling Design and Project Plan included 165 sites, 141 random sample sites and 24 biased sites. Out of the original 141 random sites, 11 were relocated due to known fish presence, inaccessibility or "clumped" site distribution. Also, 2 additional biased sites were completed. This resulted in the completion of 130 random sample sites and 37 biased sites (11 relocated biased, 2 additional biased, 24 original biased).

4.1 Logistics

Eleven of the random sites selected in 1998 during Phase III (Sampling Design and Project Plan) to be sampled were relocated (Table 3). These sites were found to be either

inaccessible or known to support fish populations or located too close to sites previously sampled during the project.

Table 3. Relocated sampling sites for the Barriere River watershed, 1998/1999 and 1999/2000.

Original Site	Alternate Site	Reason for Change
ILP Map 82M.021, ILP 34, Reach 1 (Random)	Site 4, ILP Map 82M.021, ILP 8, Reach 2 (Biased)	Known Fish Presence
ILP Map 82M.032, ILP 93, Reach 2 (Random)	Site 57, ILP Map 82M.033, ILP 93, Reach 1 (Biased)	Known Fish Presence
ILP Map 82M.012, ILP 6, Reach 1 (Random)	Site 165, ILP Map 82M.041, ILP 74, Reach 2 (Biased)	No Access
ILP Map 82m.033, ILP 5, Reach 3 (Random)	Site 101, ILP Map 82M.021, ILP 1, Reach 2 (Biased)	Known Fish Presence
ILP Map 82M.032, ILP 20, Reach 2 (Random)	Site 44, ILP Map 82M.020, ILP 1, Reach 7 (Biased)	No Access
ILP Map 82M.032, ILP 4, Reach 5 (Random)	Site 145, ILP Map 82M.031, ILP 46, Reach 3 (Biased)	Clumping
ILP Map 82M.042, ILP 4, Reach 1 (Random)	Site 155, ILP Map 82M.031, ILP 94, Reach 3 (Biased)	Clumping
ILP Map 82M.031, ILP 15, Reach 2 (Random)	Site 166, ILP Map 82M.041, ILP 82, Reach 3 (Biased)	Known Fish Presence
ILP Map 82M.033, ILP 36, Reach 1 (Random)	Site 153, ILP Map 82M.021, ILP 56, Reach 1 (Biased)	Clumping
ILP Map 82M.021, ILP 15, Reach 1 (Random)	Site 108, ILP Map 82M.021, ILP 27, Reach 1 (Biased)	No Access
ILP Map 82M.021, ILP 101, Reach 1 (Random)	Site 142, ILP Map 92P.030, ILP67, Reach 3 (Biased)	No Access

The additional sites (Site 68, and 167) were surveyed due to available time and accessibility (Table 4).

4.2 Habitat and Fish Distribution

In total, 167 reaches were surveyed within the Barriere River watershed in the 1998/1999 and 1999/2000 field seasons. Selected habitat sampling parameters, including channel morphology, available cover, and substrate composition, are summarized in Table 5. Of the 167 reaches surveyed in the Barriere River watershed 33 sites had no visible channel (NVC), 48 were intermittent (INT), and five were dewatered (DW).

Table 4. Summary of sampling sites completed during the 1998/1999 and 1999/2000 field seasons for the Barriere River Watershed.

Site No.	Survey Date	NID Map No.	NID No.	ILP Map No.	ILP No.	Reach No.	Access	Sample Type	Comment
1998 Sampling Sites									
1	1998/07/29	82M.022	3001	82M.012	7	3	V4	R	
2	1998/08/07	92P.030	3002	82M.021	6	1	V4	R	
3	1998/08/10	92P.030	3003	82M.021	6	2	V4	R	
4	1998/08/31	82M.021	3004	82M.021	8	2	H	B	
5	1998/08/07	82M.033	3005	82M.021	21	7	V4	R	
6	1998/08/07	82M.033	3006	82M.021	21	9	V4	R	
7	1998/07/28	82M.022	3007	82M.021	22	10	V2	R	
8	1998/07/28	82M.022	3008	82M.021	34	2	FT	R	
9	1998/08/31	82M.021	3009	82M.021	49	2	H	R	
10	1998/08/31	82M.031	3010	82M.021	53	2	H	R	
11	1998/08/11	92P.030	3011	82M.021	81	2	FT	R	
12	1998/07/31	82M.031	3012	82M.021	97	1	V2	B	Requested by Tolko
13	1998/08/04	82M.031	3013	82M.021	97	2	V4	B	Requested by Tolko
14	1998/08/05	82M.031	3014	82M.021	97	3	FT	B	Requested by Tolko
15	1998/07/28	82M.022	3015	82M.022	3	1	V2	R	
16	1998/07/28	82M.022	3016	82M.022	4	1	V2	R	
17	1998/07/31	82M.022	3017	82M.022	10	1	V4	B	Requested by Tolko
18	1998/07/31	82M.022	3018	82M.022	10	2	V4	B	Requested by Tolko
19	1998/07/31	82M.022	3019	82M.022	10	3	V4	R	
20	1998/08/04	82M.022	3020	82M.022	18	1	FT	R	
21	1998/07/30	82M.022	3021	82M.022	20	2	V4	R	
22	1998/07/29	82M.022	3022	82M.022	23	1	V4	R	
23	1998/07/29	82M.022	3023	82M.022	27	1	FT	R	
24	1998/07/30	82M.022	3024	82M.022	28	1	V4	R	
25	1998/07/30	82M.022	3025	82M.022	29	1	FT	R	
26	1998/07/28	82M.022	3026	82M.022	33	1	FT	R	
27	1998/07/31	82M.022	3027	82M.022	39	1	V2	R	
28	1998/07/29	82M.022	3028	82M.022	46	1	V2	B	Requested by Tolko
29	1998/07/29	82M.022	3029	82M.022	46	2	V2	R	
30	1998/07/30	82M.022	3030	82M.022	46	5	V4	B	Requested by Tolko
31	1998/07/30	82M.022	3031	82M.022	46	7	FT	R	
32	1998/07/29	82M.022	3032	82M.022	49	1	V2	R	
33	1998/07/30	82M.022	3033	82M.022	52	2	V4	R	
34	1998/07/31	82M.031	3034	82M.031	10	1	V2	B	Requested by Tolko
35	1998/08/04	82M.031	3035	82M.031	10	2	V4	B	Requested by Tolko
36	1998/08/05	82M.031	3036	82M.031	10	3	V2	B	Requested by Tolko
37	1998/08/05	82M.031	3037	82M.031	20	2	V4	R	
38	1998/08/05	82M.031	3038	82M.031	24	1	V4	R	
39	1998/08/11	82M.031	3039	82M.031	46	2	FT	R	
40	1998/08/12	82M.042	3040	82M.032	4	3	V4	R	
41	1998/08/28	82M.042	3041	82M.032	4	6	H	R	
42	1998/08/13	82M.033	3042	82M.032	93	8	FT	R	
43	1998/08/11	82M.042	3043	82M.032	123	2	FT	R	
44	1998/08/31	82M.032	3044	82M.032	128	2	H	B	
45	1998/08/12	82M.033	3045	82M.033	1	1	FT	R	
46	1998/08/13	82M.033	3046	82M.033	5	5	FT	R	
47	1998/08/10	82M.033	3047	82M.033	7	1	FT	R	
48	1998/08/10	82M.033	3048	82M.033	8	1	FT	R	
49	1998/08/10	82M.033	3049	82M.033	14	1	V2	B	Requested by Tolko
50	1998/08/10	82M.033	3050	82M.033	15	1	FT	R	
51	1998/08/28	82M.033	3051	82M.033	38	1	H	R	
52	1998/08/11	82M.033	3052	82M.033	41	4	V4	R	
53	1998/08/12	82M.033	3053	82M.033	45	1	FT	R	
54	1998/08/11	82M.033	3054	82M.033	51	1	V4	R	
55	1998/08/11	82M.033	3055	82M.033	56	1	FT	R	
56	1998/08/28	82M.033	3056	82M.033	91	1	H	R	
57	1998/08/28	82M.033	3057	82M.033	93	1	H	B	
58	1998/08/28	82M.041	3058	82M.041	48	3	H	B	Requested by Tolko
59	1998/08/06	82M.041	3059	82M.041	59	1	V4	R	
60	1998/08/31	82M.041	3060	82M.041	60	2	H	R	
61	1998/08/28	82M.041	3061	82M.041	62	5	H	R	
62	1998/08/28	82M.041	3062	82M.041	67	3	H	R	
63	1998/08/28	82M.041	3063	82M.041	68	2	H	B	Requested by Tolko
64	1998/08/06	82M.042	3064	82M.041	82	4	V4	R	
65	1998/08/06	82M.041	3065	82M.041	90	1	V4	R	
66	1998/08/12	82M.042	3066	82M.042	184	1	FT	R	
67	1998/08/12	82M.033	3067	82M.043	17	4	FT	R	
68	1998/08/04	92P.030	3068	92P.020	5	2	V4	B	Extra site
69	1998/08/07	92P.030	3069	92P.030	5	1	V4	R	

Table 4. Continued.

Site No.	Survey Date	NID Map No.	NID No.	ILP Map No.	ILP No.	Reach No.	Access	Sample Type	Comment
1998 Sampling Sites (continued)									
70	1998/08/07	92P.030	3070	92P.030	5	3	FT	R	
71	1998/08/05	92P.030	3071	92P.030	5	4	V4	B	Requested by Tolko
72	1998/08/06	92P.030	3072	92P.030	23	2	FT	R	
73	1998/08/06	92P.030	3073	92P.030	28	1	V4	B	Requested by Tolko
74	1998/08/06	92P.030	3074	92P.030	28	2	FT	B	Requested by Tolko
75	1998/08/05	92P.030	3075	92P.030	29	1	V4	B	Requested by Tolko
76	1998/08/10	92P.030	3076	92P.030	71	3	V4	B	Requested by Tolko
1999 Sampling Sites									
77	1999/09/10	82M.011	3077	82M.011	2	1	ATV	R	
78	1999/09/10	82M.011	3078	82M.011	2	2	ATV	R	
79	1999/09/10	92P.020	3079	82M.011	2	3	V4	R	
80	1999/09/09	82M.011	3080	82M.011	3	1	V2	R	
81	1999/09/28	82M.011	3081	82M.011	4	1	V2	R	
82	1999/09/09	82M.011	3082	82M.011	6	1	V2	R	
83	1999/09/09	82M.011	3083	82M.011	6	2	V4	R	
84	1999/09/08	82M.011	3084	82M.011	11	1	V2	R	
85	1999/09/07	82M.011	3085	82M.011	12	1	V4	R	
86	1999/09/07	82M.011	3086	82M.011	14	1	V2	B	Requested by Tolko
87	1999/09/08	82M.011	3087	82M.011	15	1	V4	R	
88	1999/09/07	82M.011	3088	82M.011	18	1	V2	R	
89	1999/09/07	82M.011	3089	82M.011	20	1	V2	R	
90	1999/09/07	82M.011	3090	82M.011	21	1	V2	R	
91	1999/09/28	82M.011	3091	82M.011	25	1	V2	R	
92	1999/09/28	82M.011	3092	82M.011	28	1	V2	R	
93	1999/09/07	82M.011	3093	82M.011	28	2	V4	R	
94	1999/09/28	82M.012	3094	82M.011	29	1	V2	R	
95	1999/09/07	82M.012	3095	82M.011	32	1	V4	R	
96	1999/10/12	82M.012	3096	82M.012	1	1	V4	R	
97	1999/10/12	82M.012	3097	82M.012	5	1	V2	R	
98	1999/10/10	82M.021	3098	82M.021	6	1	V4	R	
99	1999/09/27	82M.021	3099	82M.021	1	1	V2	R	
100	1999/09/27	82M.021	3100	82M.021	5	1	V2	R	
101	1999/10/14	82M.021	3101	82M.021	1	2	V2	B	
102	1999/09/08	82M.021	3102	82M.021	1	3	V2	R	
103	1999/09/08	82M.021	3103	82M.021	10	1	V2	R	
104	1999/09/08	82M.021	3104	82M.021	12	1	V2	R	
105	1999/09/08	82M.021	3105	82M.021	13	1	V2	R	
106	1999/10/07	82M.021	3106	82M.021	14	1	FT	R	
107	1999/10/05	82M.021	3107	82M.021	14	2	FT	R	
108	1999/10/06	82M.021	3108	82M.021	27	1	V4	B	
109	1999/09/30	82M.021	3109	82M.021	17	1	V2	R	
110	1999/10/05	82M.021	3110	82M.021	17	2	V4	R	
111	1999/09/29	82M.021	3111	82M.021	18	1	V2	R	
112	1999/09/29	82M.011	3112	82M.021	19	1	V4	R	
113	1999/09/29	82M.021	3113	82M.021	20	1	V4	R	
114	1999/10/09	82M.012	3114	82M.021	22	9	H	B	Requested by Tolko
115	1999/09/29	82M.021	3115	82M.021	23	2	V4	R	
116	1999/10/07	82M.021	3116	82M.021	24	1	FT	R	
117	1999/10/05	82M.021	3117	82M.021	25	1	FT	R	
118	1999/10/07	82M.021	3118	82M.021	26	1	FT	R	
119	1999/10/04	82M.011	3119	82M.021	26	2	H	R	
120	1999/10/06	82M.011	3120	82M.021	27	2	V4	R	
121	1999/10/01	82M.021	3121	82M.021	30	1	V2	B	Requested by Tolko
122	1999/10/01	82M.021	3122	82M.021	30	2	FT	R	
123	1999/10/01	82M.021	3123	82M.021	30	4	FT	R	
124	1999/10/08	82M.021	3124	82M.021	36	1	FT	R	
125	1999/09/26	82M.011	3125	82M.021	36	2	V2	R	
126	1999/10/04	82M.011	3126	82M.021	36	4	H	R	
127	1999/10/08	82M.021	3127	82M.021	39	1	FT	R	
128	1999/10/08	82M.021	3128	82M.021	43	1	V4	R	
129	1999/09/29	82M.021	3129	82M.021	52	2	V2	R	
130	1999/09/30	82M.021	3130	82M.021	61	1	V2	R	
131	1999/09/30	82M.021	3131	82M.021	63	1	V2	R	
132	1999/09/30	82M.021	3132	82M.021	66	1	V2	R	
133	1999/09/30	82M.021	3133	82M.021	71	1	FT	R	
134	1999/10/01	82M.021	3134	82M.021	72	1	FT	R	
135	1999/10/01	82M.021	3135	82M.021	81	1	FT	R	
136	1999/09/09	82M.021	3136	82M.021	86	1	FT	R	
137	1999/09/27	92P.040	3137	82M.021	90	1	FT	R	

Table 4. Continued.

Site No.	Survey Date	NID Map No.	NID No.	ILP Map No.	ILP No.	Reach No.	Access	Sample Type	Comment
1999 Sampling Sites (continued)									
138	1999/09/09	82M.021	3138	82M.021	91	1	FT	R	
139	1999/09/09	82M.021	3139	82M.021	92	1	FT	R	
140	1999/09/30	82M.021	3140	82M.021	94	1	V2	R	
141	1999/09/30	82M.021	3141	82M.021	96	1	V2	R	
142	1999/10/05	82M.021	3142	92P.030	67	3	V4	B	
143	1999/09/10	82M.022	3143	82M.022	4	1	V2	R	
144	1999/09/28	92P.040	3144	82M.031	15	3	V2	R	
145	1999/10/04	82M.042	3145	82M.031	46	4	H	B	
146	1999/10/14	82M.032	3146	82M.032	6	1	V4	R	
147	1999/10/01	82M.032	3147	82M.032	10	1	V2	R	
148	1999/10/05	82M.032	3148	92P.020	1	7	V2	B	
149	1999/10/05	82M.032	3149	82M.032	41	1	FT	R	
150	1999/10/05	82M.032	3150	82M.032	44	1	V2	R	
151	1999/09/29	82M.043	3151	82M.032	93	3	V2	R	
152	1999/09/29	82M.043	3152	82M.032	123	3	V2	R	
153	1999/10/14	82M.021	3153	82M.021	56	1	V2	B	
154	1999/10/04	82M.041	3154	82M.041	74	3	H	R	
155	1999/10/04	82M.031	3155	82M.031	94	1	H	B	
156	1999/10/07	92P.020	3156	92P.020	6	2	V2	R	
157	1999/10/06	92P.020	3157	92P.020	6	3	V2	B	Requested by Tolko
158	1999/10/07	92P.020	3158	92P.020	13	1	V2	R	
159	1999/10/07	92P.020	3159	92P.020	14	1	V2	R	
160	1999/10/06	92P.020	3160	92P.020	53	1	FT	B	Requested by Tolko
161	1999/10/04	92P.020	3161	92P.020	58	1	H	R	
162	1999/09/28	92P.040	3162	92P.040	13	1	V2	R	
163	1999/09/28	92P.040	3163	92P.040	16	1	V2	R	
164	1999/09/28	92P.040	3164	92P.040	23	1	FT	R	
165	1999/10/12	82M.041	3165	82M.041	74	2	V2	B	
166	1999/10/12	82M.041	3166	82M.041	82	3	FT	B	
167	1999/10/14	82M.021	3167	82M.021	49	1	V2	B	Extra site

V2 - 2 wheel drive
V4 - 4 wheel drive
FT - walking
H - helicopter
ATV - all terrain vehicle

Table 5. Habitat data summary of sampling sites completed in 1998/1999 and 1999/2000 for the Barriere River Watershed.

Site No.	NID Map No.	NID No.	ILP Map No.	ILP No.	Reach No.	Channel Condition	Average Channel Width (m)	Average Gradient (%)	Average Pool Depth (m)	Total Cover	SWD Cover	LWD Cover	Boulder Cover	Cutbank Cover	Deep Pool Cover	Overhanging Vegetation Cover	Instream Vegetation Cover	Dominant Bed Material	Subdominant Bed Material	Channel Morphology
1	82M.022	3001	82M.012	7	3		2.45	27	0.12	T	S	D	D	T	S	S	N	B	C	SP*r*
2	92P.030	3002	82M.021	6	1		2.55	13	0.40	A	S	D	S	D	S	S	T	C	B	SP*bw*
3	92P.030	3003	82M.021	6	2	DW	1.42	5	-	-	-	-	-	-	-	-	-	G	F	-
4	82M.021	3004	82M.021	8	2		1.12	10	0.19	M	T	T	D	T	S	T	N	C	G	RP*cw*
5	82M.033	3005	82M.021	21	7		5.55	2	0.48	A		T		D	T		D	F	G	RP*gw*
6	82M.033	3006	82M.021	21	9		2.05	3	0.14	T	T	N	N	N	N	N	N	F	G	RP*gw*
7	82M.022	3007	82M.021	22	10		3.68	18	0.17	T	S	D	D	N	T	D	N	C	B	SP*bw*
8	82M.022	3008	82M.021	34	2		9.77	6	0.41	M	T	D	N	T	S	D	N	C	G	RP*cw*
9	82M.021	3009	82M.021	49	2	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	82M.031	3010	82M.021	53	2	INT	1.81	5	0.01	A	S	D	S	S	N	S	N	F	G	RP
11	92P.030	3011	82M.021	81	2		4.72	5	0.38	A	T	D	D	T	D	D	N	C	G	CP*cw*
12	82M.031	3012	82M.021	97	1		3.98	8	0.22	A	S	D	D	S	D	D	N	G	C	CP
13	82M.031	3013	82M.021	97	2		3.97	30	0.19	T	N	T	N	N	N	N	N	B	C	SP*r*
14	82M.031	3014	82M.021	97	3		3.70	38	0.29	N	N	N	N	N	N	N	N	C	B	SP*r*
15	82M.022	3015	82M.022	3	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	82M.022	3016	82M.022	4	1		1.26	22	0.07	T	T	S	D	T	N	D	N	C	B	SP*bw*
17	82M.022	3017	82M.022	10	1	INT	1.40	12	0.13	T	S	D	N	S	D	D	S	F	NA	LC
18	82M.022	3018	82M.022	10	2	NVC	-	3	-	-	-	-	-	-	-	-	-	-	-	-
19	82M.022	3019	82M.022	10	3	NVC	-	4	-	M	S	D	N	N	D	S	D	-	-	-
20	82M.022	3020	82M.022	18	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	82M.022	3021	82M.022	20	2		4.38	13	0.46	A	S	D	D	D	D	D	T	B	C	SP*bw*
22	82M.022	3022	82M.022	23	1		1.12	13	0.12	M	D	S	T	S	T	D	N	F	G	RP*gw*
23	82M.022	3023	82M.022	27	1		2.13	3	0.33	M	S	S	D	D	D	S	S	G	C	RP*gw*
24	82M.022	3024	82M.022	28	1		1.58	10	0.13	A	D	D	D	S	T	D	N	C	B	SP*bw*
25	82M.022	3025	82M.022	29	1		1.05	23	0.25	A	D	S	T	T	N	D	N	C	G	SP*bw*
26	82M.022	3026	82M.022	33	1		0.93	5	0.08	A	D	T	T	S	T	D	N	F	G	RP*cw*
27	82M.022	3027	82M.022	39	1		1.32	10	0.20	M	S	S	S	D	D	S	N	G	F	CP
28	82M.022	3028	82M.022	46	1		4.08	6	0.20	A	S	D	D	T	S	D	S	B	C	CP*cw*
29	82M.022	3029	82M.022	46	2		4.87	6	0.21	A	S	D	D	S	S	D	S	B	C	RP*cw*
30	82M.022	3030	82M.022	46	5		1.91	15	0.23	M	S	D	D	T	D	S	N	B	C	SP*r*
31	82M.022	3031	82M.022	46	7		3.15	3	0.15	T	S	S	D	T	N	T	T	B	C	RP*gw*
32	82M.022	3032	82M.022	49	1		3.15	1	0.24	M	S	D	N	S	S	T	S	F	G	RP*gw*
33	82M.022	3033	82M.022	52	2		1.36	22	0.08	T	D	D	D	T	N	S	N	B	C	SP*r*
34	82M.031	3034	82M.031	10	1	DW	3.16	6	0.15	A	S	D	D	D	S	D	N	G	B	CP
35	82M.031	3035	82M.031	10	2		4.02	31	0.23	T	N	N	T	N	T	N	N	C	B	SP*r*
36	82M.031	3036	82M.031	10	3	INT	0.71	13	-	N	N	N	N	N	N	N	N	C	G	RP*cw*
37	82M.031	3037	82M.031	20	2	INT	0.71	13	-	N	N	N	N	N	N	N	N	F	G	SP
38	82M.031	3038	82M.031	24	1	INT	0.88	10	-	N	N	N	N	N	N	N	N	G	F	RP
39	82M.031	3039	82M.031	46	2		10.20	14	0.32	A	T	T	D	N	D	S	N	B	C	SP*bw*
40	82M.042	3040	82M.032	4	3		6.92	6	0.50	A	T	T	D	T	D	T	T	B	C	SP*b*
41	82M.042	3041	82M.032	4	6		1.47	10	0.12	M	T	T	S	S	T	T	S	G	C	RP
42	82M.033	3042	82M.032	93	8		2.47	5	0.11	M	S	S	T	T	T	S	T	F	C	RP
43	82M.042	3043	82M.032	123	2		6.85	16	0.33	A	S	D	D	S	S	S	T	B	C	SP*bw*
44	82M.032	3044	82M.032	128	2	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
45	82M.033	3045	82M.033	1	1		2.42	5	0.14	M	D	T	N	T	S	T	N	F	G	SP
46	82M.033	3046	82M.033	5	5		3.27	2	0.96	M	T	S	T	D	D	T	S	F	C	SP
47	82M.033	3047	82M.033	7	1		0.59	5	0.13	T	T	N	T	D	S	S	T	F	B	RP*gw*
48	82M.033	3048	82M.033	8	1		0.62	1	0.11	T	T	N	T	D	S	T	T	F	B	RP*gw*
49	82M.033	3049	82M.033	14	1		2.77	6	0.11	T	S	D	D	S	T	S	T	B	G	CP*cw*
50	82M.033	3050	82M.033	15	1	INT	0.62	1	-	-	-	-	-	-	-	-	-	F	G	RP*gw*
51	82M.033	3051	82M.033	38	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
52	82M.033	3052	82M.033	41	4		1.11	3	0.01	T	T	S	T		N	S	S	F	G	RP*cw*
53	82M.033	3053	82M.033	45	1		1.08	1	0.14	T	N	N	T	S	D	N	T	F	B	RP*cw*
54	82M.033	3054	82M.033	51	1		1.68	2	0.12	M	T	S	S	D	S	S	T	F	B	CP
55	82M.033	3055	82M.033	56	1		0.64	2	0.11	T	T	T	N	D	S	T	T	F	G	RP*gw*
56	82M.033	3091	82M.033	91	1	DW	0.92	2	-	-	-	-	-	-	-	-	-	F	G	
57	82M.033	3057	82M.033	93	1	DW	2.53	19	0.25	T	T	T	D	N	N	T	N	B	C	SP
58	82M.041	3058	82M.041	48	3		4.23	1	0.54	A	T	S	N	D	D	N	T	F	G	RP
59	82M.041	3059	82M.041	59	1		2.37	13	0.29	T	T	N	T	N	T	T	N	B	C	RP*cw*
60	82M.041	3060	82M.041	60	2		3.40	7	0.28	A	S	S	D	T	T	T	T	C	G	RP
61	82M.041	3061	82M.041	62	5		1.57	2	0.18	T	T	N	S	D	S	T	D	F	C	LC

Table 5. Continued.

Site No.	NID Map No.	NID No.	ILP Map No.	ILP No.	Reach No.	Channel Condition	Average Channel Width (m)	Average Gradient (%)	Average Pool Depth (m)	Total Cover	SWD Cover	LWD Cover	Boulder Cover	Cutbank Cover	Deep Pool Cover	Overhanging Vegetation Cover	Instream Vegetation Cover	Dominant Bed Material	Subdominant Bed Material	Channel Morphology
62	82M.041	3062	82M.041	67	3		4.86	3	0.35	A	N	T	D	T	D	T	N	B	C	RP
63	82M.041	3063	82M.041	68	2		4.25	22	0.25	A	S	D	S	S	S	S	S	C	B	SP*bw*
64	82M.042	3064	82M.041	82	4		4.56	10	0.34	A	D	D	N	D	T	N	T	F	B	RP*cw*
65	82M.041	3065	82M.041	90	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
66	82M.042	3066	82M.042	184	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
67	82M.033	3067	82M.043	17	4		2.13	1	0.11	T	N	N	N	D	D	N	S	F	B	RP*gw*
68	92P.030	3068	92P.020	5	2		5.85	1	0.37	A	T	T	D	S	S	S	T	C	G	RP*cw*
69	92P.030	3069	92P.030	5	1	DW	2.47	11	-	-	-	-	-	-	-	-	-	C	B	SP*bw*
70	92P.030	3070	92P.030	5	3	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
71	92P.030	3071	92P.030	5	4		0.90	3	0.11	A	T	T	T	D	S	D	T	F	C	RP*gw*
72	92P.030	3072	92P.030	23	2	INT	1.87	2	-	A	S	D	N	S	T	D	T	F	NS	LC
73	92P.030	3073	92P.030	28	1		4.48	8	0.39	A	T	D	D	D	D	D	T	C	G	CP*cw*
74	92P.030	3074	92P.030	28	2		5.97	9	0.41	A	S	D	D	T	D	S	T	B	C	SP*bw*
75	92P.030	3075	92P.030	29	1	INT	7.53	3	-	-	-	-	-	-	-	-	-	G	C	NS
76	92P.030	3076	92P.030	71	3	INT	2.15	12	0.29	A	S	D	D	D	D	D	T	B	C	SP*bw*
77	82M.011	3077	82M.011	2	1		1.65	5	0.23	M	S	D	N	S	S	S	N	G	F	RP
78	82M.011	3078	82M.011	2	2		2.34	13	0.20	M	S	D	T	T	S	S	N	C	G	RP
79	92P.020	3079	82M.011	2	3	INT	0.95	10	0.04	T	S	T	N	T	N	D	N	F	G	RP
80	82M.011	3080	82M.011	3	1		0.73	8	0.19	T	N	T	T	S	T	D	N	G	F	RP
81	82M.011	3081	82M.011	4	1	INT	0.68	2	0.19	T	T	T	N	T	T	D	S	F	G	RP
82	82M.011	3082	82M.011	6	1	INT	2.41	8	0.27	M	S	S	S	S	T	D	N	C	B	RP
83	82M.011	3083	82M.011	6	2		1.53	12	0.17	M	T	S	T	S	T	D	N	B	C	RP
84	82M.011	3084	82M.011	11	1	INT	1.22	12	0.11	T	D	S	T	S	T	S	N	G	F	RP
85	82M.011	3085	82M.011	12	1	INT	1.20	3	0.17	M	S	S	N	S	T	D	N	F	NA	RP
86	82M.011	3086	82M.011	14	1		1.24	12	0.19	M	T	S	T	S	S	D	N	C	G	RP
87	82M.011	3087	82M.011	15	1	INT	0.84	31	-	-	-	-	-	-	-	-	-	F	G	
88	82M.011	3088	82M.011	18	1	INT	0.80	3	0.29	T	D	S	N	T	T	S	N	F	NA	RP
89	82M.011	3089	82M.011	20	1		0.80	13	0.14	T	T	T	D	S	T	S	N	G	F	RP
90	82M.011	3090	82M.011	21	1		0.96	5	0.17	M	S	T	N	T	T	D	T	F	G	RP
91	82M.011	3091	82M.011	25	1	INT	0.66	8	0.13	A	S	S	N	S	N	D	N	F	NS	LC
92	82M.011	3092	82M.011	28	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
93	82M.011	3093	82M.011	28	2	INT	1.24	8	0.03	A	S	S	T	T	T	D	T	F	G	RP
94	82M.012	3094	82M.011	29	1	INT	0.84	22	-									G	F	RP
95	82M.012	3095	82M.011	32	1	INT	0.33	3	-	A	S	S	T	N	S	D	T	F	NS	LC
96	82M.012	3096	82M.012	1	1	INT	1.49	1	-	-	-	-	-	-	-	-	-	G	F	-
97	82M.012	3097	82M.012	5	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
98	82M.021	3098	82M.021	6	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
99	82M.021	3099	82M.021	1	1	INT	3.53	7	0.24	T	T	T	D	S	T	T	N	G	C	RP
100	82M.021	3100	82M.021	5	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101	82M.021	3101	82M.021	1	2		3.22	25	0.32	M	T	S	D	N	S	S	T	B	C	CP
102	82M.021	3102	82M.021	1	3	INT	2.29	15	-	-	-	-	-	-	-	-	-	C	G	RP
103	82M.021	3103	82M.021	10	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
104	82M.021	3104	82M.021	12	1	INT	0.65	7	-	-	-	-	-	-	-	-	-	F	G	RP
105	82M.021	3105	82M.021	13	1	INT	0.32	9	-	-	-	-	-	-	-	-	-	-	-	-
106	82M.021	3106	82M.021	14	1		1.19	12	0.25	A	S	D	T	T	S	S	T	F	G	RP
107	82M.021	3107	82M.021	14	2	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
108	82M.021	3108	82M.021	27	1	INT	1.04	12	-	-	-	-	-	-	-	-	-	F	G	RP
109	82M.021	3109	82M.021	17	1	INT	2.32	14	-	-	-	-	-	-	-	-	-	G	C	CP
110	82M.021	3110	82M.021	17	2	INT	2.23	22	0.38	A	D	S	S	S	S	S	N	G	C	CP
111	82M.021	3111	82M.021	18	1		1.25	21	0.12	A	S	S	T	D	T	S	T	F	G	RP
112	82M.011	3112	82M.021	19	1	INT	0.97	6	-	A	S	S	T	S	N	D	N	F	G	LC
113	82M.021	3113	82M.021	20	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
114	82M.012	3114	82M.021	22	9		1.34	1	0.34	M	T	S	N	T	D	S	T	F	G	LC
115	82M.021	3115	82M.021	23	1	NVC	-	36	-	-	-	-	-	-	-	-	-	-	-	-
116	82M.021	3116	82M.021	24	1	INT	1.09	19	-	-	-	-	-	-	-	-	-	F	C	CP
117	82M.021	3117	82M.021	25	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
118	82M.021	3118	82M.021	26	1	INT	2.21	50	-	-	-	-	-	-	-	-	-	B	F	CP
119	82M.011	3119	82M.021	26	2	INT	1.59	12	0.46	A	S	S	T	D	S	S	T	F	G	RP
120	82M.011	3120	82M.021	27	2	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
121	82M.021	3121	82M.021	30	1	INT	4.04	28	0.21	A	S	D	T	S	S	S	T	F	G	CP

Table 5. Continued.

Site No.	NID Map No.	NID No.	ILP Map No.	ILP No.	Reach No.	Channel Condition	Average Channel Width (m)	Average Gradient (%)	Average Pool Depth (m)	Total Cover	SWD Cover	LWD Cover	Boulder Cover	Cutbank Cover	Deep Pool Cover	Overhanging Vegetation Cover	Instream Vegetation Cover	Dominant Bed Material	Subdominant Bed Material	Channel Morphology
122	82M.021	3122	82M.021	30	2	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
123	82M.021	3123	82M.021	30	4	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
124	82M.021	3124	82M.021	36	1	INT	2.21	4	-	-	-	-	-	-	-	-	-	G	F	RP
125	82M.011	3125	82M.021	36	2		1.24	17	0.16	A	S	S	T	S	T	D	T	F	G	LC
126	82M.011	3126	82M.021	36	4	NVC	-	10	-	-	-	-	-	-	-	-	-	-	-	-
127	82M.021	3127	82M.021	39	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
128	82M.021	3128	82M.021	43	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
129	82M.021	3129	82M.021	52	2		2.43	12	0.30	M	T	T	D	T	S	S	N	B	G	RP
130	82M.021	3130	82M.021	61	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
131	82M.021	3131	82M.021	63	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
132	82M.021	3132	82M.021	66	1	INT	0.97	22	0.16	T	S	D	S	N	T	T	N	C	G	RP
133	82M.021	3133	82M.021	71	1		0.84	19	0.17	T	T	D	T	N	T	S	N	F	G	RP
134	82M.021	3134	82M.021	72	1	INT	1.09	42	-	-	-	-	-	-	-	-	-	C	B	
135	82M.021	3135	82M.021	81	1		5.18	7	0.37	A	T	S	D	T	S	T	N	B	G	RP
136	82M.021	3136	82M.021	86	1	INT	2.84	37	0.13	A	S	S	D	T	T	T	N	C	B	CP
137	92P.040	3137	82M.021	90	1		1.71	16	0.23	A	S	D	T	S	T	S	N	G	C	RP
138	82M.021	3138	82M.021	91	1		5.76	38	0.19	A	S	S	D	S	T	T	N	B	C	CP
139	82M.021	3139	82M.021	92	1	INT	2.13	52	-	-	-	-	-	-	-	-	-	C	B	CP
140	82M.021	3140	82M.021	94	1	INT	1.86	15	-	-	-	-	-	-	-	-	-	B	G	-
141	82M.021	3141	82M.021	96	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
142	82M.021	3142	92P.030	67	3		1.65	27	0.27	A	S	D	S	S	S	S	T	G	C	CP
143	82M.022	3143	82M.022	4	1	INT	1.35	12	0.22	A	S	S	T	S	D	S	N	G	C	RP
144	92P.040	3144	82M.031	15	3		3.24	2	0.34	M	T	S	S	T	D	T	T	C	B	RP
145	82M.042	3145	82M.031	46	4		3.02	3	0.30	M	T	N	D	S	S	T	S	G	C	RP
146	82M.032	3146	82M.032	6	1	INT	0.95	7	0.28	T	T	D	N	S	S	S	T	F	G	RP
147	82M.032	3147	82M.032	10	1	INT	1.31	1	-	-	-	-	-	-	-	-	-	F	G	-
148	82M.032	3148	92P.020	1	7		13.65	3	0.58	M	T	D	S	T	S	T	N	C	F	RP
149	82M.032	3149	82M.032	41	1	INT	0.56	10	0.11	T	T	D	N	T	N	S	N	F	G	RP
150	82M.032	3150	82M.032	44	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
151	82M.043	3151	82M.032	93	3		2.78	10	0.34	A	T	S	D	T	S	T	T	B	F	RP
152	82M.043	3152	82M.032	123	3		1.58	1	0.66	M	N	N	S	S	D	T	T	F	B	RP
153	82M.021	3153	82M.021	56	1		3.92	5	0.30	T	S	T	S	N	T	D	N	C	F	RP
154	82M.041	3154	82M.041	74	3	INT	-	-	-	-	-	-	-	-	-	-	-	-	-	-
155	82M.031	3155	82M.031	94	1		3.75	11	0.35	M	T	S	D	T	S	T	N	B	F	RP
156	92P.020	3156	92P.020	6	2		5.77	6	0.45	A	T	S	D	T	S	T	N	B	C	RP
157	92P.020	3157	92P.020	6	3		4.77	3	0.44	A	S	D	S	T	S	T	T	B	C	RP
158	92P.020	3158	92P.020	13	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
159	92P.020	3159	92P.020	14	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
160	92P.020	3160	92P.020	53	1	INT	2.01	3	-	-	-	-	-	-	-	-	-	G	C	-
161	92P.020	3161	92P.020	58	1	INT	0.80	11	-	-	-	-	-	-	-	-	-	F	C	RP
162	92P.040	3162	92P.040	13	1	INT	2.16	3	0.24	T	T	T	S	T	D	T	N	C	G	RP
163	92P.040	3163	92P.040	16	1	INT	1.41	3	0.15	T	S	D	T	T	S	S	T	F	G	RP
164	92P.040	3164	92P.040	23	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
165	82M.041	3165	82M.041	74	2		6.52	11	0.38	M	T	S	D	T	S	T	N	B	G	RP
166	82M.041	3166	82M.041	82	3		5.76	16	0.47	A	T	S	S	S	D	S	T	C	G	CP
167	82M.021	3167	82M.021	49	1	NVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: N - none
T - trace
M - moderate
A - abundant
D - dominant
S - subdominant
INT - intermittent
DW - dewatered
NVC - no visible channel
LC = large channel

F - fines
G - gravel
C - cobble
B - boulder

NS - not specified

CP = Cascade-pool
CP *c-w* = Cascade-pool, cobble, LWD present-minor function

SP = step-pool
SP *b-w* = Step-pool, boulder, LWD present-minor function
SP *r* = boulder-block, LWD absent

RP = riffle-pool
RPcw = riffle-pool, cobble, LWD functioning
RPgw = riffle-pool, gravel, LWD functioning

Two typical streams sampled in the Barriere River watershed are shown in Figures 3 and 4.

Throughout the Barriere River study area, field estimates of water turbidity were described as either clear (91% of the sites) or low (9% of the sites), suggesting low sediment inputs from erosion at the time of sampling. At all the sites where water was observed, the stage of flow was described as low (77% of the sites) or moderate (23%). The pH ranged from 6.3 to 10.3 with a mean pH (± SD) of 8.0 ± 0.7. The moderate stages were noted in streams sampled in 1999 (all sites were low in 1998), and were likely the result of the record snowpack recorded in Region 3, combined with an unusually wet spring and early summer that resulted in higher than normal discharge. Fish were likely provided a greater opportunity in the fall of 1999 to utilize available habitat than in typically lower water years.

Water temperatures ranged from 1°C to 26°C during the periods of study, with a mean (± 1 SD) of 11 ± 5°C. However, only three sites had temperatures below 4°C; Sites 162 and 163 were 3°C and Site 95 was 1°C. All three sites were intermittent and were determined to be non fish bearing.

In reaches where water flow allowed for fish sampling, sampling procedures were judged to be sufficient to determine fish presence or absence. Within the Barriere River watershed fish distribution is limited, with only 23 sites currently designated as fish bearing, and an additional 8 sites suspected of having seasonal fish usage. Of the 31 reaches designated as fish bearing or suspected fish bearing, the 7 reaches sampled in the Leonie Creek Community Watershed resulted in 3 reaches (Sites: 68-S2, 73-S3 and 74-S3) designated as fish bearing and 2 reaches designated as suspected fish bearing (Sites: 69 - S3 and 72 - S3). In addition, 1 reach was designated a NVC (Site: 70) and although 1 reach (Site: 71) was designated non-fish bearing it received a S4 classification due to its location within the community watershed.

Figure 3. Barriere River watershed: Upstream view of typical habitat with step-pool morphology, cobble-boulder substrate, 6% gradient, and abundant cover (overhanging vegetation, boulders, cutbanks, large woody debris). Site 34, ILP Map 82M.031, ILP 10, Reach 1, July 31, 1998.

Figure 4. Barriere River watershed: Downstream view of typical habitat with riffle-pool morphology, 12% gradient, gravel-cobble substrate, and moderate cover (large woody debris, overhanging vegetation, deep pools). Site 129, ILP Map 82M.021, ILP 52, Reach 2, September 29, 1999.

Within the Barriere River watershed, three salmonid species and one non-salmonid species were captured. A total of 209 rainbow trout were captured at 22 sites (Sites 12, 27, 28, 29, 32, 39, 45, 68, 73, 74, 75, 77, 86, 89, 90, 99, 124, 143, 148, 153, 156, and 157), four bull trout were captured at two sites (Sites 148 and 155), one coho was captured at one site (Site 27) and three prickly sculpins were captured at one site (Site 148).

Of the 209 rainbow trout captured in the Barriere River watershed (Figure 5) 146 were caught by electrofishing, 11 by pole-seining, 13 by minnow traps and 39 by dip net. Bull trout (Figure 6) and prickly sculpins were only caught by electrofishing. Coho were captured only by minnow trap.

At sites in the Barriere River watershed where fish were captured by electrofishing, the Catch-Per-Unit-Effort (CPUE) ranged from 0.10 to 25.45 fish/100m² (or 0.22 to 17.50 fish/100 seconds). Where fish were captured with pole seines and minnow traps the CPUE ranged from 0.17 to 1.50 fish/100 seconds and from 0.04 to 0.33 fish/hr., respectively. No effort was recorded for the one site (Site 75) where 39 rainbow trout were captured using the dip net.

Features of concern to fish populations, fish habitat, or the inventory were identified during sampling. Features may be *barriers* to fish migration (e.g. a falls where fish cannot move upstream at any time), they may be *obstructions* to fish migration (e.g. a beaver dam which may impede but not block upstream fish passage), or other types of features which may impact fish habitat values but not fish migration (e.g. effluent outfalls). Features may be natural (e.g. cascades, beaver dams) or man-made (e.g. culverts).

Figure 5. Barriere River watershed: Rainbow trout captured by electrofishing. Site 73, ILP Map 92P.030, ILP 28, Reach 1, August 6, 1998.

Figure 6. Barriere River watershed: Bull trout captured by electrofishing. Site 148, ILP Map 92P.020, ILP 1, Reach 7, October 5, 1999.

Natural obstructions and barriers were observed in the Barriere River watershed. Natural seasonal obstructions to fish migration identified in fish bearing reaches in the Barriere River watershed during the study included beaverdams and log jams (Figure 7). Four beaverdams were identified within reaches (Sites: 86, 124, 143 and 157) and three log jams were identified within reaches (Sites: 34, 39 and 153). Other observed natural barriers included falls and cascades, although they did not affect fish and fish habitat, since they were located in non-fish bearing reaches.

Fifty-two sites in the Barriere River watershed were noted to have various road crossings as features during field sampling. However, only 13 of these features were within fish bearing reaches, where; 8 culverts were identified as barriers (Sites: 27, 34, 69, 75, 89, 99, and 153 where 2 culverts were identified) (Table 6, Figure 8), 3 culverts were identified as obstructions (Sites: 12, 29, and 16) and 2 bridge crossings were identified (Sites: 73 and 148) which posed no risk to fish migration. In addition to these features, an irrigation structure with a dam and spillway was observed at the outlet of Leonie Lake (Site: 68), however, it was not considered to be a barrier or obstruction.

During this project, sampling procedures such as timing and fish capture methodologies followed the standards outlined in RIC (May 1998) and Appendix C of Schedule A of the Standards Agreement, and were sufficient to determine fish presence or absence in the upper reaches. Therefore, it is reasonable to infer that fish absence could be a result of;

i) A barrier to upstream fish migration at some point below the sampling site, and/or,

ii) Overwintering conditions (i.e. inadequate pool depths) were not suitable for fish in upper tributary reaches, and/or,

Figure 7. Barriere River watershed: Upstream view of logjam. Site 34, ILP Map 82M.031, ILP 10, Reach 1, August 12, 1998.

Figure 8. Barriere River watershed: Upstream view of perched culvert. Site 153, ILP Map 82M.021, ILP 56, Reach 1, October 14, 1999.

Table 6. Summary of historic and new barriers to fish migration found in the Barriere River Watershed.

Site No.	ILP No.	ILP Map No.	Reach No.	NID No.	NID Map No.	Barrier Type	Height of Barrier (m)	Verified in Field	Description and Comments
27	39	82M.022	1	3027	82M.022	CV	0.6	Yes	Barrier to upstream fish migration.
34	10	82M.031	1	3034	82M.031	CV	1.1	Yes	Barrier to upstream fish migration
69	5	92P.030	1	3069	92P.030	CV	0.9	Yes	Barrier to upstream fish migration
75	29	92P.030	1	3075	92P.030	CV	0.7	Yes	Barrier to upstream fish migration
89	20	82M.011	1	3089	82M.011	CV	0.7	Yes	Barrier to upstream fish migration
99	1	82M.021	1	3099	82M.021	CV	0.8	Yes	Barrier to upstream fish migration
153	56	82M.021	1	3153	82M.021	CV	0.6	Yes	Barrier to upstream fish migration
153	56	82M.021	1	3153	82m.021	CV	0.6	Yes	Barrier to upstream fish migration

CV - culvert

iii) Low densities of fish populations within the watershed, utilizing only the lower, more productive reaches, even though headwater reaches were contiguous with fish habitat (Raleigh et al. 1984).

The fish sampling results for the Barriere River watershed suggest that fish distribution is generally limited to the Barriere River mainstem and to its 4th and 5th order tributaries. During the 1998/1999 and 1999/2000 sampling periods in the Barriere River watershed, juvenile salmonids were not found in 1st, 2nd and 3rd order tributaries that did not flow into known fish bearing streams. Salmonids are suspected to utilize the lower reaches of 1st, 2nd, and 3rd order tributaries to the Barriere River mainstem and its 4th and 5th order tributaries where suitable habitat conditions are likely to exist. Reaches within tributaries at higher elevation areas in the watershed do not appear to have suitable overwintering habitat and, although fish are not physically excluded from ascending these tributaries, Barriere River fish stocks do not use them. The high water noted for 1999 would have improved fish access into these areas, but the pattern of fish distribution remained consistent from the 1998/1999 sampling to the 1999/2000 sampling.

Generally, the presence of fish is associated with valley flats where, over time, channel forming processes have downcut and established reaches with uniform gradients (< 20%) that provide more favorable habitat. The majority of the non fish-bearing tributaries that were sampled originate from higher elevation hillslopes and consist of reaches with irregular gradient patterns and habitat characteristics which appear to be unfavorable to fish. Similar patterns of fish distribution were also described for other streams in the Kamloops region, in systems such as Monte and Scuitto Creeks Watershed, the Upper North Thompson River Watershed and the Tranquille River Watershed (ARC Environmental Ltd. and the Adams Lake Indian Band 1997, ARC Environmental Ltd. and the North Thompson Indian Band 1997, ARC Environmental Ltd. and the Kamloops

Indian Band 1997) and is reflected in previous studies conducted in the Barriere River watershed.

4.3 Fish Age, Size and Life History

Table 7 provides a summary of the fish sampling results for the Barriere River watershed, including sampling methods, species captured, maturity, fork length, and wet weight. Within the Barriere River watershed a total of 209 rainbow trout, four bull trout, one coho and 3 prickly sculpins were captured between 23 reaches, using a backpack electrofisher, pole seine, minnow traps and/or dip net. Of the fish captured, scale samples were taken from a representative sample of 72 rainbow trout, 3 bull trout and 1 coho and analyzed (Attachment IV).

For the rainbow trout, 14 fish were aged at 0+, 45 fish were aged at 1+, and 13 fish were aged at 2+. For the bull trout, two fish were 1+ and one fish was 2+. The one coho aged was 0+. Table 8 provides a summary of length at age data for sampled rainbow trout from the Barriere River watershed. A length-frequency histogram and length-at-age graph of sampled rainbow trout is provided in Figure 9 and 10, respectively.

Rainbow trout within the watershed may exhibit one of three life history strategies; adfluvial - spawning and rearing for one to three years in streams before moving into lakes to rear or mature, fluvial, - spawning and rearing in smaller tributaries and rearing as adults in mainstems or large tributaries, or resident - living their entire lives within smaller (usually headwater) tributaries (Ford et al. 1995). Rainbow trout are spring spawners, and depending on stream flow and water temperatures, will spawn from mid-April to mid-June. Fry emergence usually occurs between mid-June to mid-August. Depending upon life history strategy, as fry emerge from the spawning gravels they will move into slow moving waters along the margins and/or pools, and as they grow, may

Table 7. Fish sampling summary for the Barriere River Watershed study area, 1998/1999 and 1999/2000.

Site No.	ILP Map No.	ILP No.	Reach No.	Species	Capture Method	Fish Length (mm)	Fish Weight (g)	Age Sample No.	Age
12	82M.021	97	1	RB	EF	91	12.4	2	1+
12	82M.021	97	1	RB	EF	89	9.5	1	1+
12	82M.021	97	1	RB	EF	102	14.7	3	1+
27	82M.022	39	1	CO	MT	67	4.1	4	0+
27	82M.022	39	1	RB	EF	120	25.4	5	1+
28	82M.022	46	1	RB	EF	135	26.3	7	1+
28	82M.022	46	1	RB	MT	135	28.1	6	1+
28	82M.022	46	1	RB	MT	125	23.0		
29	82M.022	46	2	RB	EF	125	25.1	9	1+
29	82M.022	46	2	RB	EF	120	23.0	8	2+
32	82M.022	49	1	RB	EF	115	20.7	12	2+
32	82M.022	49	1	RB	EF	138	28.1	11	2+
32	82M.022	49	1	RB	EF	139	36.7	10	2+
39	82M.031	46	2	RB	EF	107	16.7		
39	82M.031	46	2	RB	EF	110	21.9		
39	82M.031	46	2	RB	EF	130	33.5		
39	82M.031	46	2	RB	EF	141	35.2	14	1+
39	82M.031	46	2	RB	EF	115	18.9	13	1+
45	82M.033	1	1	RB	EF	34	0.3		
45	82M.033	1	1	RB	EF	32	0.2		
45	82M.033	1	1	RB	EF	30	0.2		
45	82M.033	1	1	RB	EF	32	0.3		
45	82M.033	1	1	RB	EF	45	1.0		
45	82M.033	1	1	RB	EF	115	17.0	15	1+
45	82M.033	1	1	RB	EF	145	34.4	16	2+
45	82M.033	1	1	RB	EF	36	0.5		
45	82M.033	1	1	RB	EF	33	0.3		
45	82M.033	1	1	RB	EF	39	0.8		
45	82M.033	1	1	RB	EF	42	0.7		
45	82M.033	1	1	RB	EF	172	65.5	17	2+
45	82M.033	1	1	RB	SN	31	0.2		
45	82M.033	1	1	RB	SN	43	1.0		
68	92P.020	5	2	RB	MT	111	18.7	22	1+
68	92P.020	5	2	RB	MT	116	20.6	28	1+
68	92P.020	5	2	RB	EF	50	2.6	26	0+
68	92P.020	5	2	RB	EF	47	2.0	25	0+
68	92P.020	5	2	RB	EF	32	0.8		
68	92P.020	5	2	RB	EF	104	16.4	24	1+
68	92P.020	5	2	RB	EF	105	16.3	23	1+
68	92P.020	5	2	RB	EF	85	9.1	27	1+
68	92P.020	5	2	RB	EF	125	25.8		
68	92P.020	5	2	RB	EF	126	24.2	21	1+
68	92P.020	5	2	RB	EF	137	34.4	20	1+
68	92P.020	5	2	RB	EF	108	13.5	18	1+
68	92P.020	5	2	RB	EF	122	26.9	19	1+
68	92P.020	5	2	RB	EF	29	0.4		
73	92P.030	28	1	RB	EF	119	14.8	15	1+
73	92P.030	28	1	RB	EF	133	26.7	16	2+
73	92P.030	28	1	RB	EF	183	66.0	17	2+
73	92P.030	28	1	RB	EF	71	3.6	18	0+
73	92P.030	28	1	RB	EF	115	16.6	13	1+
73	92P.030	28	1	RB	EF	109	10.6		
73	92P.030	28	1	RB	EF	116	18.1	8	1+
73	92P.030	28	1	RB	EF	114	13.6		
73	92P.030	28	1	RB	EF	114	11.2		
73	92P.030	28	1	RB	EF	115	16.6		
73	92P.030	28	1	RB	EF	112	11.0		
73	92P.030	28	1	RB	EF	112	12.3	12	1+
73	92P.030	28	1	RB	EF	115	17.2	11	1+
73	92P.030	28	1	RB	EF	116	16.7	9	1+
73	92P.030	28	1	RB	EF	113	16.6	7	1+
73	92P.030	28	1	RB	EF	118	19.2	6	1+

Table 7. Continued.

Site No.	ILP Map No.	ILP No.	Reach No.	Species	Capture Method	Fish Length (mm)	Fish Weight (g)	Age Sample No.	Age
73	92P.030	28	1	RB	EF	125	20.9	5	1+
73	92P.030	28	1	RB	MT	119	18.0	4	1+
73	92P.030	28	1	RB	MT	68	3.9	2	1+
73	92P.030	28	1	RB	MT	145	34.5	3	2+
73	92P.030	28	1	RB	MT	115	18.9	14	1+
73	92P.030	28	1	RB	MT	124	22.4	10	1+
73	92P.030	28	1	RB	EF	98	10.5	1	1+
74	92P.030	28	2	RB	EF	67	4.9	52	0+
74	92P.030	28	2	RB	EF	170	86.5	51	2+
74	92P.030	28	2	RB	EF	111	21.2	50	1+
74	92P.030	28	2	RB	EF	170	71.7	49	2+
74	92P.030	28	2	RB	EF	160	61.9	48	2+
74	92P.030	28	2	RB	EF	67	4.2	47	0+
74	92P.030	28	2	RB	EF	123	20.2	54	1+
74	92P.030	28	2	RB	MT	63	4.4	53	0+
75	92P.030	29	1	RB	DN	30	0.2		
75	92P.030	29	1	RB	DN	29	0.2		
75	92P.030	29	1	RB	DN	29	0.2		
75	92P.030	29	1	RB	DN	30	0.2		
75	92P.030	29	1	RB	DN	32	0.2		
75	92P.030	29	1	RB	DN	32	0.2		
75	92P.030	29	1	RB	DN	31	0.2		
75	92P.030	29	1	RB	DN	30	0.3		
75	92P.030	29	1	RB	DN	30	0.2		
75	92P.030	29	1	RB	DN	30	0.3		
75	92P.030	29	1	RB	DN	30	0.2		
75	92P.030	29	1	RB	DN	30	0.2		
75	92P.030	29	1	RB	DN	31	0.3		
75	92P.030	29	1	RB	DN	31	0.2		
75	92P.030	29	1	RB	DN	33	0.3		
75	92P.030	29	1	RB	DN	29	0.1		
75	92P.030	29	1	RB	DN	31	0.2		
75	92P.030	29	1	RB	DN	31	0.2		
75	92P.030	29	1	RB	DN	29	0.2		
75	92P.030	29	1	RB	DN	15	0.4		
75	92P.030	29	1	RB	DN	31	0.3		
75	92P.030	29	1	RB	DN	29	0.1		
75	92P.030	29	1	RB	DN	31	0.2		
75	92P.030	29	1	RB	DN	30	0.4		
77	82M.011	2	1	RB	EF	98	13.7	1	1+
86	82M.011	14	1	RB	EF	115	22.4	2	NA
89	82M.011	20	1	RB	EF	53	2.6	3	0+
90	82M.011	21	1	RB	EF	38	1.2		
90	82M.011	21	1	RB	EF	33	0.5		
90	82M.011	21	1	RB	EF	38	0.9	4	0+
99	82M.021	1	1	RB	EF	130		5	1+
124	82M.021	36	1	RB	SN	39	0.6		
124	82M.021	36	1	RB	SN	41	1.2		
124	82M.021	36	1	RB	SN	36	0.4		
124	82M.021	36	1	RB	SN	41	0.8		
124	82M.021	36	1	RB	SN	44	1.1		
124	82M.021	36	1	RB	EF	45	1.3		
124	82M.021	36	1	RB	EF	55	2.3	6	0+
124	82M.021	36	1	RB	EF	52	1.8	7	0+
124	82M.021	36	1	RB	EF	51	1.6	8	0+
124	82M.021	36	1	RB	EF	54	1.8		
124	82M.021	36	1	RB	EF	35	0.7		
124	82M.021	36	1	RB	EF	35	0.8		
124	82M.021	36	1	RB	EF	42	1.2		
124	82M.021	36	1	RB	EF	49	1.0		
124	82M.021	36	1	RB	EF	54	1.0		
124	82M.021	36	1	RB	EF	51	1.1		
124	82M.021	36	1	RB	EF	45	1.0		
124	82M.021	36	1	RB	EF	46	1.1		

Table 7. Continued.

Site No.	ILP Map No.	ILP No.	Reach No.	Species	Capture Method	Fish Length (mm)	Fish Weight (g)	Age Sample No.	Age
124	82M.021	36	1	RB	EF	46	1.1		
124	82M.021	36	1	RB	EF	40	0.9		
143	82M.022	4	1	RB	EF	108	16.1	9	1+
148	92P.020	1	7	CRH	EF	89	19.7		
148	92P.020	1	7	BT	EF	183	81.5	10	2+
148	92P.020	1	7	CRH	EF	88	20.8		
148	92P.020	1	7	RB	EF	98	12.5	13	1+
148	92P.020	1	7	RB	EF	55	2.0		
148	92P.020	1	7	RB	EF	52	1.4		
148	92P.020	1	7	RB	EF	52	2.5		
148	92P.020	1	7	RB	EF	46	2.1		
148	92P.020	1	7	RB	EF	66	4.8		
148	92P.020	1	7	RB	EF	56	3.3		
148	92P.020	1	7	CRH	EF	37	1.8		
148	92P.020	1	7	RB	EF	64	4.4		
148	92P.020	1	7	RB	EF	61	3.1		
148	92P.020	1	7	RB	EF	56	2.6		
148	92P.020	1	7	RB	EF	39	0.9		
148	92P.020	1	7	RB	EF	61	3.4		
148	92P.020	1	7	RB	EF	50	2.2	12	0+
148	92P.020	1	7	RB	EF	79	5.5		
148	92P.020	1	7	RB	EF	68	5.7	11	0+
148	92P.020	1	7	RB	EF	49	1.9		
148	92P.020	1	7	RB	EF	67	4.1		
153	82M.021	56	1	RB	EF	76	7.6	14	1+
153	82M.021	56	1	RB	EF	76	6.1	15	1+
155	82M.031	94	1	BT	EF	85	7.5	16	1+
155	82M.031	94	1	BT	EF	88	8.1	17	1+
155	82M.031	94	1	BT	EF	94	9.7		
156	92P.020	6	2	RB	MT	99	13.1		
156	92P.020	6	2	RB	MT	121	22.5		
156	92P.020	6	2	RB	MT	89	11.9		
156	92P.020	6	2	RB	EF	102	14.5		
156	92P.020	6	2	RB	EF	89	10.5	18	1+
156	92P.020	6	2	RB	EF	100	16.2		
156	92P.020	6	2	RB	EF	148	45.8		
156	92P.020	6	2	RB	EF	73	5.1		
156	92P.020	6	2	RB	EF	95	12.1		
156	92P.020	6	2	RB	EF	64	3.5		
156	92P.020	6	2	RB	EF	49	1.5		
156	92P.020	6	2	RB	EF	86	8.2	20	1+
156	92P.020	6	2	RB	EF	113	21.5	19	1+
156	92P.020	6	2	RB	EF	141	38.6		
157	92P.020	6	3	RB	EF	46	1.7		
157	92P.020	6	3	RB	EF	58	3.8		
157	92P.020	6	3	RB	EF	51	2.5		
157	92P.020	6	3	RB	EF	55	3.2		
157	92P.020	6	3	RB	EF	99	12.2		
157	92P.020	6	3	RB	EF	85	9.2		
157	92P.020	6	3	RB	EF	92	10.9		
157	92P.020	6	3	RB	EF	153	47.2		
157	92P.020	6	3	RB	EF	42	1.6		
157	92P.020	6	3	RB	EF	44	1.7		
157	92P.020	6	3	RB	EF	53	2.8		
157	92P.020	6	3	RB	EF	49	2.2		
157	92P.020	6	3	RB	EF	64	4.6		
157	92P.020	6	3	RB	EF	51	2.3		
157	92P.020	6	3	RB	EF	49	2.1		
157	92P.020	6	3	RB	EF	47	1.8		
157	92P.020	6	3	RB	EF	47	2.0		
157	92P.020	6	3	RB	EF	53	53.0		
157	92P.020	6	3	RB	EF	155	61.8		
157	92P.020	6	3	RB	EF	159	56.6	23	2+
157	92P.020	6	3	RB	EF	97	11.2	22	1+
157	92P.020	6	3	RB	EF	46	1.7	21	0+
157	92P.020	6	3	RB	EF	49	2.7		

RB - rainbow trout
BT - bull trout
CO - coho
CRH - torrent sculpin

Table 8. Summary of length-at-age data from rainbow trout, coho and bull trout sampled in the Barriere River Watershed study area, 1998/1999 and 1999/2000.

Site No.	ILP Map No.	ILP No.	Reach No.	Species	Age	No. of Fish	Mean Length (mm)	Range of Lengths (mm)
12	82M.021	97	1	RB	1+	3	94	89 - 102
27	82M.022	39	1	CO	0+	1	67	na - na
27	82M.022	39	1	RB	1+	1	120	na - na
28	82M.022	46	1	RB	1+	2	135	na - na
29	82M.022	46	1	RB	1+	1	125	na - na
29	82M.022	46	1	RB	2+	1	120	na - na
32	82M.022	49	1	RB	2+	3	131	115 - 139
39	82M.031	46	2	RB	1+	2	128	115 - 141
45	82M.033	1	1	RB	1+	1	115	na - na
45	82M.033	1	1	RB	2+	2	159	145 - 172
68	92P.020	5	2	RB	0+	2	49	47 - 50
68	92P.020	5	2	RB	1+	9	113	85 - 137
73	92P.030	28	1	RB	0+	1	71	na - na
73	92P.030	28	1	RB	1+	14	112	68 - 125
73	92P.030	28	1	RB	2+	3	154	133 - 183
74	92P.030	28	2	RB	0+	3	66	63 - 67
74	92P.030	28	2	RB	1+	2	117	111 - 123
74	92P.030	28	2	RB	2+	3	167	160 - 170
77	82M.011	2	1	RB	1+	1	98	na - na
89	82M.011	20	1	RB	0+	1	53	na - na
90	82M.011	21	1	RB	0+	1	38	na - na
99	82M.021	1	1	RB	1+	1	130	na - na
124	82M.021	36	1	RB	0+	3	53	51 - 55
143	82M.022	4	1	RB	1+	1	108	na - na
148	92P.020	1	7	BT	2+	1	183	na - na
148	92P.020	1	7	RB	0+	2	59	50 - 68
148	92P.020	1	7	RB	1+	1	98	na - na
153	82M.021	56	1	RB	1+	2	76	na - na
155	82M.031	94	1	BT	1+	2	87	85 - 88
156	92P.020	6	2	RB	1+	3	96	86 - 113
157	92P.020	6	3	RB	0+	1	46	na - na
157	92P.020	6	3	RB	1+	1	97	na - na
157	92P.020	6	3	RB	2+	1	159	na - na

RB - rainbow trout
BT - bull trout
CO - coho

Figure 9. Length-frequency histogram of sampled rainbow trout from the Barriere River Watershed, 1998/1999 and 1999/2000.

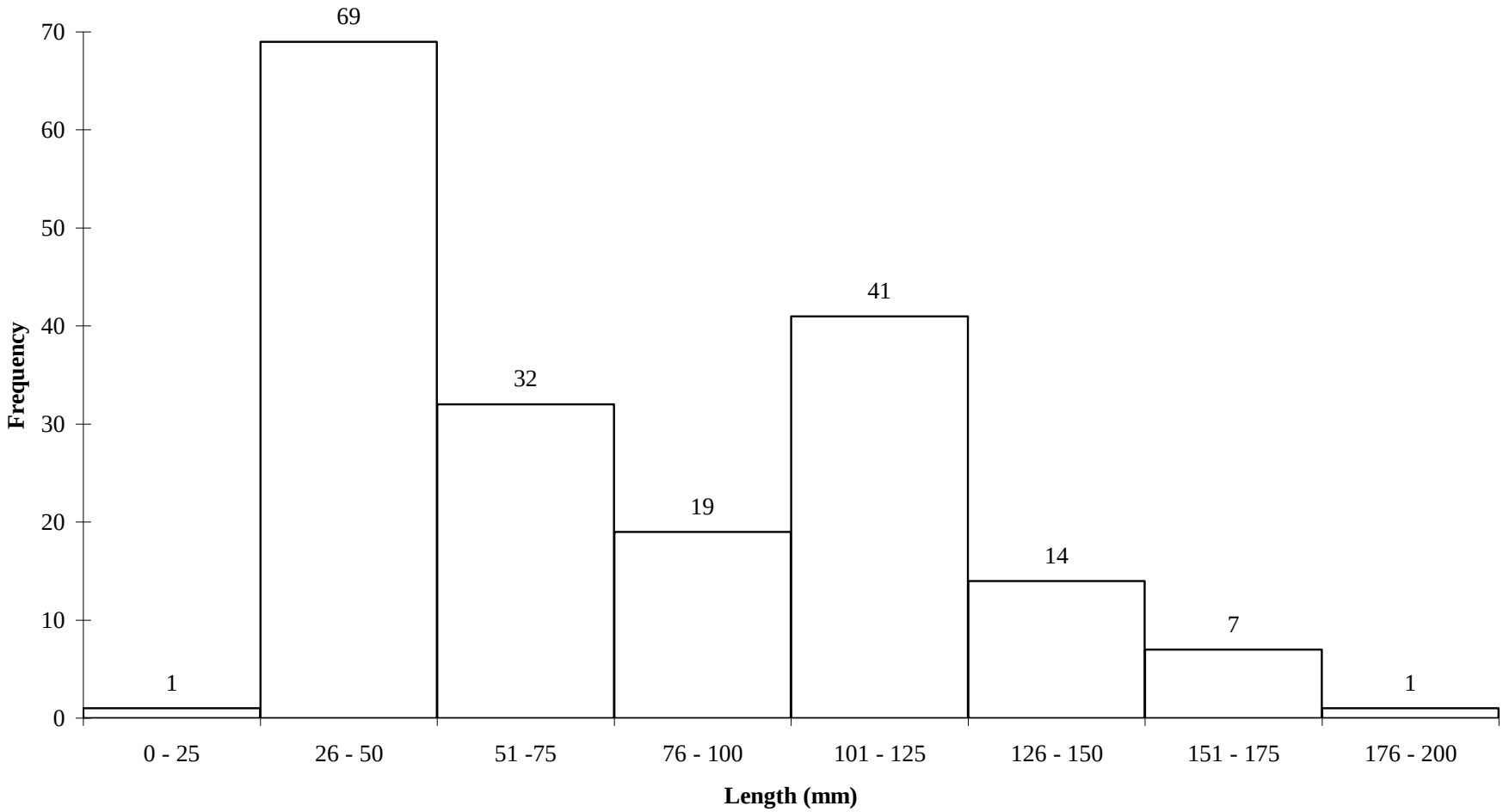
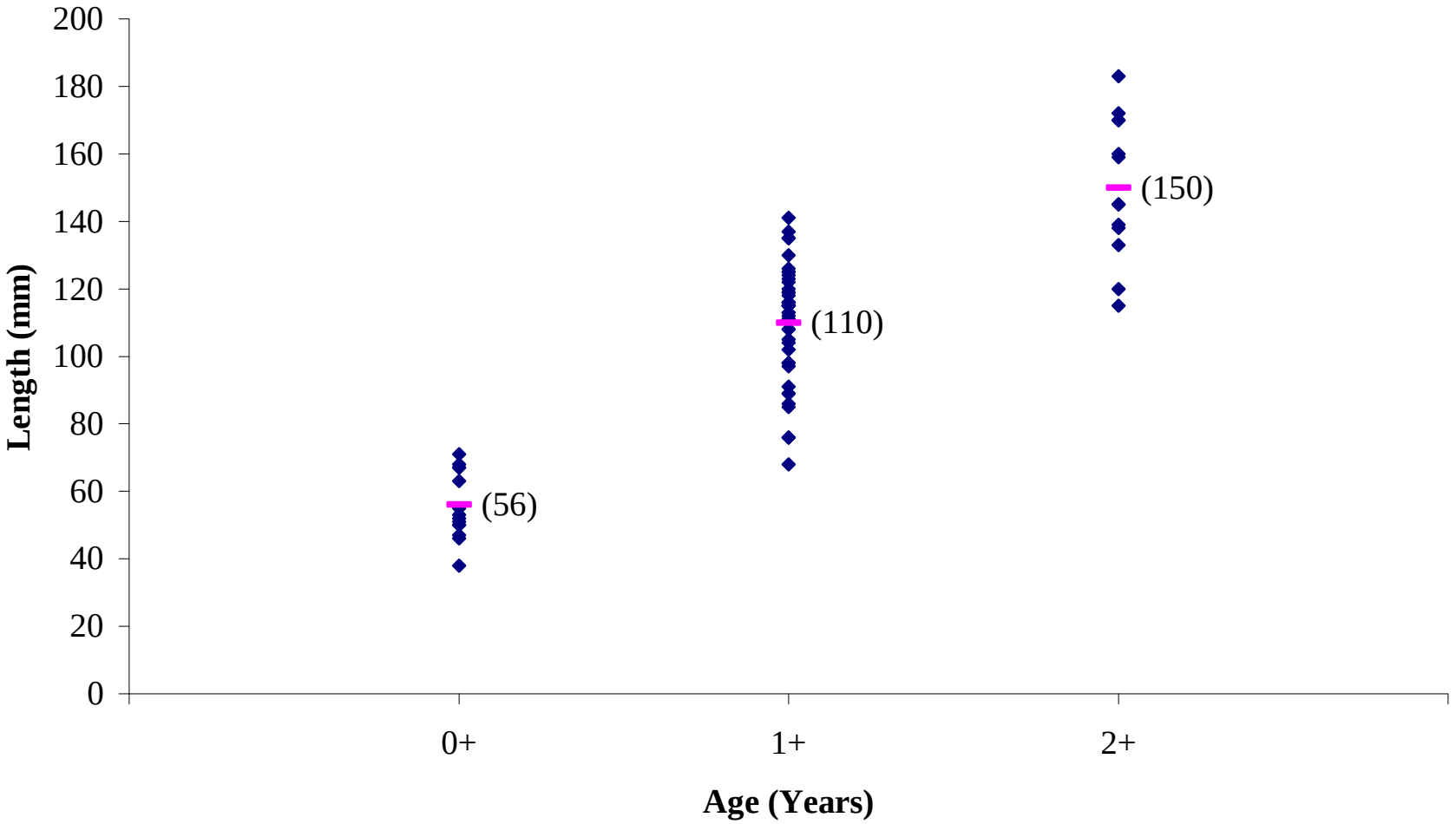


Figure 10. Length-at-age of sampled rainbow trout from the Barriere River watershed, 1998/1999 and 1999/2000.
(mean length provided in parenthesis)



inhabit stream riffle areas where they will remain for the summer (fluvial, adfluvial and resident) or move into rearing areas in associated lakes (adfluvial). By late summer and early fall the young of the year and juveniles may then take up residence in suitable overwintering habitat within stream or lake systems (Ford et al. 1995).

The length-at-age data from the scale analysis for the Barriere River watershed may suggest that the rainbow trout in the smaller tributaries of this system are fluvial and adfluvial due to the presence of 0+, 1+, and 2+ fish and the absence of older or mature fish. After three years, immature fish may move to the larger lakes or the mainstem streams of these systems to rear and mature.

Coho salmon from the North Thompson River drainage spawn over an extended period from late October to January. Fry emergence occurs in April/May, before and after peak river discharge. Coho in this drainage may have at least two rearing strategies; a large percentage of coho fry appear to move into the North Thompson River mainstem to rear or in some systems such as Fennell Creek, the coho may rear and overwinter in their natal streams (Harding et al. 1994). Coho may spend one or two years in freshwater to reach smolting size, depending on stream temperatures and growth rate of fry. Smolt migration peaks in mid-May (Harding et al. 1994).

4.4 Significant Features and Fisheries Observations

4.4.1 Fish and Fish Habitat

No staging areas or large spawning grounds were identified within the sites sampled in the Barriere River watershed. However, two species that are of special concern within the province of British Columbia were captured during the fish sampling for the FFHIP. Coho salmon were captured in Site 27 and bull trout were captured in Sites 148 and 155. Additionally, coho salmon and bull trout were captured in Birk Creek and bull trout were visually observed in Harper Creek as part of Watershed Restoration Program projects

ARC Environmental Ltd. is currently involved with (ARC Environmental Ltd. and the North Thompson Indian Band 1998 and 1999). Coho salmon were also captured in 1998 in Reach 1 of Leonie Creek during a fish salvage for Argo Road Maintenance Ltd.

4.4.2 Habitat Protection Concerns

4.4.2.1 Fisheries Sensitive Zones

No Fisheries Sensitive Zones were identified during the field surveys of the 167 sites completed for the project. Although habitat such as flooded depressions, ponds, or swamps, which either perennially or seasonally contain water, was present, it was only in sites that have been determined to be non-fish bearing.

However, additional information on Fisheries Sensitive Zones was gathered in the Barriere River watershed in 1998, in conjunction with a Watershed Restoration Program helicopter overflight of the watershed. This overflight revealed three sites with potential groundwater sources where there may be some opportunities for the creation of off channel fish habitat within Reaches 1, 3 and 4 of the Barriere River mainstem (ARC Environmental Ltd. and North Thompson Indian Band 1998).

In 1999, ARC Environmental Ltd. and Summit Environmental Consultants Ltd. began works within the groundwater channel identified within Reach 3 of the Barriere River. To date surveying of the channel has been completed, and LWD, boulders and instream vegetation has been placed within the upper 200m of the channel to provide channel stability and fish habitat. Preliminary fish sampling conducted before works began revealed that salmonid species (coho) were utilizing the lower 350m wetted area of the channel.

4.4.2.2 Fish Above 20% Gradients

During field sampling, fish populations were not detected within the reaches sampled which had gradients greater than 20%. Fish were also not captured in reaches located upstream of reaches with gradients greater than 20%. However, due to bull trout being present within the Barriere River watershed, gradients up to 30% were considered to be potentially fish bearing.

4.4.2.3 Restoration and Rehabilitation Opportunities

Rehabilitation opportunities exist for 8 culverts identified as barriers (Sites: 27, 34, 69, 75, 89, 99, and 153 where 2 culverts were identified) and 3 culverts identified as obstructions (Sites: 12, 29, and 16) to fish passage. Relocation of these culverts could result in restored fish passage to upstream reaches.

Additional fisheries information was gathered in the Barriere River watershed in 1998, in conjunction with Watershed Restoration Program work on Birk and Haggard Creeks and helicopter overflights of the watershed, as well as, fish salvages in conjunction with public road maintenance (ARC Environmental Ltd. 1998 and ARC Environmental Ltd. and North Thompson Indian Band 1999a, and 1999b). The following projects have provided additional information that adds to the fish and fish habitat data collected for the FFHIP;

i) Birk and Haggard Creeks Watershed Restoration Projects

ARC Environmental Ltd. was retained by Tolko Industries Ltd. to conduct the second phase of a two-phase habitat restoration project on Birk Creek, below the North Barriere Lake Mainline. In conjunction with the enhancement of fish habitat, ARC Environmental Ltd. conducted baseline fish sampling along the 1.3 km study area in order to better understand and compare fish species assemblages and habitat use both before and after the

completion of the restoration project. This 1.3 km section flows over an alluvial fan with gradients ranging from 1 – 4 %. Cobble is the dominant substrate and Large Woody Debris (LWD) and boulder substrate provide cover. Several gravel bars and numerous LWD jams are present. Many of these LWD jams have redirected stream flows and contributed to overbank flooding, eroding stream banks and sediment deposition. The lower portion of the study area, near the confluence with the Barriere River, has minimal flows and at some points becomes subterranean. Some areas of fair spawning gravel were noted. This stream section provided some rearing habitat for coho and chinook, as well as, complex habitat associated with LWD that could be used by rainbow trout and/or bull trout. Sampling was conducted at three sites in 1998 and 1999. In 1998, amongst the three sites, 1 rainbow trout, 19 coho, 11 chinook and 2 bull trout were captured in minnow traps, and 22 chinook, 4 bull trout and 1 torrent sculpin were captured by electrofishing. In 1999, 4 rainbow trout and 2 chinook were captured in minnow traps, and 8 rainbow trout were captured by electrofishing. Instream work to date has focused on channel works and strategic placement of materials to expedite down-cutting of the channel to native bed materials. Additional habitat improvements will be constructed after several freshets take place and the channel stabilizes.

In conjunction with the replacement of a culvert crossing with a bridge on Haggard Creek, ARC Environmental Ltd. conducted baseline fish sampling within Reaches 1 and 3 of the creek in order to better understand and compare fish species assemblages and habitat use both before and after the removal of the culverts. Additionally, Integrated Woods Services Ltd. has completed an assessment of Haggard Creek in the vicinity of the bridge site in order to produce a traverse map and cross section profiles for this study area. Rearing values within Reach 3 of Haggard Creek are considered to be high quality, with abundant cover in the mainstem provided by overstream vegetation and undercut banks and additional pool habitat available in the sidechannel habitat created by beaver activity. Reach 1 of Haggard Creek provides some rearing habitat along the banks in the form of overstream vegetation. Spawning habitat is limiting within the section of stream surveyed, with only small pockets of suitable gravel present. Historical Department of Fisheries and

Oceans records indicate the presence of coho in Haggard Creek. One of the goals associated with the culvert replacement is to increase upstream accessibility for coho. Previous sampling conducted in Reach 1 revealed low species diversity, with rainbow trout being the only fish captured (Grinton 1994). However, the sampling conducted in 1998 for this project identified rainbow trout, chinook, and torrent sculpins (*Cottus rhotheus*) in Reach 1 and rainbow trout in Reach 3. The sampling conducted in 1999 in Reach 1, which occurred after the culvert replacement, identified rainbow trout, chinook, and torrent sculpins, as well as, coho and longnose dace. In 1999 in Reach 3, only rainbow trout were captured.

ii) Leonie Creek Fish Salvage

ARC Environmental Ltd. was contracted by Argo Road Maintenance Ltd. to conduct a fish salvage on Reach 1 of Leonie Creek. At the time of the salvage the creek was dry, with the exception of a 2 m^2 pool at the downstream opening of a perched culvert crossing on East Barriere Lake Road and a small area approximately 50 m downstream of the culvert. Argo planned to raise the channel bed of Leonie Creek so that the culvert would no longer perched, in an attempt to improve fish migration through the culvert crossing. As construction activity would likely impact these wetted areas, it was necessary to remove any fish present before instream work began. On September 29, 1998, ARC Environmental Ltd. placed minnow traps within the pool area and allowed them to fish overnight. On September 30, 1998, the minnow traps were pulled and any remaining fish within the pool and the wetted portion at 50 m downstream were captured using a backpack electrofisher. Captured fish were moved downstream of the site to the mainstem Barriere River. A total of 109 chinook, 21 coho, 58 rainbow trout and 100+ longnose dace were captured within the wetted areas. Chinook and coho captured were estimated as young-of-the-year or 1+ and rainbow trout as 1+, 2+, or 3+. Longnose dace captured were estimated to be young-of-the-year. Water temperature was 11.5 °C.

iii) Barriere River Helicopter Over-Flight and Field Survey

A helicopter over-flight of the Barriere River watershed was completed on October 27, 1998, as part of activities conducted under the Watershed Restoration Program (WRP) (ARC Environmental Ltd. and North Thompson Indian Band 1998). The overflight was Phase 2 of a two-phase initiative for restoration work within the watershed in 1998. The objective of Phase 2 was to identify any other impacted areas within the Barriere River and its tributaries that could be candidates for restoration activities.

The overflight focused on the mainstem Barriere River, as well as, Dixon, Harper, Vermelin, Fennell, Birk and Haggard Creeks and the East Barriere River.

Additional field visits to Dixon, Haggard, and Harper Creeks, as well as, the Barriere River were completed on November 2, 1998 to verify potential impacts and restoration opportunities identified during the overflight.

Barriere River

The Barriere River below North Barriere Lake can be characterized as meandering riffle/glide habitat with lateral pools along cutbanks and along the outside of stream bends. It is generally low gradient (< 1%) with abundant spawning and rearing habitat for salmonids. Much of this section of the river is within private land and influenced by agricultural and urban developments. Impacts include direct physical habitat alterations, as well as, water quality and quantity concerns. Specifically, areas within Reach 2 (TRIM map 82M.021) were identified that were associated with the removal of riparian vegetation, and with bank slumping, bedload movement and/or water diversion. Potentially, stream restoration could be undertaken within this area, but due to its association on private lands restoration activities are limited.

Above North Barriere Lake, in Reach 6 of the Barriere River, there are portions of the riparian zone that have been removed along the right bank during past forestry activity. The field visit verified that there is a lack of LWD contribution to the right side of the river when compared to the left side of the same reach where no logging activity appears to have occurred. Potentially, habitat values could be increased with the addition of LWD structures in this section.

Additionally, potential groundwater sources were identified within Reach 1 (TRIM map 92P.020), near the confluence with the North Thompson River, in Reach 3 (TRIM map 82M.021), upstream of the East Barriere River confluence and in Reach 4 (TRIM map 82M.031), downstream of Birk Creek. The groundwater site in Reach 1 was located on private lands, behind a gate with a '*No Trespassing*' sign. Gaining access to this site will require identification of the proprietor and permission for access. The groundwater site in Reach 4 was assessed from the air. The groundwater site on Reach 3 was verified in the field, and off-channel fish habitat works have been started.

Dixon Creek

Dixon Creek was difficult to observe during the helicopter overflight. Those areas visible appeared unimpacted. Integrated Woods Services (IWS) has surveyed the lower section of Dixon Creek as part of their ongoing Channel Assessment Procedure (CAP) within the Barriere River watershed and report minimal impacts and restoration opportunities. The field survey conducted on November 2, 1998 confirmed that habitat quality within the lower section of Dixon Creek was good, although the potential exists for increasing the depths of pool habitat and for creating additional step/pool sequences. There are potential water quality concerns from agricultural activities upstream (conductivity was 420 µS).

Harper Creek

Habitat quality within Harper Creek was good. Above the confluence of Harper Creek with North Barriere Lake there is some excess woody debris, which appears to have mobilized from upstream, creating large jams and channel braiding. Ground surveys revealed that there may be some fish passage concerns in this area during low flows. The jams provide excellent rearing habitat, and rainbow trout and bull trout were observed during the survey. Some stream clearance may improve fish passage while retaining rearing habitat values. Stable channel elements such as natural lateral jams are present and, overall, the creek appears to be in good shape. Good habitat values exist in Harper Creek, including both rock and LWD based features. Features in this stream could be used as templates for use in restoration projects of similar morphological character.

Vermelin Creek

Vermelin Creek appears to be in excellent shape. Within Reach 1, there is good rearing habitat for coho below the culvert crossing and for rainbow trout and bull trout above the culvert crossing. The creek flows through a mature forest where there are lots of snags (cedar) for LWD recruitment. Stable channel elements and the presence of instream habitat structures suggest that this is a good "template" stream on which to base restoration activities within watersheds with similar characteristics. No restoration activity is recommended.

Fennell Creek

Fennell Creek has minimal impacts. There is some loss of riparian within Reach 1 where a cutblock occurs along the right bank, however, there is adequate regeneration of coniferous vegetation. Spawning and rearing habitat for salmonids such as sockeye and coho is good. No restoration activity is recommended.

Birk Creek

Since the completion of the 1998 restoration activity within Birk Creek, water is flowing and the channel is beginning to downcut. Instream structures placed for fish habitat and to aid in channel forming processes appear , in general, to be stable and functioning at this time.

Haggard Creek

The removal of the culvert crossing within Reach 1 of Haggard Creek has been completed. The culvert has been replaced with a bridge to improve fish passage into the upper reaches. Monitoring occured in 1999.

A section of Reach 1 was identified during the overflight as having a loss of riparian vegetation due to the activities on a private wood lot, and in Reach 4, a wooden bridge crossing appears to be a possible sediment source where a portion of the roadside has sloughed. Two large beaverdams on the outlet of the South Barriere Lake appear to restrict fish passage from Haggard Creek into the lake at low flows.

Ground surveys confirmed that the beaverdams are restricting fish passage at low flows, and that the bank sloughing near the bridge crossing within Reach 4 of Haggard Creek might have been a potential sediment source. The bridge appeared to be undersized, and in 1999 was removed and replaced with a 3.3m culvert partially buried. The culvert has improved fish passage at the site.

The culvert crossing at kilometer 6.3 of Haggard Creek was also assessed during the ground survey. The culvert is perched (drop approximately 0.30 m at the time of the site visit), but the deep pool at the culvert outlet and water velocity through the culvert appears to be acceptable for upstream passage of adult fish.

An additional deactivated bridge crossing was identified at kilometer 9.3 of Haggard Creek. Some bridge structures were still within the stream channel, and there was a lack of riparian vegetation and stream complexity at this site.

Generally, there appears to be a lack of Large Woody Debris within the stream channel of Reach 4 of Haggard Creek. It appears that, as a result of past forest harvesting, the majority of the riparian zone within Haggard Creek has not reached a stage of succession where trees are dying and contributing LWD to the stream channel. This type of stream section, which has significant regeneration, is often not noted in fish habitat surveys, however, it could benefit from stream restoration activities.

East Barriere River

Reach 3 of the East Barriere River meanders through a low gradient meadow area. There are traces of old beaver activity and a high frequency of LWD. This section is a possible template for low energy stream reaches with similar characteristics. Restoration activities are not recommended for this river.

Generally, the Barriere River watershed appears to be in good condition. The mainstem river and all the major tributaries have been surveyed during the aerial overflight and ground surveys. In addition to the specific sites identified above for Dixon, Harper and Haggard Creeks and the Barriere River mainstem, the potential for additional restoration opportunities does exist in other areas of agriculture and urbanization in the lower reaches of the Barriere River. Due to their association with private lands, restoration activities are not prescribed. Potential areas for aditional surveys would be Reach 4 of Haggard Creek and the groundwater source identified in Reach 3 of the Barriere River.

A Channel Assessment Procedure (CAP) has been completed for the Barriere River watershed by Integrated Woods Services of Kamloops, B.C. This project involved a preliminary field assessment on potentially degraded areas.

4.5 Fish Bearing Status

Within the Barriere River watershed study area, reaches were described as having a confirmed, suspected, or no fish presence. This information, combined with measurements of channel width and gradient, provided the opportunity to propose a riparian class for each reach surveyed. Riparian classifications are based on fish sampling and channel and gradient measurements, in conjunction with biological judgement of the likelihood that fish are utilizing the reaches surveyed.

Of the 167 sample sites surveyed in the Barriere River watershed, 31 were designated fish bearing or suspected fish bearing (8-S2's, 17-S3's, and 6-S4's), 101 were designated non-fish bearing (21-S5's and 80-S6's) and 34 had no visible channel (NVC). In addition, there was one non-fish bearing reach (Site: 71) in Leonie Creek, a Community Watershed, which was classified as S4.

4.5.1 Fish Bearing Reaches

Thirty-one surveyed reaches were designated fish bearing (S2 to S4) in the Barriere River watershed (Table 9). All fish bearing reaches provided suitable habitat for rearing, with gradients ranging from 1% to 14%, adequate cover primarily comprised of cutbank and woody debris, and substrates of mainly cobbles and gravels (particle size generally between 2 and 256 mm). Of the 31 fish bearing reaches, fish were captured at 23 reaches, where; rainbow trout were captured in 22 reaches (Sites 12, 27, 28, 29, 32, 39, 45, 68, 73, 74, 75, 77, 86, 89, 90, 99, 124, 143, 148, 153, 156, and 157), bull trout were captured in 2 reaches (Sites 148 and 155), coho were captured in one reach (Site 27) and prickly sculpins were captured in one reach (Site: 148).

Table 9. Summary of data from surveyed fish-bearing reaches in the Barriere River Watershed, 1998/1999 and 1999/2000.

Site No.	ILP Map No.	ILP No.	Reach No.	Survey Date	Species	Average Channel Width (m)	Average Gradient (%)	Water Temp. (°C)	Proposed Stream Class	Comment
5	82M.021	21	7	1998/08/07	(RB)	5.55	2	9	S2	Suspected seasonal use. Reach provides good potential for juvenile salmonid rearing. Excellent coho habitat with LWD, DP and undercut bank cover.
6	82M.021	21	9	1998/08/07	(RB)	2.05	2	12	S3	Suspected seasonal use.
12	82M.021	97	1	1998/07/31	RB	3.98	8	10	S3	Confirmed fish bearing.
27	82M.022	39	1	1998/07/31	RB, CO	1.32	10	14	S4	Confirmed fish bearing.
28	82M.022	46	1	1998/07/29	RB	4.08	6	19	S3	Confirmed fish bearing.
29	82M.022	46	2	1998/07/29	RB	4.87	6	19	S3	Confirmed fish bearing.
32	82M.022	49	1	1998/08/11	RB	3.15	1	15	S3	Confirmed fish bearing.
34	82M.031	10	1	1998/07/31	(RB)	3.16	7	11	S3	Suspected seasonal use. Good rearing habitat during spring freshet. Good spawning habitat. Channel has good LWD, OV and boulder cover. Continuous with the Barriere River.
39	82M.031	46	2	1998/07/29	RB	10.20	14	13	S2	Confirmed fish bearing.
45	82M.033	1	1	1998/08/12	RB	2.42	5	11	S3	Confirmed fish bearing.
68	92P.020	5	2	1998/08/04	RB	5.85	1	24	S2	Confirmed fish bearing.
69	92P.030	5	1	1998/08/07	(RB)	2.47	12	-	S3	S3 due to location within Leonie Creek Community Watershed. Dewatered. Suspected seasonal fish use. Stream may be a spawning tributary for Leonie Creek.
71*	92P.030	5	4	1998/08/05	(RB)	0.90	4	15	S4	S4 due to location within Leonie Creek Community Watershed. Suspected non-fish bearing.
72	92P.030	23	2	1998/0806	(RB)	1.87	2	17	S3	Suspected seasonal use downstream of known fish-bearing lake
73	92P.030	28	1	1998/08/06	RB	4.48	8	14	S3	Confirmed fish bearing.
74	92P.030	28	2	1998/08/06	RB	5.97	9	14	S2	Confirmed fish bearing.
75	92P.030	29	1	1998/08/05	RB	7.53	3	15	S2	Confirmed fish bearing.
77	82M.011	2	1	1999/09/27	RB	1.65	5	11	S3	Confirmed fish bearing.
86	82M.011	14	1	1999/09/10	RB	1.24	12	7	S4	Confirmed fish bearing.
89	82M.011	20	1	1999/09/07	RB	0.80	13	8	S4	Confirmed fish bearing.
90	82M.011	21	1	1999/09/07	RB	0.96	5	10	S4	Confirmed fish bearing.
99	82M.021	1	1	1999/09/07	RB	3.53	7	9	S3	Confirmed fish bearing.
114	82M.021	22	9	1999/10/09	(RB)	1.34	1	9	S4	Suspected fish bearing
124	82M.021	36	1	1999/10/04	RB	2.21	4	9	S3	Confirmed fish bearing.
135	82M.021	81	1	1999/10/01	(RB)	5.18	7	11	S2	Suspected fish bearing
143	82M.022	4	1	1999/10/08	RB	1.35	12	9	S4	Confirmed fish bearing.
148	92P.020	1	7	1999/10/14	RB, BT, CRH	13.65	3	8	S2	Confirmed fish bearing.
153	82M.021	56	1	1999/10/05	RB	3.92	5	7	S3	Confirmed fish bearing.
155	82M.031	94	1	1999/09/10	BT	3.75	11	5	S3	Confirmed fish bearing.
156	92P.020	6	2	1999/10/07	RB	5.77	6	7	S2	Confirmed fish bearing.
157	92P.020	6	3	1999/10/06	RB	4.77	3	6	S3	Confirmed fish bearing.
160	92P.020	53	1	1999/10/06	(RB)	2.01	3	-	S3	Suspected seasonal use.

71*= is non-fish bearing but presented in this table because of the S4 community watershed classification

RB = rainbow trout
BT = bull trout
CO = coho
CRH = prickly sculpin
( ) = fish use suspected
NA = not applicable

Stream Class	Fish Bearing	Channel width
S2		>5 to 20 m
S3		1.5 $\leq$ 5 m
S4		<1.5 m

Eight reaches were suspected to have seasonal rainbow trout presence (Sites: 5, 6, 34, 69, 72, 114, 135 and 160). In addition, one site (Site: 71), although non-fish bearing was designated S4 due to its location in the Leonie Creek Community Watershed.

4.5.2 Non-Fish Bearing Reaches

One hundred and one surveyed reaches in the Barriere River watershed were designated as non- fish bearing (Table 10) and an additional 34 were designated as NVC. Of the 101 non-fish bearing reaches, 21 were classified as S5 and 80 were classified as S6. In addition to the 101 reaches, one was classified as S4 (Site: 71) because it was located in the Leonie Creek Community Watershed.

Of the 101 reaches, 78 were sampled for fish and fish absence was confirmed, and 23 sites were not sampled due to reaches being either dewatered (3 sites) or intermittent (20 sites). These 23 reaches were still designated non-fish bearing because of confirmed fish absence downstream, and/or known or suspected gradient barriers within them or downstream of them.

4.5.3 Follow-up Sampling

Within the Barriere River watershed, 167 sites were surveyed in the 1998/1999 and 1999/2000 field seasons, representing the completion of the project. However, through discussion with P. Holman (FES, MoELP) and D. Tesch (Fisheries Specialist, MoELP) on June 5, 2000, two additional reaches were identified as potential candidates for additional sampling to confirm the presence/absence of fish and possible barriers; Reach 5 of the East Barriere River and Reach 11 of the Barriere River.

Table 10. Summary of data from surveyed non-fish bearing reaches of the Barriere River Watershed, 1998/1999 and 1999/2000.

Site No.	ILP No.	ILP Map No.	Reach No.	Channel Condition	Avg. Channel Width (m)	Avg. Gradient (%)	Electrofishing Specifications				Other Methods			Proposed Riparian Class	Follow up Sampling y/n	Comments
							Dist. (m)	Time (s)	Cond. (uS)	Temp. (C)	Type	Effort SN	Effort MT			
1	7	82M.012	3		2.45	27	300	200	200	9	MT	-	3, overnight	S6	n	No fish captured or observed. Poor to no rearing or spawning habitat.
2	6	82M.021	1		2.60	13	700	537	110	13	MT	-	1, overnight	S6	n	No fish captured or observed. Fish may not be able to access because of high gradient section near confluence with Chapman Creek.
3	6	82M.021	2	DW	1.42	5	-	-	-	-	NA	-	NA	S6	n	Dewatered.
4	8	82M.021	2		1.12	10	324	427	50	14	no water depth for MT	-		S6	n	No fish captured or observed. Fair to moderate fish habitat.
7	22	82M.021	10		3.68	18	300	200	180	14	MT	-	1, overnight	S5	n	No fish captured or observed. Poor spawning and rearing habitat. High gradient cascades within reach
8	34	82M.021	2		9.77	6	700	1218	-	15	MT	-	4, overnight	S5	n	No fish captured or observed. Rearing habitat is excellent with abundant pools and LWD.
9	49	82M.021	2	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
10	53	82M.031	2	INT	1.81	5	-	-	-	-	-	-	-	S6	n	Intermittent.
11	81	82M.021	2		4.72	5	700	470	40	11	SN	100 m		S5	n	No fish captured or observed. Good rearing habitat.
13	97	82M.021	2		3.97	30	100	170	90	17	MT	-	3, overnight	S5	n	No fish captured or observed. Poor spawning and rearing habitat.
14	97	82M.021	3		3.70	38	-	-	-	-	-	-	-	S5	n	No fish captured or observed. Impassible gradient in Reach
15	3	82M.022	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
16	4	82M.022	1	INT	1.26	22	700	1607	270	15	MT	-	1, overnight	S6	n	Intermittent. No fish captured or observed. Poor spawning and rearing habitat
17	10	82M.022	1	INT	1.40	12	700	374	-	11	MT	-	3, overnight	S6	n	Intermittent. Electrofished above and below 55% gradien
18	10	82M.022	2	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
19	10	82M.022	3	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
20	18	82M.022	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
21	20	82M.022	2		4.38	13	700	939	-	15	MT	-	3, overnight	S5	n	No fish captured or observed. Excellent rearing habitat qualit
22	23	82M.022	1		1.12	13	700	455	-	20	MT	-	3, overnight	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
23	27	82M.022	1		2.13	3	700	388	-	17	MT	-	3, overnight	S6	n	No fish captured or observed. Good rearing habitat.
24	28	82M.022	1		1.58	9	540	420	-	20	MT	-	3, overnight	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
25	29	82M.022	1		1.05	23	183	92	-	10	MT	-	3, overnight	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
26	33	82M.022	1		0.93	5	195	260	-	12	er depth for MT	-	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
30	46	82M.022	5		2.00	17	300	448	30	17	er depth for MT	-	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
31	46	82M.022	7		3.20	3	200	82	20	-	er depth for MT	-	-	S5	n	No fish captured or observed. Poor spawning and rearing habitat.
33	52	82M.022	2		1.36	22	100	83	30	12.5	er depth for MT	-	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
35	10	82M.031	2		4.02	31	121	278	90	18	MT	-	3, overnight	S5	n	No fish captured or observed. Poor spawning and rearing habitat.
36	10	82M.031	3	INT	0.71	13	105	156	60	12	er depth for MT	-	-	S6	n	Intermittent. No fish captured or observed. Poor spawning and rearing habitat. > 30% gradient downstream in Reach 2.
37	20	82M.031	2	INT	0.71	13	-	-	-	-	-	-	-	S6	n	Intermittent. No fish captured or observed. Poor spawning and rearing habitat
38	24	82M.031	1	INT	0.88	10	-	-	-	-	-	-	-	S6	n	Intermittent. No fish captured or observed. Poor spawning and rearing habitat
40	4	82M.032	3		6.92	12	312	615	30	18	SN	100 m	-	S5	n	No fish captured or observed. Reach has two falls not passable by fish.
41	4	82M.032	6		1.47	10	550	305	0	10	SN	100 m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
42	93	82M.032	8		2.47	5	375	407		23	SN	100 m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.

Table 10. Continued.

Site No.	ILP No.	ILP Map No.	Reach No.	Channel Condition	Avg. Channel Width (m)	Avg. Gradient (%)	Electrofishing Specifications				Other Methods			Proposed Riparian Class	Follow up Sampling y/n	Comments
							Dist. (m)	Time (s)	Cond. (uS)	Temp. (C)	Type	Effort SN	Effort MT			
43	123	82M.032	2		6.90	17	700	1725	126	14	SN	100 m	-	S5	n	No fish captured or observed. Gradients to 22%, 2.5m cascades, as well as, log jams present.
44	128	82M.032	2	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
46	5	82M.033	5		3.27	2	700	506	160	14	SN	100 m		S6	n	No fish captured or observed. Poor spawning and rearing habitat.
47	7	82M.033	1		0.59	5	300	92	10	7	MT	-	1, overnight	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
48	8	82M.033	1		0.62	1	200	48	10	16	er depth for MT	-		S6	n	No fish captured or observed. Poor spawning and rearing habitat.
49	14	82M.033	1		2.77	6	500	303	10	11	MT	-	2, overnight	S6	n	No fish captured or observed. Moderate to fair rearing habitat. No spawning habitat.
50	15	82M.033	1	INT	0.62	1	-	-	-	-	-	-	-	S6	n	Intermittent. No fish captured or observed. Poor spawning and rearing habitat
51	38	82M.033	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
52	41	82M.033	4		1.11	3	-	-	-	-	-	-	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat. High gradient cascades within reach. No water depth for sampling
53	45	82M.033	1		1.08	2	300	235	10	16	SN	100 m	-	S6	n	No rearing habitat - no fish habita
54	51	82M.033	1		1.68	2	400	555	10	14	MT	-	2, overnight	S6	n	No fish captured or observed. Moderate to fair rearing habitat
55	56	82M.033	1		0.64	2	200	100	10	12	MT	-	1, overnight	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
56	91	82M.033	1	DW	0.92	2	-	-	-	-	-	-	-	S6	n	Dewatered. No fish captured or observed. Poor spawning and rearing habitat
57	93	82M.033	1	DW	2.53	19	-	-	-	-	-	-	-	S6	n	Dewatered. No fish captured or observed. Poor spawning and rearing habitat
58	48	82M.041	3		4.23	1	300	379	10	11	SN	100 m	-	S5	n	No fish captured or observed. Good rearing habitat (deep pools and undercut banks).
59	59	82M.041	1		2.37	13	210	343	10	14	MT	-	3, overnight	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
60	60	82M.041	2		3.40	7	700	555	10	10	SN	100 m	-	S6	n	No fish captured or observed. Excellent reaing habitat. Impassible gradient in downstream reach
61	62	82M.041	5		1.57	2	450	500	10	14	SN	100 m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
62	67	82M.041	3		4.86	3	700	654	50	12	SN	100 m	-	S5	n	No fish captured or observed. Good rearing habitat (deep pools and boulder cover). Moderate spawning habitat.
63	68	82M.041	2		4.30	22	700	924	10	13	SN	100 m	-	S5	n	No fish captured or observed. Fair to moderate rearing habitat
64	82	82M.041	4		4.56	10	610	610	20	10	MT	-	3, overnight	S5	n	No fish captured or observed. Fair to moderate rearing habitat. High gradient cascades within reach
65	90	82M.041	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
66	184	82M.042	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
67	17	82M.043	4		2.13	1	200	98	10	26	SN	100 m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
70	5	92P.030	3	NVC	-	-	-	-	-	-	-	-	-	S4	n	S4 due to location within Leonie Creek Community Watershed. No defineable main channel present. Several small, dry, braided channels throughout surveyed section. Suspected non-fish bearing.
71*	5	92P.030	4		0.90	4	700	481	120	15	MT	-	3, overnight	S4	n	S4 due to location within Leonie Creek Community Watershed. Suspected non-fish bearing.
76	71	92P.030	3		2.20	12	700	298	50	12	SN	100 m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
78	2	82M.011	2		2.34	13	700	351	160	8	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
79	2	82M.011	3	INT	0.95	10	-	-	-	-	-	-	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
80	3	82M.011	1		0.73	8	390	120	260	9	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.

Table 10. Continued.

Site No.	ILP No.	ILP Map No.	Reach No.	Channel Condition	Avg. Channel Width (m)	Avg. Gradient (%)	Electrofishing Specifications				Other Methods			Proposed Riparian Class	Follow up Sampling y/n	Comments
							Dist. (m)	Time (s)	Cond. (uS)	Temp. (C)	Type	Effort SN	Effort MT			
81	4	82M.011	1	INT	0.68	2	310	218	320	6	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
82	6	82M.011	1	INT	2.41	8	450	306	220	9	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
83	6	82M.011	2		1.53	12	700	370	180	8	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
84	11	82M.011	1	INT	1.22	12	750	290	280	8	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
85	12	82M.011	1	INT	1.20	3	280	185	190	9	SN	100m		S6	n	No fish captured or observed. Poor spawning and rearing habitat.
87	15	82M.011	1	INT	0.84	31	-	-	-	-	-	-	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
88	18	82M.011	1	INT	0.80	3	310	168	250	10	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
91	25	82M.011	1	INT	0.66	8	313	249	170	7	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
92	28	82M.011	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
93	28	82M.011	2	INT	1.24	8	433	752	310	15	SN	100m		S6	n	No fish captured or observed. Poor spawning and rearing habitat.
94	29	82M.011	1	INT	0.84	22	-	-	-	-	-	-	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
95	32	82M.011	1	INT	0.33	3	30	205	410	1	SN	100m		S6	n	No fish captured or observed. Poor spawning and rearing habitat.
96	1	82M.012	1	INT	1.49	1	-	-	-	-	-	-	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
97	5	82M.012	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
98	6	82M.021	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
100	5	82M.021	5	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
101	1	82M.021	2		3.22	25	700	586	110	6	SN	100m		S5	n	No fish captured or observed. Poor spawning and rearing habitat.
102	1	82M.021	3	INT	2.29	15	-	-	-	-	-	-	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
103	10	82M.021	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
104	12	82M.021	1	INT	0.65	7	-	-	-	-	-	-	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
105	12	82M.021	1	INT	0.32	9	-	-	-	-	-	-	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
106	14	82M.021	1		1.19	12	362	1029	360	8	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
107	14	82M.021	2	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
108	27	82M.021	1	INT	1.04	12	10	99	290	5	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
109	17	82M.021	1	INT	2.32	14	700	789	310	8	MT	-	3, overnight	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
110	17	82M.021	2	INT	2.23	22	700	966	250	7	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
111	18	82M.021	1		1.25	21	700	721	350	8	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
112	19	82M.021	1	INT	0.97	6	81	245	250	9	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
113	20	82M.021	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
115	23	82M.021	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.

Table 10. Continued.

Site No.	ILP No.	ILP Map No.	Reach No.	Channel Condition	Avg. Channel Width (m)	Avg. Gradient (%)	Electrofishing Specifications				Other Methods			Proposed Riparian Class	Follow up Sampling y/n	Comments
							Dist. (m)	Time (s)	Cond. (uS)	Temp. (C)	Type	Effort SN	Effort MT			
116	24	82M.021	1	INT	1.09	19	-	-	-	-	-	-	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
117	25	82M.021	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
118	26	82M.021	1	INT	2.21	50	-	-	-	-	-	-	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
119	26	82M.021	2	INT	1.59	12	700	1133	260	7	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
120	27	82M.021	2	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
121	30	82M.021	1	INT	4.04	28	300	680	430	8	MT, SN	100m	3, overnight	S5	n	No fish captured or observed. Poor spawning and rearing habitat.
122	30	82M.021	2	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
123	30	82M.021	4	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
125	36	82M.021	2		1.24	17	700	824	150	7	MT, SN	100m	3, overnight	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
126	36	82M.021	4	NVC	-	10	10	103	240	8	SN	100m		NA	n	No visible channel.
127	39	82M.021	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
128	43	82M.021	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
129	52	82M.021	2	NVC	2.43	12	700	481	240	9	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
130	61	82M.021	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
131	63	82M.021	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
132	66	82M.021	1	INT	0.97	22	93	164	270	8	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
133	71	82M.021	1		0.84	19	75	110	270	9	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
134	72	82M.021	1	INT	1.09	42	-	-	-	-	-	-	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
136	86	82M.021	1	INT	2.84	37	200	588	100	7	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
137	90	82M.021	1		1.71	16	443	810	60	5	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
138	91	82M.021	1		5.76	38	250	313	60	9	SN	100m	-	S5	n	No fish captured or observed. Poor spawning and rearing habitat.
139	92	82M.021	1	INT	2.13	52	-	-	-	-	-	-	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
140	94	82M.021	1	INT	1.86	15	-	-	-	-	-	-	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
141	96	82M.021	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
142	67	92P.030	3		1.65	27	700	1116	370	8	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
144	15	82M.031	3		3.24	2	700	891	20	4	SN	100m	-	S5	n	No fish captured or observed. Poor spawning and rearing habitat.
145	46	82M.031	3		3.02	3	700	1202	0	8	SN	100m	-	S5	n	No fish captured or observed. Poor spawning and rearing habitat.
146	6	82M.032	1	INT	0.95	7	535	461	10	4	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
147	10	82M.032	1	INT	1.31	1	-	-	-	-	-	-	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
149	41	82M.032	1	INT	0.56	10	-	-	-	-	-	-	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
150	44	82M.032	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
151	93	82M.032	3		2.78	10	500	373	10	5	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.

Table 10. Continued.

Site No.	ILP No.	ILP Map No.	Reach No.	Channel Condition	Avg. Channel Width (m)	Avg. Gradient (%)	Electrofishing Specifications				Other Methods			Proposed Riparian Class	Follow up Sampling y/n	Comments
							Dist. (m)	Time (s)	Cond. (uS)	Temp. (C)	Type	Effort SN	Effort MT			
152	123	82M.032	3		1.58	1	700	694	10	4	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
154	74	82M.041	3	INT	-	-	-	-	-	-	-	-	-	NA	n	Inaccessible by helicopter
158	13	92P.020	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
159	14	92P.020	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
161	58	92P.020	1	INT	0.80	11	-	-	-	-	-	-	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
162	13	92P.040	1	INT	2.16	3	700	383	30	3	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
163	16	92P.040	1	INT	1.41	3	700	410	20	3	SN	100m	-	S6	n	No fish captured or observed. Poor spawning and rearing habitat.
164	23	92P.040	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.
165	74	82M.041	2		6.52	11	700	549	20	4	SN	100m	-	S5	n	No fish captured or observed. Poor spawning and rearing habitat.
166	82	82M.041	3		5.76	16	700	2292	60	4	SN	100m	-	S5	n	No fish captured or observed. Poor spawning and rearing habitat.
167	49	82M.021	1	NVC	-	-	-	-	-	-	-	-	-	NA	n	No visible channel.

71*= is a S4 classification due to its location within Leonie Creek community watershed

SN = pole seine
EF = electrofishing
MT = minnow trap

Stream Class	Non Fish Bearing	Channel width
	S5	>3 m
	S6	≤3 m

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