

**FISHERIES ASSESSMENT OF  
PROPOSED RIP RAP SITES FROM KM 17  
TO KM 25 MORICE RIVER 1998**

prepared by

**DAVID BUSTARD AND ASSOCIATES LTD.**

for

**BC MINISTRY OF FORESTS**

**Morice District**

May 1998

# TABLE OF CONTENTS

	<u>Page</u>
<b>1.0 INTRODUCTION.....</b>	<b>1</b>
<b>1.1 Proposed Rip Rap Sites.....</b>	<b>1</b>
<b>1.2 Fisheries Concerns.....</b>	<b>2</b>
<b>1.3 Study Objectives.....</b>	<b>2</b>
<b>2.0 METHODS.....</b>	<b>4</b>
<b>2.1 Steelhead Overwinter Surveys.....</b>	<b>4</b>
<b>2.2 Juvenile Fish Assessments.....</b>	<b>4</b>
<b>3.0 RESULTS.....</b>	<b>5</b>
<b>3.1 Adult Surveys.....</b>	<b>5</b>
<b>3.2 Juvenile Surveys.....</b>	<b>11</b>
<b>4.0 CONCLUSIONS AND RECOMMENDATIONS.....</b>	<b>13</b>
<b>4.1 Conclusions.....</b>	<b>13</b>
<b>4.2 Recommendations.....</b>	<b>14</b>
<b>5.0 LITERATURE CITED.....</b>	<b>15</b>
<b>APPENDIX 1</b>	

## 1.0 INTRODUCTION

David Bustard and Associates Ltd. was retained by the Ministry of Forests (Morice District) to undertake fisheries assessment work on the Morice River from Km 17 to Km 25 (Morice Forest Service Road). Slope failures along this section have led to a number of proposed remedial works, including rip rap placement at sites identified by Ministry of Environment, Lands and Parks (MOELP) and the Department of Fisheries and Oceans (DFO) staff as sensitive to fish utilizing the mainstem Morice River.

The Morice River is a major salmon and steelhead producer of provincial significance. Whately et al. (1978) provide the best background information describing the steelhead fishery in the Morice River. A detailed description of all fish species utilizing the Morice River is presented in Envirocon Ltd. (1984).

### 1.1 Proposed Rip Rap Sites

Background information describing the proposed slope stabilization works and the history of remedial activities along this section of road are summarized in a report prepared by Geonorth Engineering Ltd. (1997). Based on this report, three main areas of works adjacent to the Morice River were identified:

- Km 25 - Riparian vegetation removal and rip rap placement along a 155 m length<sup>1</sup> of bank that would extend upstream from existing rip rap (Photo 1).
- Km 23 - Lengthen an existing rip rap placement along this section to protect the base of a 30-m long slide on the Morice River (Photo 2).
- Km 17.5 - Complete a rip rap blanket at the toe of a slide along the river at this location<sup>2</sup>.

---

<sup>1</sup> This length is based on site measurements in March 1998.

<sup>2</sup> This proposal has been withdrawn based on comments by Geonorth Engineering Ltd. during a field examination of this site on April 24, 1998. Slope movement rates have increased and other measures to stabilize the situation are considered higher priority.

## 1.2 Fisheries Concerns

A meeting with MOELP and DFO in Smithers<sup>3</sup> identified the following concerns related to proposed works along the Morice River:

- The location at Km 25 is considered to be an important adult steelhead overwintering site. Concern for altered hydraulic conditions that might change the suitability of this site for overwintering steelhead due to the placement of rip rap into the river channel was identified.
- The need for information describing the utilization of rip rap by juvenile fish was identified as important in evaluating the overall impacts of rip rap placements along the Morice River mainstem.
- Concern for loss of riparian areas and the impacts of this on aesthetics and recreation use along the Morice River was expressed by fisheries management agencies.
- Concerns that present shoreline irregularities creating fish habitat diversity will be replaced by a straight rip rap facing were identified.
- An overall plan that addresses all of the proposed rip rap placements and shows the existing rip rap locations along this section of the Morice River was requested.

## 1.3 Study Objectives

- To delineate the extent of adult steelhead overwintering in the Morice River from Km 17 to Km 25, and to evaluate the proposed rip rap projects relative to the specific holding areas.
- To conduct juvenile fish sampling at existing rip rap sites and compare these to results from sampling at sites of proposed rip rap placement.
- To make specific design recommendations for rip rap placements that take into account sizing, placement, and riparian vegetation concerns.

---

<sup>3</sup> Meeting with Andy Witt (MOELP) and Pierre Lemieux (DFO), February 4, 1998.



**Photo 1. Proposed rip rap site at Km 25 of the Morice River. The conifer riparian zone on the river's right side is located on the section where rip rap is to be placed.**



**Photo 2. This small rotational failure is located at Km 23 of the Morice River. Rip rap is proposed for approximately 60 m along this section. The adjacent channel is dry during the low flow March period.**

## METHODS

### 2.1 Steelhead Overwinter Surveys

Snorkel surveys were conducted from Owen Canyon to Km 17 (Aspen Campground) on March 7 and 17<sup>th</sup> (Figures 1a and 1b). The first survey was in the 2.5 km section from the canyon to Km 23. The second survey extended from Km 23 to Km 17.

Two swimmers in dry suits conducted the surveys on warm sunny days to ensure good light conditions. Total numbers and locations of all fish observations were recorded on slates and marked on an air photo mosaic.

Specific overwintering areas identified by MOELP staff based on steelhead tagging surveys (Lough 1995) were compared to the snorkel observations. These surveys were part of a population estimate conducted in the winter of 1993/94.

### 2.2 Juvenile Fish Assessments

The juvenile fish assessments used electrofishing and minnow trapping as sample methods. The electrofishing assessments were conducted at three locations along the edge of existing rip rap (Photo 3) and three locations along the section of proposed rip rap placement (Photo 4). Catch results for these sites were combined for comparisons. All juvenile assessments were conducted in the vicinity of Km 25, as this is the main area of proposed works<sup>4</sup>. The juvenile assessments were conducted between March 25 and April 15, 1998 and were representative of juvenile winter habitat utilization.

Electrofishing was conducted within sites enclosed using rebar and stopnets. Two-pass removal was used at each of the sites. All fish captured were counted, sorted by species, measured to the closest mm fork length, and subsequently returned to the location of capture. Site characteristics including area sampled and habitat descriptions (DFO/MOE Stream Survey Forms) were measured for each of the sites. Two-pass removal estimates for density calculations were derived using methods outlined in Seber and LeCren (1967).

Fifteen baited (roe) minnow traps were placed overnight along slow deep sections of rip rap and along the mainstem channel at the proposed rip rap site at Km 25.

---

<sup>4</sup> The immediate shoreline in the vicinity of the proposed rip rap placement at Km 23 was dry during the spring assessments (Photo 2).

### 3.0 RESULTS

#### 3.1 Adult Surveys

Viewing conditions for the adult surveys in early March were excellent. The entire section was ice-free throughout March. Visibility in the river upstream from Houston Tommy Creek was at least 7 m. Downstream from Houston Tommy Creek, visibility was approximately 2 m on March 17<sup>th</sup>. Water temperatures were less than 3° C during the surveys. Swimmers could see to the bottom of nearly all pools (the exception was the deep pool at Owen Canyon).

A total of 213 steelhead was observed in this 8 km section of the Morice River (Table 1). Of this total, 58 (27%) were located in the run at Km 25 immediately adjacent to the proposed project area. An additional 10 sites accounted for the balance of the observations in this portion of the Morice River (see Figures 1a and 1b for specific locations).

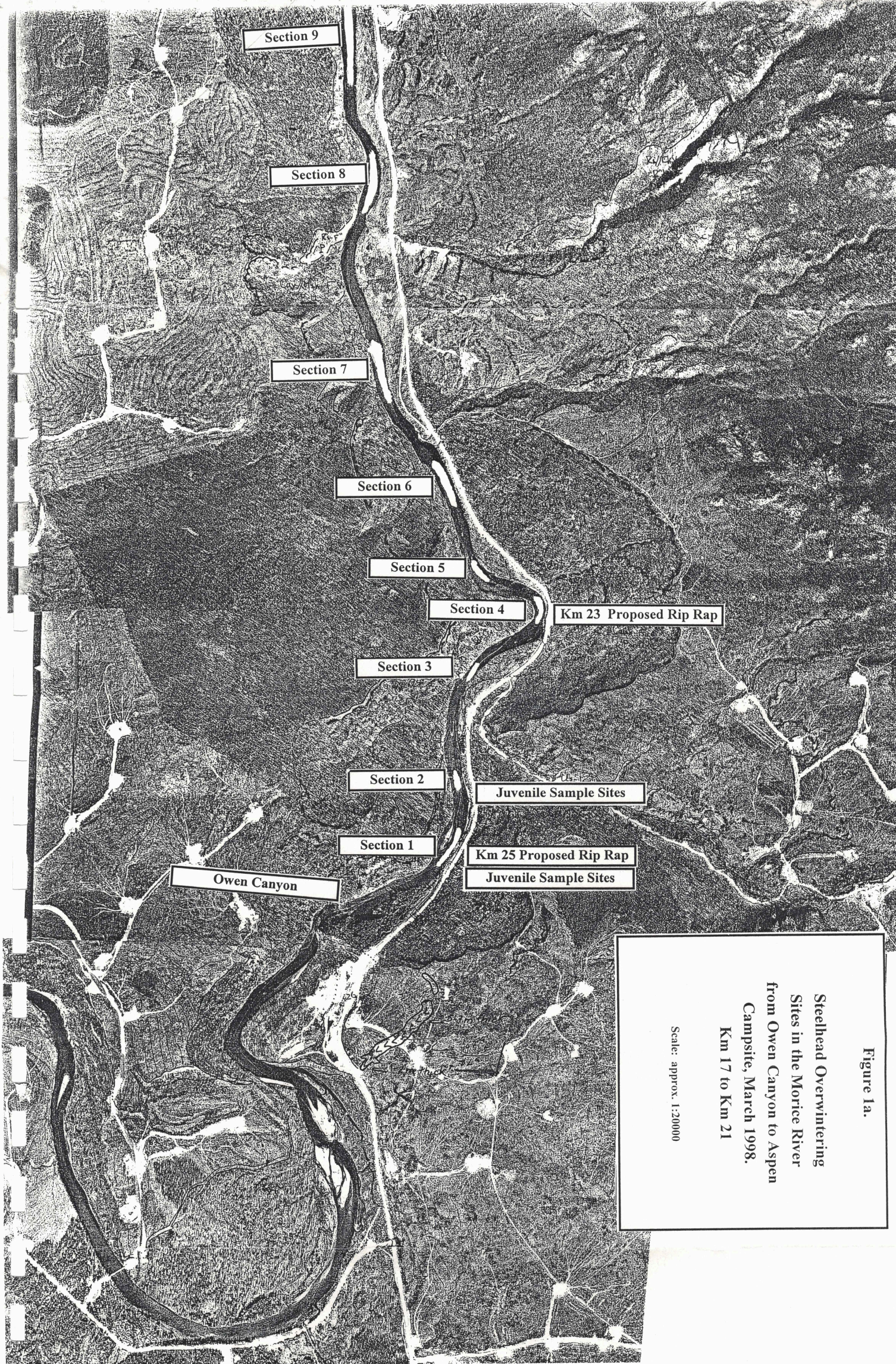
This total does not represent all of the steelhead present in this section of the river. Although two swimmers were effective at covering much of the holding water, we suspect some steelhead moved around the swimmers without being observed.

As well, 22 adult bull trout and 21 mountain whitefish were observed in this section of the Morice. Most bull trout were holding in Section 7. These fish were typically holding with groups of steelhead.

Table 2 compares the results of spring (late March 1994) angling surveys to recapture marked fish in this section of the Morice (Lough 1995) to the snorkel observations conducted in 1998. The angling surveys also identified the Km 25 run in Section 1 as an important site, based on the numbers of fish captured at this site (30% of total) compared to the other runs in this 8 km section of the river.

Data provided in the MOELP tagging surveys gives us some perspective on the relative importance of the study section compared to other reaches of the Morice River in terms of overwintering fish. Based on the 1994 studies, just over 500 steelhead were estimated in this section, comprising 18% of the total estimated steelhead population between Aspen Campground and Morice Lake (Table 3). Conditions were unsuitable for recaptures in the river section downstream from Aspen during the 1994 studies, although significant numbers of steelhead were holding in this section in the fall.

It should be noted that the marks were undertaken during the fall, and the recaptures were done in the spring. Some steelhead movements between sections occur during this time period as outlined in Lough (1994). Similar winter movements were recorded for Morice steelhead following radio telemetry studies in 1979 (Envirocon Ltd. 1984).



**Figure 1a.**  
Steelhead Overwintering  
Sites in the Morice River  
from Owen Canyon to Aspen  
Campsite, March 1998.  
Km 17 to Km 21  
Scale: approx. 1:20000



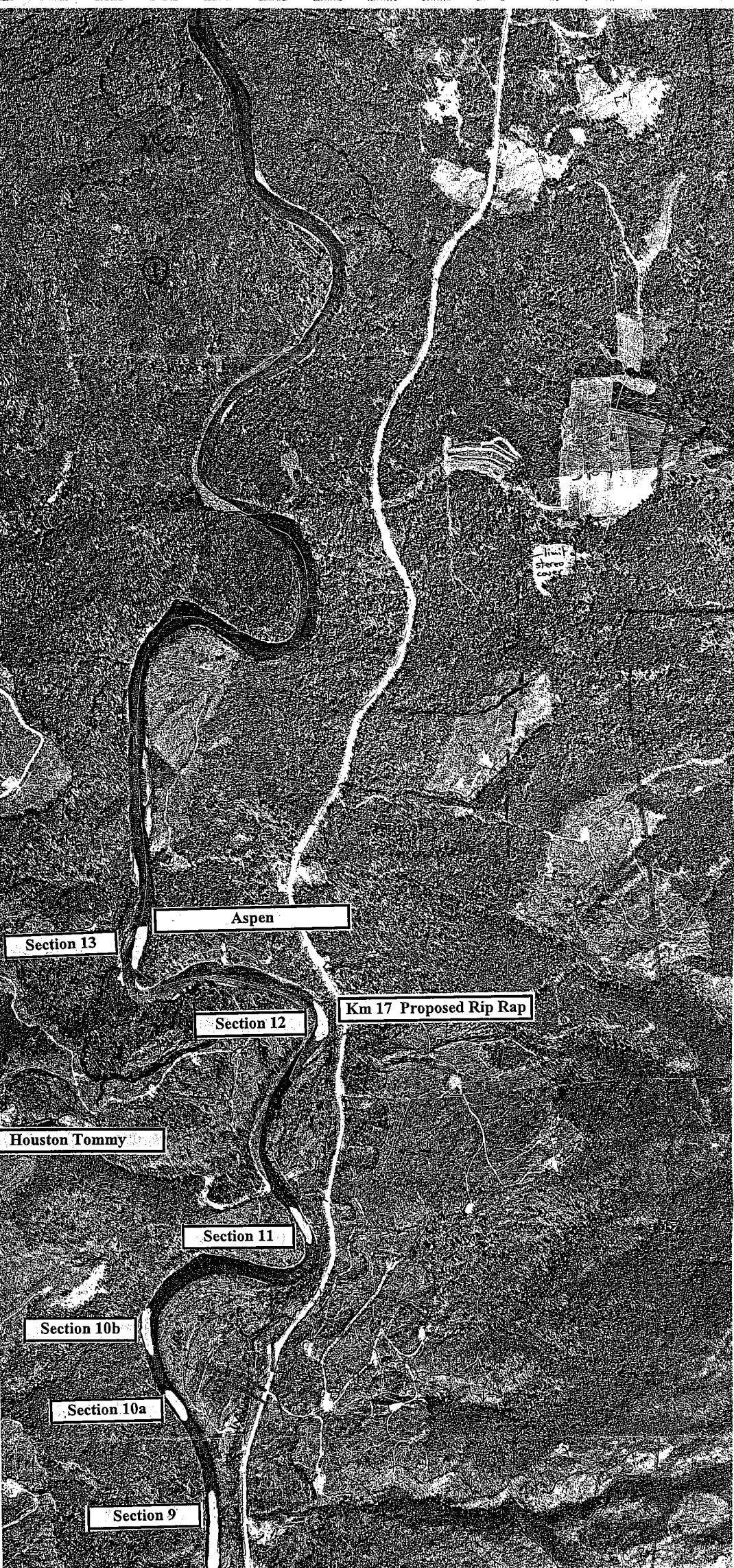


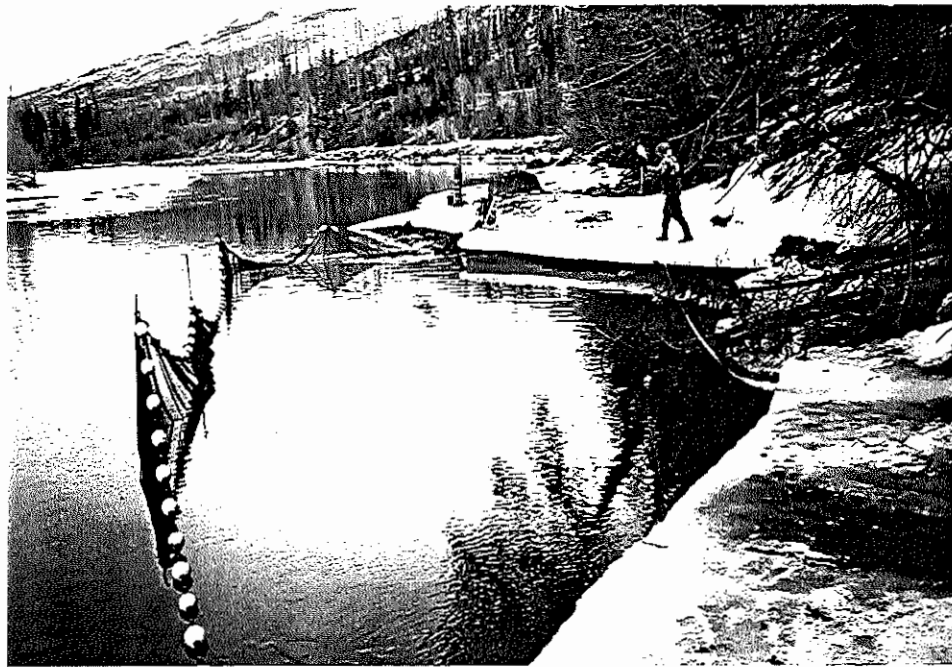
Figure 1b.

Steelhead Overwintering  
Sites in the Morice River  
from Owen Canyon to Aspen  
Campsite, March 1998.  
Km 21 to Km 25

Scale: approx. 1:20000



**Photo 3. Enclosed electrofishing site along existing rip rap section at Km 25 of the Morice River.**



**Photo 4. Enclosed margin site along Km 25 section of Morice River proposed for rip rap placement.**

**Table 1. Snorkel survey results for Morice River from Km 25 (Owen Canyon) downstream to Km 17 (Aspen Campground) during early March 1998.**

SECTION	STEELHEAD	BULL TROUT	OTHER	COMMENT
1 - Km 25	58	0		Proposed rip-rap section. Overhanging tree to along island.
2 - Km 24.8	9	1		
3 - Km 23.8	7	1		
4 - Km 23.5 corner	5	3		
5 - Km 23	4	0		
6 - Km 22.7	24	1		Section A
7 - Km 22 to 22.5	38	14		Section B
8 - Km 21	14	0		Section D - rock bluff
9 - Km 20 to 20.7	26		1 MW	Top of E
	9	1		Bottom of E
10 - Km 19.8	10		20 MW	Top of F
	1			Outer corner
11 - Km 18.8	8	1		Section G u/s from Houston Tommy
12 - Km 17 to Km 18.6	0	0		Visibility reduced to 1-2 m d/s from Houston Tommy.
<b>TOTAL</b>	<b>213</b>	<b>22</b>	<b>21</b>	

**Table 2. Comparison of MOELP angling summary (1994) versus snorkel observations (1998) for Morice River Km 17 to Km 25.**

Section	Number Angled <sup>5</sup>	%	Snorkel Observations	%
1 - Km 25 - d/s Owen Canyon	21	30.4	58	27.2
2 - Km 24.8	0	0.0	9	4.2
3 - Km 23.8	0	0.0	7	3.3
4 - Km 23.5 - corner	1	1.4	5	2.3
5 - Km 23	7	10.1	4	1.9
6 - Km 22.7	0	0.0	24	11.3
7 - Km 22.5 - Flat run	8	11.6	38	17.8
8 - Km 21 - Horseshoe	5	7.2	14	6.6
9 - Km 20 - Garbage Can	10	14.5	35	16.4
10 - Km 19.8	0	0.0	11	5.2
11 - Km 18.8	7	10.1	8	3.8
12 - Km 17.5	5	7.2	0	0.0
13 - Km 17.0 - Aspen	5	7.2	0	0.0
<b>Total</b>	<b>69</b>	<b>100</b>	<b>213</b>	<b>100</b>

<sup>5</sup> March 18-22, 1994.

**Table 3. Population estimates by section for Morice River steelhead in 1993/94.**

Section	Fall	Spring	Recaptures	Estimate <sup>6</sup>	%
Morice Lake to bridge	4	61	4	61	2.2
Bridge to Lamprey Ck	81	89	11	614	22.0
Lamprey Ck to Owen Canyon	69	91	3	1609	57.5
Owen Canyon to Aspen	43	69	5	512	18.3
Aspen to Three Mile	58	0	0	na	na
				2796	100

The data indicates that the 8 km section of river from Aspen Campground to Owen Canyon provides important overwintering habitat for steelhead adults, and that the specific run located at Km 25 is the most heavily utilized site in this section.

Detailed habitat measurements could not be conducted during the snorkel surveys. However observations indicated a tendency for steelhead to be holding towards the tail end of runs, often in areas 1 to 2 m deep over cobble and boulder bed material. Holding locations were characterized by moderate stream velocities up to approximately 1 m/s. We suspect that the combination of streamflow (velocity and laminar flow), depth and bed material are all important in determining whether or not a site is suitable.

Riparian cover was variable over the range of sites that steelhead were observed in the 8 km section of the Morice, including some sites with rip rap and an immature alder edge.

### 3.2 Juvenile Surveys

Estimates of juvenile fish based on electrofishing surveys at existing rip rap and proposed sites for rip rap placement are shown in Table 4. The data represents a combination of catch results for three sites at each location. The detailed results for each site are presented in Appendix 1.

<sup>6</sup> Based on modified Peterson mark-recapture by section.

Table 4. Comparison of juvenile fish abundance and habitat characteristics in rip rap and proposed rip rap sections on the Morice River, March and April 1998.

		N/100 m <sup>2</sup> m	N/100 m	Mean Run Depth (cm)	Surface Velocity (cm/s)	Bed Material (cm)	
						D90	D50
Rip Rap	Sthd	8.0	24.1	67	45	97	28
	Chin	0	0				
	Chin	0.5	1.6				
	Pink	1.1	3.2				
	Cottid	2.8	8.5				
Non Rip Rap	Sthd	2.1	8.9	62	6	53	20
	Chin	0.8	3.4				
	Chin	9.6	41.0				
	Pink	2.1	8.9				
	Cottid	2.1	8.9				

The results indicate that steelhead parr were the predominant fish species utilizing the existing rip rap sites at Km 25. Estimates of 24 steelhead parr/100 m of rip rap edge or 8 fish/100m<sup>2</sup> of habitat sampled were obtained during the surveys. The density estimates indicate that the rip rap sites were providing good habitat for steelhead parr when compared to estimates (typically less than 5 parr/100m<sup>2</sup>) derived from past sampling in the Morice mainstem (Bustard 1992).

Observation during sampling indicated that the steelhead parr were wintering right in the rip rap and not in the larger river cobbles off the edge of the rip rap placements. These steelhead parr ranged in size from 51 to 143 mm fork length and are assumed to be a mix of age 1+ to age 3+ fish.

Sampling along the edge of the non rip rap sites (predominantly low velocity cobble sites) indicated that chinook juveniles were most abundant, with a small number of steelhead parr and newly-emerged chinook and pink fry also present (Table 4). Chinook estimates were 41 chinook juveniles/100m of stream margin or 10 chinook/100m<sup>2</sup> of habitat. These densities of chinook juveniles were comparable to a mean of 8 chinook/100m<sup>2</sup> estimated for all mainstem Morice River sites sampled during a fall program conducted in 1991 (Bustard 1992). These chinook normally leave the Morice River system as smolts within 1-2 months of the April sampling.

The habitat utilized by juvenile chinook at the non rip rap sites was very similar to the undisturbed section of the rip rap site in terms of depth and bed material (Table 4). However, water velocities were nearly ten times higher at the rip rap sites, and we suspect this accounted for the difference in chinook utilization between the two sites. Chinook overwinter in the coarse bed material at sites with low overhead water velocity.

## **4.0 CONCLUSIONS AND RECOMMENDATIONS**

### **4.1 Conclusions**

The studies during March and April 1998 confirm that the 8 km section of Morice River from Owen Canyon to the Aspen Campground provides important overwintering habitat for steelhead adults. The specific run located right at the site of proposed bank protection at Km 25 is the most heavily utilized site in this section of river.

A combination of water velocity and flow characteristics, depth and bed material are thought to be important characteristics of steelhead overwintering sites in this section of the Morice. Riparian edge characteristics were highly variable at 10 other holding locations.

Steelhead parr dominated the use of the rip rap edge located just downstream from the study area during the late March and April sampling. Chinook juveniles were present in

the loose cobbles along the outside edge of the Km 25 site proposed to be rip rapped. The proposed rip rap project should not affect this habitat. Replacement of the clay bed material with rip rap along sections within the high-water section should improve potential rearing at higher flow conditions.

Aesthetics and recreation are important considerations on the mainstem Morice River. The Km 25 site is characterized by a short section of mature conifer forest along the edge (Photo 1). Much of the forested edge of the river has been lost in this section of the Morice River. The removal of the riparian edge at Km 25 will result in a decline in the aesthetic/recreation features along this section of river until a well-developed riparian edge can be re-established.

## **4.2 Recommendations**

### **Km 25 Morice River**

Based on the above observations and discussions with agency personnel we recommend that the following be incorporated into the design of rip rap placements at Km 25:

- Rip rap placement at this site should not extend beyond the existing high water mark at this site to ensure that hydraulic conditions are not altered. Precise requirements of overwintering steelhead are not known, but the site is presently receiving very high use. Site design objectives should be to avoid any risk to the flow characteristics at this site from construction of the rip rap berm that would narrow the existing channel during high-flow conditions.
- It is acceptable to pull back exposed clay areas within the high water zone when this area is dewatered during the low flow period, and replace with rip rap. Sediment control measures (site enclosure) are needed if this is to be undertaken. The work should be conducted during the lowest flow period in the Morice (February to mid-April).
- The rip rap placement should follow the existing bank configuration at this location to maintain the present flow characteristics.
- While it is recognized that most of the riparian vegetation will be lost during the rip rap placement, efforts should be made to retain whatever is possible while still undertaking construction of an adequate rock placement. The design of the rip rap should incorporate sites that will be suitable for the establishment of riparian vegetation as soon as the construction is complete. This may include special planting structures built into the rip rap berm and replacing soil on the berm to allow the rapid re-growth of trees. Efforts to save some of the smaller vegetation presently at this site to re-establish at the end of the project should be considered in the design.



- The construction contractor undertaking the above works must clearly understand the objectives and special considerations at this site at the time the contract is tendered so any extra costing requirements can be built into the estimate.

### **Km 23 Morice River**

The fisheries protection measures at the proposed rip rap site at Km 23 should be directed at creating juvenile fish habitat to replace edge habitat lost at this location. Given these objectives the following is recommended:

- Do not encroach beyond the high water edge at this location. Material can be pulled back and replaced with rip rap, but do not move out into the channel area with the face of the rip rap berm, as this location probably provides good chinook and steelhead rearing habitat at moderate flow conditions.
- Use large rip rap that creates an edge that mimics the existing irregular margin. Placement of some large rocks scattered out from the berm edge is recommended to break up the water velocities in this section, making the site more suitable for juvenile rearing, particularly during high flow conditions.
- Planting sites should be built into the design of the rip rap berms and vegetation should be re-established at these location at the end of construction. A mix of native conifers and fast-growing deciduous species is recommended.
- Construction at this site should also be timed for the late winter low-flow period. The channel adjacent the construction site was dry during the late winter of 1998.

## **5.0 LITERATURE CITED**

- Bustard, D. 1992. Juvenile steelhead surveys in the Kitwanga, Morice, Sustut and Zymoetz rivers 1991. Man. report prepared for Ministry of Environment, Smithers.
- Envirocon Ltd. 1984. Fish resources of the Morice River system: baseline information. *In: Environmental Studies Associated with the Proposed Kemano Completion Hydroelectric Development.*
- Geonorth Engineering Ltd. 1997. Geotechnical report. Slides at Km 17 to 26, Morice River Forest Service Road. Prepared for BC Ministry of Forests, Smithers.

- Lough, J. 1995 (draft report). Estimating the population of adult steelhead in the Morice River using mark-recapture methods, 1993/94. Skeena Fisheries Section, Smithers.
- Seber, G.A.F. and E.D. LeCren. 1967. Estimating population parameters from catches large relative to the population. *J. Anim. Ecol.* 36.: 631-643.
- Whately, W.R. , W.E. Chydyk, and M. Morris. 1978. Morice River steelhead trout: The 1976 and 1977 sport fishery and life history characteristics from angler catches. Fisheries Technical Circular No. 36. B.C. Environment, Skeena Fisheries Report SK- #14.

**APPENDIX 1: Juvenile Fish Sample Results and Habitat Descriptions**

MORICE RIVER ELECTROFISHING SITE 1998

SITE:	RR1	REACH:		DATE:	Mar 26/98	PHOTO:	A4/4-6
SITE LOCATION: Rip rap edge - uppermost site, ~100 m below top of rip rap section.							
ACCESS:		V2					
MARGIN = 1 FULL = 2							
S = SIDE / M = MAIN:		M		SLOPE (%):		<1	
EFFORT: (sec)		PASS 1		PASS 2		PASS 3	
		650		658			
TEMP (C):		3.0					
TIME:		11:40					
COND.(uS):		30.0					
SAMPLING COMMENTS:		Site was enclosed with rebar and stopnets.					

POPULATION ESTIMATES:

SPECIES	AGE	FL RANGE	FL MEAN	MEAN WT (g)	PASS			EST. NUMB	95% C.I.		N/M*M	N/100M	BIO-MASS (g/m*m)
					1	2	3		LCI	UCI			
Sthd	0+												
Sthd	=>1+	88-143	110.8	nm	4	0	na	4.0	4	4	0.052	17.5	
Chinook	0+												
Chinook	=>1+												
Pink	0+	34-37	35.5	nm	1	1	na	2.0	2	na	0.026	8.8	
Cottid	=>1+	68-105	86.3	nm	3	1	na	4.5	4	8	0.059	19.7	
TOTAL								11			0.138	46.1	

DIST (m)	WET WIDTH (m)	CHAN WIDTH (m)	SITE COVER (%)	SITE WATER TYPE (%)	DEPTH (cm)
0	3.1	nm			
5	3.9		100		
10	3.9			100	80
15	4.2				
20	3.5				
25	3.1				
30	1.7				
35			95		
40					
AREA	76.2	MARGIN (M)	22.8		

HABITAT COMMENTS: 2 lamprey ammocoetes were observed.  
 The pink fry were not yet buttoned up. Sculpins were present in the cobbles.  
 SST were present in the rip rap, were dark in color, and inactive.  
 Surface velocity: 0.349 m/s.

MORICE RIVER ELECTROFISHING SITE 1998

SITE:	RR2	REACH:		DATE:	Mar 26/98	PHOTO:	A4/7, 8
SITE LOCATION: Rip rap margin site, 15 m d/s from Site RR1.							
		ACCESS:	V2	EFFORT: (sec)		PASS 1	525
						PASS 2	512
						PASS 3	
MARGIN = 1	FULL=2			TEMP (C):		3.0	
S = SIDE / M = MAIN:	M	SLOPE (%):	<1	TIME:		12:30	
				COND.(uS):		30.0	
SAMPLING COMMENTS:		Site was enclosed with rebar and stopnets.					

POPULATION ESTIMATES:

SPECIES	AGE	FL	FL	MEAN	PASS			EST.	95% C.I.		N/M*M	N/100M	BIO- MASS (g/m*m)
		RANGE	MEAN	WT (g)	1	2	3	NUMB	LCI	UCI			
Sthd	0+												
Sthd	=>1+	77-168	122.0	nm	5	1	na	6.3	6	8	0.101	29.5	
Chinook	0+												
Chinook	=>1+	76	76.0	nm	0	1	na	1.0	1	1	0.016	4.7	
Pink	0+												
Cottid	=>1+												
TOTAL								7			0.117	34.2	

DIST (m)	WET WIDTH (m)	CHAN WIDTH (m)		SITE COVER (%)		SITE WATER TYPE (%)	DEPTH (cm)
0	1.1	nm	LOD		POOL		
5	2.7		COBBLE	100	RIFFL		
10	3.6		IN VEG		RUN	100	51
15	3.7		OVER VEG		OTHER		
20	3.4		CUTBANK				
25	3.0		DEEP POOL				
30					D90	70	
35			TOTAL	95	D50	30	
40					(cm)		
AREA	61.8	2.9 nm MARGIN (M)	21.2				

HABITAT COMMENTS:	3 lamprey ammocoetes were observed. Photo A4 # 9: rainbow juvenile. Surface velocity: 0.349 m/s.
-------------------	--------------------------------------------------------------------------------------------------------

MORICE RIVER ELECTROFISHING SITE 1998

SITE:	RR3	REACH:		DATE:	Mar 26/98	PHOTO:	A4/9, 10
SITE LOCATION: Rip rap margin site, 50 m d/s from Site RR2.							
		ACCESS:	V2	EFFORT: (sec)		PASS 1 PASS 2 PASS 3	nm nm
MARGIN = 1 FULL=2				TEMP (C):		3.0	
S = SIDE / M = MAIN:		M	SLOPE (%):	<1	TIME:		15:00
				COND.(uS):		30.0	
SAMPLING COMMENTS:		Site was enclosed with rebar and stopnets.					

POPULATION ESTIMATES:

SPECIES	AGE	FL		MEAN WT (g)	PASS			EST. NUMB	95% C.I.		N/M*M	N/100M	BIO-MASS (g/m*m)
		RANGE	MEAN		1	2	3		LCI	UCI			
Sthd	0+												
Sthd	=>1+	51-113	83.0	nm	2	2	na	4.0	4	nm	0.079	21.4	
Chinook	0+												
Chinook	=>1+												
Pink	0+												
Cottid	=>1+	107	107.0	nm	1	0	na	1.0	1	1	0.020	5.3	
TOTAL								5			0.099	26.7	

DIST (m)	WET WIDTH (m)	CHAN WIDTH (m)	SITE COVER (%)	SITE WATER TYPE (%)	DEPTH (cm)
0	2.4	nm	5		
5	2.8		95		
10	3.3			100	71
15	3.0				
20	3.2				
25	1.5				
30					
35					
40					
AREA			2.7 nm		
50.5 MARGIN (M)			18.7		

HABITAT COMMENTS:	1 lamprey ammocoete was observed. Surface velocity: 0.566 m/s.
-------------------	-------------------------------------------------------------------

MORICE RIVER ELECTROFISHING SITE 1998

SITE:	N1	REACH:		DATE:	Mar 27/98	PHOTO:	A4/11, 12									
SITE LOCATION: Margin site in proposed rip rap section; along forested edge at Km 25.																
ACCESS:		V2														
MARGIN = 1 FULL=2		<table border="1"> <tr> <td>EFFORT:</td> <td>PASS 1</td> <td>785</td> </tr> <tr> <td>(sec)</td> <td>PASS 2</td> <td>589</td> </tr> <tr> <td></td> <td>PASS 3</td> <td></td> </tr> </table>						EFFORT:	PASS 1	785	(sec)	PASS 2	589		PASS 3	
EFFORT:	PASS 1	785														
(sec)	PASS 2	589														
	PASS 3															
S = SIDE / M = MAIN:	M	SLOPE (%):	<1	TEMP (C):	1.5											
				TIME:	9:00											
				COND.(uS):	40.0											
SAMPLING COMMENTS:		Site was enclosed with rebar and stopnets.														

POPULATION ESTIMATES:

SPECIES	AGE	FL RANGE	FL MEAN	MEAN WT (g)	PASS			EST. NUMB	95% C.I.		N/M*M	N/100M	BIO-MASS (g/m^2 m)
					1	2	3		LCI	UCI			
Sthd	0+												
Sthd	=>1+	39	39.0	nm	1	0	na	1.0	1	1	0.008	4.6	
Chinook	0+	38	38.0	nm	0	1	na	1.0	1	1	0.008	4.6	
Chinook	=>1+	50-68	61.6	nm	8	1	na	9.1	9	10	0.074	41.7	
Pink	0+	34-36	35.0	nm	1	1	na	2.0	2	nm	0.016	9.1	
Cottid	=>1+	65-128	95.3	nm	3	0	na	3.0	3	3	0.024	13.7	
TOTAL								16			0.131	73.7	

DIST (m)	WET WIDTH (m)	CHAN WIDTH (m)		SITE COVER (%)		SITE WATER TYPE (%)	DEPTH (cm)
0	4.8	nm	LOD	5	POOL		
5	6.5		COBBLE	95	RIFFLE		
10	7.0		IN VEG		RUN	100	64
15	5.7		OVER VEG		OTHER		
20	4.2		CUTBANK				
25			DEEP POOL				
30					D90	45	
35			TOTAL	70	D50	25	
40					(cm)		
AREA	5.6	nm	MARGIN (M)	21.9			

HABITAT COMMENTS: Chinook fry was not yet buttoned up.  
 Sampled a slow cobble/silt bay area.  
 No fish were caught in sandy areas; chinook were caught in the cobbles.  
 Surface velocity: 0.06 m/s.

MORICE RIVER ELECTROFISHING SITE 1998

SITE:	N2	REACH:		DATE:	Apr 15/98	PHOTO:	B/1, 2
SITE LOCATION: Margin site in proposed rip rap section, ~10 m u/s from Site N1.							
ACCESS:		V2					
MARGIN = 1 FULL=2							
S = SIDE / M = MAIN:		M		SLOPE (%):		<1	
TEMP (C):		4.0					
TIME:		11:45					
COND.(uS):		40.0					
SAMPLING COMMENTS:		Site was enclosed with rebar and stopnets.					

POPULATION ESTIMATES:

SPECIES	AGE	FL	FL	MEAN	PASS			EST.	95% C.I.		N/M*M	N/100M	BIO- MASS (g/m*m)
		RANGE	MEAN	WT	1	2	3	NUMB	LCI	UCI			
Sthd	0+												
Sthd	=>1+	85-102	90.8	nm	4	1	na	5.3	5	7	0.072	27.8	
Chinook	0+	38	38.0	nm	1	0	na	1.0	1	1	0.014	5.2	
Chinook	=>1+	57-78	69.7	nm	9	1	na	10.1	10	11	0.137	52.7	
Pink	0+	35	35.0	nm	1	0	na	1.0	1	1	0.014	5.2	
Cottid	=>1+	86, 88	87.0	nm	1	1	na	2.0	2	nm	0.027	10.4	
TOTAL								19			0.264	101.3	

DIST (m)	WET WIDTH (m)	CHAN WIDTH (m)	SITE COVER (%)	SITE WATER TYPE (%)	DEPTH (cm)
0	3.0	nm	LOD	POOL	
5	4.8		COBBLE	RIFFLE	
10	4.4		IN VEG	RUN	100 66
15	3.2		OVER VEG	OTHER	
20	3.8		CUTBANK		
25			DEEP POOL		
30				D90	50
35			TOTAL	D50	nm
40				(cm)	
AREA	3.8	nm	73.7	MARGIN (M)	19.2

HABITAT COMMENTS: Several lamprey ammocoetes were observed.  
 Sampled a very slow cobble/boulder section; shore drops off quickly so outside edge of site was quite deep.  
 Surface velocity: ~0.055 m/s.



MORICE RIVER ELECTROFISHING SITE 1998

SITE:	N3	REACH:		DATE:	Apr 15/98	PHOTO:	B/3, 4
SITE LOCATION: Margin site in proposed rip rap section, ~30 m u/s from Site N2.							
ACCESS:		V2		EFFORT: (sec)		PASS 1	640
				PASS 2			450
				PASS 3			
MARGIN = 1 FULL=2				TEMP (C):		4.0	
S = SIDE / M = MAIN:	M	SLOPE (%):		<1		TIME:	
						13:50	
						COND.(uS):	
						40.0	
SAMPLING COMMENTS:		Site was enclosed with rebar and stopnets.					

POPULATION ESTIMATES:

SPECIES	AGE	FL RANGE	FL MEAN	MEAN WT (g)	PASS			EST. NUMB	95% C.I.		N/M*M	N/100M	BIO-MASS (g/m*m)
					1	2	3		LCI	UCI			
Sthd	0+												
Sthd	=>1+												
Chinook	0+												
Chinook	=>1+	42-60	60.0	nm	3	1	na	4.5	4	8	0.079	24.2	
Pink	0+	31-32	31.5	nm	2	0	na	2.0	2	2	0.035	10.8	
Cottid	=>1+												
TOTAL								7			0.113	34.9	

DIST (m)	WET WIDTH (m)	CHAN WIDTH (m)		SITE COVER (%)		SITE WATER TYPE (%)	DEPTH (cm)
0	2.6	nm	LOD		POOL		
5	3.4		COBBLE	100	RIFFLE		
10	4.2		IN VEG		RUN	100	57
15	3.3		OVER VEG		OTHER		
20	1.9		CUTBANK				
25			DEEP POOL				
30					D90	65	
35			TOTAL	70	D50	15	
40					(cm)		
AREA	3.1	nm	MARGIN (M)	18.6			
	57.3						

HABITAT COMMENTS: Several lamprey ammocoetes were observed.  
 Fewer fish were caught at this site; may be due to a combination of shallower water and smaller bed material.  
 Surface velocity: ~0.055 m/s.







DFO / MOE  
STREAM SURVEY FORM

Stream Name		(gaz) Morice River - natural site		(local) Morice River - natural site		Access	Road	Method
Watershed Code		460-600600				ReachNo.	Length(km)	
Location		Margin site in proposed rip rap section; along forested edge at Km 25.			Map #	SiteNo.	N1	LthSurv(m) 21.9
Date Y.M.D		9	8	0	3	2	7	Time 900
Agency		C87	Crew	RD/CP	Photos	A4/11, 12	AirPhotos	
FishCard		Y	<input checked="" type="checkbox"/> N	<input checked="" type="checkbox"/> C	<input checked="" type="checkbox"/> Field	<input type="checkbox"/> Hist.		
PARAMETER		VALUE		METH		SPECIFIC DATA		OBSTRUCTIONS
Ave. Chan. Width (m)		n/a						<input type="checkbox"/> C Ht(m) Type Locn
Ave. Wet. Width (m)		5.6				4.8, 6.5, 7.0, 5.7, 4.2 (margin site width)		
Ave. Max. Riffle Depth (cm)		n/a						
Ave. Max. Run Depth (cm)		64				42, 67, 84, 62		
Gradient %		<1				BED MATERIAL		BANKS
% Pool		Riffle		Run		100		Other
Side Chan. %		0 <input checked="" type="checkbox"/> 0-10		10-40		>40		
Debris		Area %		0 <input type="checkbox"/> 0-5		5-15		>15
Stable %		0						
COVER: Total %		70						
Comp.		Dp. Pool		L.O.D.		Boulder		InVeg
sum 100%		5		95				OverVeg
Crown Closure %		<5		Aspect				Cutbank
Fines		clay, silt, sand (<2mm)		15				
Gravels		small (2-16mm)						
Larges		large (16-64mm)		5				
Bedrock		sm. cobble (64-128mm)		5				
D90(cm)		45		Compaction		L M F		
Height(m)		10		% Unstable		100		
Texture		F		G		L R		
Confinement		EN		CO		FC OC UC N/A		
Valley: Channel Ratio		2-5		5-10		10+ N/A		
Stage		Dry		L		M H Flood		
Flood Signs Ht(m)		2.5		Braided		Y		<input checked="" type="checkbox"/> N
Bars (%)		10		pH		O <sub>2</sub> (ppm)		
WaterTemp(C)		1.5		Turb(cm)		cl		Cond(25C) 40
DISCHARGE				/50 25				REACH SYMBOL
Parameter		Value		Method		Specific Data		(Fish)
Wetted Width (m)						10 m floating chip method:		
Mean Depth (m)						average = 150 sec.		
Mean Velocity (m/s)		0.06		F				
Discharge (m3/s)						Surface water velocity near zero.		(Width: Valley/Channel, Slope) BedMaterial

FISH SUMMARY							STREAM/VALLEY CROSS-SECTION	
C	Species	No.	Size Range(mm)	Life Phase	Use	Method/Ref	(Looking Downstream)	
Pass 1 - EFFORT: 785 sec.							PLANIMETRIC VIEW	
	CCG	3	65-128	J	R	EF	L	
	SST	1	39	F	R	EF	R	
	CH	8	50-68	J	R	EF		
	PK	1	34	F	R	EF		
Pass 2 - EFFORT: 589 sec.								
	PK	1	36	F	R	EF		
	CH	1	38	F	R	EF		
	CH	1	61	J	R	EF		
COMMENTS								
Channel Stability <input type="checkbox"/> Debris <input type="checkbox"/> Management Concerns <input type="checkbox"/> Obstructions <input type="checkbox"/> Riparian Zone <input type="checkbox"/> Valley Wall Processes <input type="checkbox"/> Etc.								
Sampled a slow cobble/silt bay area.								
No fish were caught in the sandy areas; all chinook were caught in the cobble sections of the site; see photo A4/14 looking u/s.								
The chinook fry caught was just out of the gravel - it was not yet buttoned up.								
15 traps were set overnight along slow, cobble natural margin areas of the proposed rip rap section; 2 slimy cottid sculpins with fork lengths of 103 mm and 111 mm were caught. Velocities were very low in these sections:								
						10 m floating chip method:		
						1) 235 sec.		
						2) 210 sec.		
						3) 102 sec. average = 182 sec.		
						surface velocity = 0.055 m/s		
							Edited by: CP	
							Date Y M D 98/04/21	



