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Fish Passage Culvert Inspection - City of Prince George

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February 2005



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EXECUTIVE SUMMARY

In the fall of 2004, EDI Environmental Dynamics Inc. (*Environmental Dynamics*) was retained by the City of Prince George to conduct Fish Passage-Culvert Inspection (FPCI) assessments on selected stream crossings within the city limits. Only those crossings that were located in confirmed or potential fish bearing areas were assessed. Sites within the Bittner Creek watershed, as well as McMillan Creek, Haggith Creek, Parkridge Creek and an unnamed stream on Indian Reserve Road were assessed between October 19 and October 27, 2004. The assessments were intended to identify stream crossings that were barriers to fish passage or had concerns that could impact fish and fish habitat (e.g., sediment sources).

A total of 18 crossings were assessed. Seven crossings were identified as full fish passage barriers and one was identified as a partial fish passage barrier. Of these 8 crossings identified as fish passage barriers, four were considered to likely only be seasonal barriers. During the spring freshet large rivers such as the Fraser and Nechako rivers back up into low-gradient tributaries, slowing water velocities in the tributary streams and eliminating sharp elevation drops, such as those found at culvert outlets. Thus, crossings that otherwise would be full barriers due to excessive outlet drops or high culvert water velocities can allow fish passage during these seasonal events. An additional 3 crossings were considered to need maintenance in various forms to minimize impacts on fish and fish habitat and 7 were recognized as having no issues.

A review of the FPCI assessment results indicate that fish have been alienated from up to 37 km of habitable stream length, due to barriers that were caused by stream crossing structures. In addition, the watershed upstream of the barrier crossings becomes disconnected from the downstream network resulting in a much larger area impacted by fish passage barriers. Non-embedded circular metal culverts were identified as the primary structure that created the barrier to fish passage. High water velocities, excessive outfall drops resulting from undersized culverts and installation of culverts at higher than recommended gradients were the most common conditions blocking fish passage.

Maintenance concerns identified during the assessments included road fill failure, damaged (crushed) culverts and old culverts discarded within the stream channels. The failure of road fills that were causing the deposition of sediment in streams was considered to be the highest maintenance priority. Introduction of fine sediment can result in an alteration of channel morphology and can decrease fish habitat quality, since the interstitial spaces between stream bed materials will often infill with fines.

The restoration of fish passage at stream crossings identified as barriers to fish movement, can provide fish populations with an immediate benefit by providing access to upstream spawning and/or rearing habitat. Addressing existing erosion and sediment concerns at the stream crossings would benefit fish by improving water quality and reducing the sedimentation and compaction of stream bed material.

General recommendations for the retrofit or replacement of existing structures causing a barrier to fish passage are included in this document. Site-specific engineering and environmental plans will have to be developed prior to implementing a fish passage restoration project.

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1.0 INTRODUCTION

In the fall of 2004, EDI Environmental Dynamics Inc. (*Environmental Dynamics*) was retained by the City of Prince George to conduct Fish Passage Culvert Inspection (FPCI) assessments at stream crossings located within the city limits as part of a multitask fisheries project. Numerous stream crossings within Prince George are located on tributary streams that flow into the Nechako and the Fraser rivers. Stream crossing structures that are fish passage barriers may exclude fish from accessing spawning and/or rearing habitat upstream of the structure. Identifying stream crossings that pose a barrier to fish passage and then restoring fish passage results in immediate benefits to the fisheries resource. The data generated from this assessment will assist resource managers and land-use planners in managing aquatic environments within the City of Prince George.

2.0 PROJECT SCOPE AND OBJECTIVES

The multiphase fisheries project contained four key tasks:

1. Fish and Fish Habitat Inventory
2. Fish Passage Culvert Inspections
3. Finalization of the City's Stream Classification Map
4. Recommendations for Specific Provisions to be incorporated into the Official Community Plan and other City Bylaws

This report provides the results for the fish passage culvert inspections. The FPCI assessments were intended to identify stream crossings that impede or block the passage of fish or have maintenance concerns. This report suggests a priority ranking with regards to the retrofit, replacement or maintenance needs for these crossing structures. Recommendations for individual problem crossings are provided. Specific design details may be developed by city engineers.

3.0 STUDY AREA

A previously mentioned, 18 crossings were surveyed with the Prince George city limits. The majority of crossings (11) assessed were located in the McMillan Creek watershed. Three site assessments were conducted in the Bittner Creek watershed. Two sites were located on Indian Reserve Road where two sets of culverts were assessed within twenty meters of each other. One site was located on Parkridge Creek and the final site was located on Haggith Creek at its crossing of the Willow-Cale Forest Service Road. Appendix I depicts the locations of individual sites.

4.0 METHODOLOGY

4.1 Planning

The Fish Passage Culvert Inspection (FPCI) assessments were conducted at culverted road crossings that were located within the city limits of Prince George, had no previous assessments and intersected known or suspected fish bearing streams. Existing information relevant to the defined study area was obtained from a number of sources including online government databases (Fisheries Information Summary System 2004), the *Review of Aquatic Resource Values Within The City of Prince George* (Environmental Dynamics 2004) and the Fish and Fish Habitat Inventory portion of this multiphase fisheries project. Fish presence and distribution data were combined with locations of potential barrier stream crossings to prioritize which crossings would be assessed.

McMillan Creek, the Bittner Creek watershed, Haggith Creek and Parkridge Creek were identified to have crossings posing potential fish barriers and lacked previous assessments. Two additional crossings located on direct tributaries to the Fraser River were assessed.

4.2 Field Assessments

The field assessments were conducted following the general procedures outlined within the Fish Passage - Culvert Inspection Procedures Technical Circular No. 11 (Parker 2000) with the exception of fish sampling 50 m upstream and downstream of the assessed crossings. Fish sampling during the FPCI assessments was not necessary since crossings were either located on known fish bearing streams or fish sampling was conducted during the Fish and Fish Habitat Inventory portion of this project. Since the Fish and Fish Habitat Inventory was conducted prior to the FPCI assessments fish presence and distribution information relevant to the assessed crossings was used to determine the restoration priority of individual crossings.

All stream and culvert characteristics are documented on Form A from the FPCI manual (Appendix II). All measurements were taken in accordance with the standards outlined in the technical circular. Culvert gradients were obtained using a surveyors level, and water velocities were measured using a buoyant floating velocity device. At least four digital photos were taken at each problem culvert. All biophysical measurements were taken outside the obvious hydraulic influence of the crossing structures.

4.2.1 Fish Passage Criteria

The assessments of fish passage conditions at individual crossings was based on the swimming ability and jumping ability of rainbow trout (*Oncorhynchus mykiss*) and chinook salmon (*O. tshawytscha*). These species were chosen as the target species due to the abundant information on their responses to stream crossings and their wide distribution within the city limits. The assessment of fish passage conditions at culverts was based on the following criteria.

Water Velocity

When natural substrates are maintained, the channel roughness at the substrate/streamflow interface creates varying water velocities and resting areas allowing for fish passage. On the contrary, water actually accelerates through non-embedded metal culverts. The significant reduction in hydraulic

complexity forces fish to maintain high energy burst swimming speeds to pass through the culvert. If discharges or culvert gradients are too high, the culvert will obstruct fish passage. The majority of crossing structures within this study were non-embedded metal culverts.

In regards to water velocity, culverts were considered barriers to fish passage if they were not embedded into the stream channel and the water velocity within the culvert exceeded the swimming capabilities of juvenile chinook salmon or juvenile rainbow trout. The rationale for using the values for juvenile fish is that a crossing should be passable to all life stages of fish. Parker (2000) suggests that water velocities exceeding 0.5 m/s are beyond the swimming capabilities of juvenile fish and water velocities exceeding 0.7 m/s should be considered a barrier to all fish passage.

The gradient of the culvert can contribute to excessive water velocity so this parameter was also calculated at each stream crossing. Parker (2000) recommends a non-embedded culvert greater than 24 m long should not have a gradient higher than 0.5%, and a culvert less than 24 m long should not have a gradient higher than 1.0%.

Culvert Outfall Height

The culvert outfall height was measured as the vertical distance from the bottom of the culvert outlet to the water surface directly below the outlet. This height must be within the jumping abilities of the target fish species to allow fish passage. These values are depicted in Table 1 from the *Fish Passage Culvert Inspection Procedures* (Parker 2000). However, this height must also consider the outfall pool depth since fish require a minimum pool depth to jump into the culvert.

A culvert was deemed a barrier to fish passage if the culvert outfall height exceeded the maximum jumping height of juvenile fish species **or** the pool depth was less than 1.25 times the culvert outfall height. The jumping heights in Table 1 are under ideal conditions and are quite optimistic (Parker 2000) so if an outfall height was slightly lower than these values it was considered a barrier.

Table 1: Jumping Abilities of the Target Fish Species

Species	Life Stage	Maximum Jump Height (m)	Minimum Pool Depth Required (m)
Chinook salmon	Fry (50 mm)	0.3	0.38
Chinook salmon	Juvenile (120 mm)	0.5	0.63
Chinook salmon	Adult	2.4	3.00
Rainbow trout	Fry (50mm)	0.3	0.38
Rainbow trout	Juvenile (120 mm)	0.6	0.75
Rainbow trout	Adult	1.5	1.88

Once a stream crossing was considered to be a fish passage barrier it was then further examined for its potential to allow fish passage during seasonal higher flows. Crossings that were located on direct tributaries and in close proximity to the Nechako or Fraser River were considered to likely experience backflooding during high flows. Therefore, some of these crossings that were rated as full barriers were constrained to *seasonal* full barriers.

4.3 Data Analysis

Data were compiled, assessed, and prioritized. Form A was entered into a proprietary Microsoft Access database developed by *Environmental Dynamics*. A brief discussion was presented for each stream crossing, and preliminary prescriptions were recommended. Office calculations were completed for all fully surveyed culverts, according to standards outlined in the technical circular (Parker 2000). The upper limit of potential fish distribution was determined during the Fish and Fish Habitat Inventory. Potential or known fish-bearing stream length above each culvert is illustrated on the project map by a red line.

Individual crossings considered fish passage barriers or having maintenance concerns were examined for installation concerns such as undersized culverts and excessive culvert gradients. These crossings were analyzed for their ability to convey a 100 year flood event (Q100).

Once individual crossings were identified as barriers they were assigned a score using the Fish Passage Culvert Inspection Scoring Matrix. Crossings that were assessed as having maintenance issues were ranked by priority using a high/moderate/low ranking system based on individual site characteristics. Sites that were chronic sediment sources (exposed road fill) were assigned the highest rank.

5.0 RESULTS

A total of 18 crossings were surveyed within the Prince George city limits from October 19 to October 27, 2004. Streams were generally at or near base flows, which allowed for the satisfactory assessment of habitat and fish passage limitations.

Table 2 presents a summary of site conditions at the 18 crossings assessed. Sites were numbered consecutively in an upstream direction when they were located on the same stream. If sites were located on separate streams, sites were numbered according to the order of completion. When more than one culvert existed at a crossing location, letters representing individual culverts were added to the site number.

Table 2: Fish Passage Culvert Inspection Site Summary

Site #	Rd Name	Stream Name	WSC	Channel Width (m)	CV Dia. (mm)	CV Length (m)	CV Outfall Drop (cm)	CV Gradient (%)
1A, 1B	Prince George Pulp Mill Road	McMillan Creek	180 - 007200	5.20	2 x 2000	33.80	37	5.0
2	Hoferkamp Road	McMillan Creek	180 - 007200	4.12	1800	39.65	14	1.6
3 A,B,C	Aberdeen Road	McMillan Creek	180 - 007200	4.70	3 x 1200	20.60	0	0.2
4 A,B	McMillan Ave	McMillan Creek	180 - 007200	3.01	2 x 1200	18.46	0	0.9
5	Northwood Pulpmill Road	McMillan Creek	180 - 007200	4.70	2000	28.20	0	0.2
6	Noranda Road East	McMillan Creek	180 - 007200	6.50	2500	30.00	0	0.5
7	Old Summit Lake Road	McMillan Creek	180 - 007200	1.58	1200	61.6	0	0.5
8	Old Summit Lake Road	McMillan Creek	180 - 007200	3.08	2 x 600	16.00	0	0.9
9	Old Summit Lake Road	McMillan Creek	180 - 007200	1.67	2 x 900	18.40	9	0.6
10	Goose Country Road	McMillan Creek	180 - 007200	2.20	Left 800, Right 600.	9.70	0	1.6
11	Old Summit Lake Road	McMillan Creek	180 - 007200	1.37	Left 900, Right 1200	17.00	7	0.9
12A, 12B	Indian Reserve Road	Unnamed Stream	100 – 583400 - 31000	3.06	2 x 1200	18.40	48	3.6
13 A,B	Indian Reserve Road	Unnamed Stream	100 – 583400 - 31000	3.40	2 x 900	19.25	0	3.2
14A, 14B	Domano Road	Parkridge Creek	100 - 562800	2.66	600 Left, 1200 Right	39.00	40	4.2
15	North Blackburn Road	Unnamed Stream	100 – 572700 - 52100	3.04	1200	17.00	0	1.1
16	Giscome Road	Bittner Creek	100 – 572700	5.42	Left 1000, Right 1200	20.50	0	0.2
17	Giscome Road	Unnamed Stream	100 – 572700 - 75500	2.02	600	35.50	0	1.0
18	Willow-Cale Road	Haggith Creek	100 - 560100	6.87	2000	60.00	125	NM

Out of the 18 crossings that were visited, 8 crossings were determined to be barriers to upstream fish passage. Seven crossings were considered full barriers and one was considered a partial barrier using the fish passage criteria described in section (3.2.1) of this document. An additional 4 sites were identified as having maintenance problems, such as damaged culverts or sediment sources. Of the 3 crossings that were considered to have maintenance problems, 2 were considered as a high priority and 1 was considered a moderate priority. Table 3 presents a summary of the results for stream crossings assessed.

Table 3: Summary of Results for Stream Crossings Assessed.

Site #	Rd Name	Stream Name	Barrier/No Barrier	Maintenance (No/Low/Mod/High)
1A, 1B	Prince George Pulp Mill Road	McMillan Creek	Full Seasonal Barrier	No
2	Hoferkamp Road	McMillan Creek	Full Barrier	No
3A,B,C	Aberdeen Road	McMillan Creek	No Barrier	No
4A, B	McMillan Ave	McMillan Creek	Full Seasonal Barrier	No
5	Northwood Pulpmill Road	McMillan Creek	No Barrier	High
6	Noranda Road East	McMillan Creek	No Barrier	High
7	Old Summit Lake Road	McMillan Creek	No Barrier	No
8	Old Summit Lake Road	McMillan Creek	No Barrier	No
9	Old Summit Lake Road	McMillan Creek	No Barrier	No
10	Goose Country Road	McMillan Creek	No Barrier	No
11	Old Summit Lake Road	McMillan Creek	No Barrier	No
12A, 12B	Indian Reserve Road	Unnamed Stream	Full Seasonal Barrier	No
13 A,B	Indian Reserve Road	Unnamed Stream	Full Seasonal Barrier	No
14A, 14B	Domano Road	Parkridge Creek	Full Barrier	No
15	North Blackburn Road	Unnamed Stream	No Barrier	Mod
16	Giscome Road	Bittner Creek	No Barrier	No
17	Giscome Road	Unnamed Stream	Partial Barrier	No
18	Willow-Cale Road	Haggith Creek	Full Barrier	No

The main environmental objectives of fish stream crossings are to ensure the crossing accommodates and retains the natural stream channel width, the stream gradient and streambed characteristics (Stream Crossing Guidebook, 2002). Following these objectives can ensure that fish and fish habitat are not harmed by stream crossings.

Undersized culverts were the most common problem at crossings that were determined to be barriers to fish passage or that had maintenance concerns. Of the 11 crossings assessed as fish passage barriers or

having maintenance concerns, all were undersized and did not meet the Q100 (100 year return) flood discharge estimate. The Encroachment Ratio of a crossing is a good indicator of the size of a crossing structure relative to the channel width and is defined simply as the ratio of the culvert width to the stream width. Encroachment Ratios ranged from 0.3 to 0.8 for the 11 sites that were considered problem crossings. Installation of culverts at greater than recommended gradients was another common issue at problem crossings. Eight crossing sites were identified to have greater than the recommended gradient (Table 2) as discussed in Section 3.2.1 of this report.

5.1 Summary of Barrier Crossing Sites

Crossing sites with undersized culverts and excessive gradient resulted in increased water velocity and the creation of outfall drops beyond the jumping abilities of the target fish species. All 8 sites considered to be barriers had water velocities beyond the swimming capabilities of juvenile fish and 4 (50%) also had jump heights at the culvert outlets that were beyond the jumping abilities of juvenile fish. Table 4 presents a summary of culvert conditions at individual crossings that were impassable to fish.

Table 4: Summary of Culvert Conditions Blocking Fish Passage

Site #	Road Name	Stream Name	Velocity Within Culvert (m/s)	Jump Height Into Culvert Outlet (cm)
1A, 1B	Prince George Pulp Mill Road	McMillan Creek	1.09	37
2	Hoferkamp Road	McMillan Creek	5.25	14
4A, B	McMillan Ave	McMillan Creek	0.80	0
12	Indian Reserve Road	Unnamed Stream	0.88	47
13	Indian Reserve Road	Unnamed Stream	1.19	0
14	Domano Road	Parkridge Creek	0.85	40
17	Giscome Road	Unnamed Stream	0.49	0
18	Willow-Cale Road	Haggith Creek	2.15	125

Three full barrier crossings were considered to provide fish passage conditions during seasonal higher flows. Sites 1, 12 and 13 were in close proximity to the Fraser or Nechako River and would become backwatered during spring freshet, which typically occurs in June. As a result, rainbow trout populations were found above all three crossings.

5.2 Summary of Crossing Sites / Structures that Require Maintenance.

It was determined that 3 of the 18 crossings that were assessed had maintenance issues. None of the structures at these crossings were considered barriers to fish passage. However, these crossings have the potential to negatively impact habitat quality within the streams. Un-vegetated road fills was a high maintenance concern that was an issue at two crossing locations. These slopes were considered to have a high potential of sediment mobilization into the stream channel. Another maintenance concern was a compressed outlet reducing the capacity of the culvert. Table 5 presents a summary of the locations and conditions at sites that were considered to require maintenance.

Table 5: Summary of Crossing Sites that Require Maintenance

Site #	Road Name	Stream Name	Maintenance Issues	Sediment Source	Comments
5	Northwood Pulpmill Road	McMillan Creek	No	Yes	The road fill is eroding and contributing sediment to the stream.
6	Noranda Road East	McMillan Creek	No	Yes	The road fill is eroding and contributing sediment to the stream. In addition this crossing is undersized.
15	North Blackburn Road	Unnamed Stream	Yes	No	The culvert outlet is compressed. There is an old culvert within the stream channel that should be removed.

5.3 McMillan Creek

McMillan Creek is a third order stream with an overall mainstem length of 15.25 km. It is a tributary to the Nechako River and provides valuable rearing, spawning and overwintering fish habitat. Fish known to be present in this stream include chinook salmon, bull trout (*Salvelinus confluentus*) northern pikeminnow (*Ptychocheilus oregonensis*) and rainbow trout. However, rainbow trout is the only species documented to be present above the Hoferkamp Road crossing.

A Fish Passage Culvert Inspection was conducted at every publicly owned crossing on McMillan Creek. Of the eleven crossings completed, three were determined to be full barriers. The first crossing at Pulpmill Road and the fourth crossing at McMillan Ave were determined to be seasonal full barriers (i.e., potential to provide fish passage during certain times of year). An additional two crossings were considered to have high maintenance concerns. The remaining six sites were considered to be in good condition and allowed fish passage (Table 2).

Site 1A, 1B (Prince George Pulp Mill Road)

The two non-embedded side-by-side culverts at Site 1 were determined to be a full barrier based on the FPCI assessment criteria. Since this site is located 20 m upstream from the Nechako River, it experiences backflooding during springtime high water volumes. The increased water depth would likely provide more suitable conditions for fish passage thereby permitting the upstream migration of

fish seeking high quality habitat. Rainbow trout and juvenile chinook salmon have been documented upstream from this crossing, suggesting that juvenile life stages can migrate past this crossing at certain flow stages. As a result this crossing was rated as a **seasonal full barrier**.

Nearly 15 km of high quality habitat lies upstream of Site 1. There are two 2000 mm round corrugated metal culverts at this crossing. Given that the average channel width was 5.2 m, these culverts are undersized. This resulted in water velocities within the culvert to be 1.09 m/s. The average gradient these culverts are installed at is 5%. The average outfall drop height was 37 cm.

Site 2 (Hoferkamp Road)

Based on the FPCI assessment criteria Site 2 was determined to be a **full** barrier. It is obstructing over 14 km of McMillan Creek. This site has one non-embedded 1800 mm round corrugated metal culvert. Given the average channel width was 4.12 m, this culvert was significantly undersized. The average culvert water velocity was 5.25 m/s. The gradient was 1.6% and the outfall drop height was 14 cm. Rainbow trout is the only fish species documented upstream from this crossing. These fish are believed to represent a resident population that is independent of the populations lower in McMillan Creek or the Nechako River.

Site 4A, 4B (McMillan Avenue)

The two non-embedded corrugated metal culverts (1200 mm diameter) at Site 4 were determined to be a **seasonal full** barrier to fish passage. The site is located approximately 2 km from the confluence of the stream and may be obstructing access to almost 13 km of McMillan Creek. However, many rainbow trout have been captured upstream from the crossing. This suggests that fish are capable of passing through these culverts under certain conditions. Given that the average channel width was 3.01 m, this crossing was undersized. The average culvert water velocity was 0.80 m/s. The gradient of this culvert was 1.6%. There was no outfall drop.

Site 5 (Northwood Pulpmill Road)

Site 5 is considered to have **high** maintenance concerns. It is located approximately 3 km from the mouth of McMillan Creek. There is one 2000 mm round corrugated metal culvert at this crossing. The inlet area has been recently excavated leaving exposed soil on the road fill. If there is heavy rainfall the slope could easily mobilize into the stream. The addition of excessive sediment into the stream channel can negatively impact water quality and fish habitat.

Site 6 (Noranda Road East)

Site 6 is considered to have **high** maintenance concerns. It is located approximately 4.5 km from the mouth of McMillan Creek. This crossing has an open bottom structure. There was recent work on the inlet resulting in exposed soil on the road fill. Heavy rainfall or excessive snow-melt could wash soil into the stream. There was one 1300 x 2500 mm metal open bottom structure at the site but the

crossings was still considered to be undersized since the channel width was 6.5 m. However, site conditions were adequate to allow upstream fish passage.

Site 3 (Aberdeen Road), Site 7 (Old Summit Lake Road), Site 8 (Old Summit Lake Road), Site 9 (Old Summit Lake Road), Site 10 (Goose Country Road) and Site 11 (Old Summit Lake Road)

These sites were considered to have no fish passage concern or maintenance concerns. Rainbow trout have been documented above Site 11, indicating that fish are able to access mainstem habitats beyond the last culvert on McMillan Creek.

5.4 Unnamed Stream

Two crossings were assessed on Indian Reserve Road intersecting an unnamed third order stream that flows directly into the Fraser River. Both crossings were located within 200 m of the confluence of this unnamed stream and the Fraser River. Thus, during the spring freshet the increased water volume within the Fraser River would cause direct tributaries such as this to become backflooded. It was confirmed through backpack electrofishing that juvenile rainbow trout utilize this stream above the crossings. One individual juvenile was caught and two more were observed.

The two crossings assessed on this unnamed stream are within 20 m of each other and both were considered full seasonal barriers. One crossing (site 12) is on the railway and is upstream of the road crossing (site 13). Four kilometers of habitable stream length lies above these crossings.

Site 12 (Indian Reserve Road)

Site 12 is considered a **full seasonal** barrier. It is located approximately 150 m from the Fraser River and consequently would likely experience backflooding conditions. However, during the remainder of the year this crossing is potentially alienating nearly 4 km of high quality habitat. There are two non-embedded 1200 mm circular corrugated metal culverts at this railway crossing. Given that the average channel width was 3.06 m, these culverts are undersized. The average culvert water velocity was 0.88 m/s. The average gradient of these culverts was 3.6%. The average outfall drop height was 47.5 cm.

Site 13 (Indian Reserve Road)

Site 13 is considered a full seasonal barrier. It is located approximately 130 m from the Fraser River and would experience backflooding conditions. There were two non-embedded 900 mm round corrugated metal culverts at this crossing. Given that the channel width was 3.4 m these culverts are undersized. The average culvert water velocity was 1.19 m/s. The average gradient of these culverts was 3.2%. There was no outfall drop at this crossing.

5.5 Parkridge Creek
Parkridge Creek is a third order stream with a length of 14.5 km. It is also a direct tributary to the Fraser River. Its high habitat quality makes it a valuable nursery area for juvenile chinook salmon and rainbow trout.

Site 14 (Domano Road)

Site 14 was considered a **full** barrier crossing. It is located approximately 1.5 km from the confluence of Parkridge Creek and the Fraser River. Thus, this crossing is potentially alienating approximately 9 km of high quality habitat. Electrofishing was conducted during the Fish Habitat Inventory upstream of this crossing and no fish were caught during two separate sampling events. However, fish have never actually been captured at the culvert outlet either. It is possible that fish distribution in Parkridge Creek is limited by natural features downstream from Domano Road. Before consideration is given to replacing this crossing, additional investigations should be undertaken downstream from Domano Road to ensure the culvert is indeed acting as a barrier.

There are two non-embedded round corrugated metal culverts at this site. The right bank culvert has a diameter of 1200 mm and the left bank culvert has a diameter of 600 mm. Given that the average channel width was 2.66 m, the sum of both culverts was considered to be undersized. The average water velocity was 0.85 m/s. The average culvert gradient was 4.2%. The average outfall drop height was 40 cm.

5.6 Bittner Creek Watershed

One crossing was located on Bittner Creek and the other two were located on tributaries to Bittner Creek. Bittner Creek is a third order stream with a mainstem length of approximately 13 km. It is also a tributary to the Fraser River. Fish present in this stream are chinook salmon, northern pikeminnow, rainbow trout, longnose sucker (*Catostomus catostomus*), and mountain whitefish. However, no fish were caught in this area during the 2004 Fish and Fish Habitat Inventory.

Of the three FPCI assessments conducted in the Blackburn Area, one crossing was determined to be a full barrier, one crossing was considered to have moderate maintenance concerns and the remaining crossing had no maintenance or fish passage concerns.

Site 15 (Northern Blackburn Road)

Site 15 was considered to have **moderate** maintenance issues. It is located on an unnamed first order stream that flows into Bittner Creek. The culvert outlet was compressed vertically thus reducing the cross-sectional area within the culvert. In addition, an old corrugated steel culvert was discarded in the channel.

Site 17 (Giscome Road)

Site 17 was considered a **partial** barrier, **high** priority crossing. It is located on an unnamed first order stream approximately 1 km from its confluence with Bittner Creek. Given that the conditions within the culvert were very close to the fish passage criteria (3.2.1) this crossing was considered a partial barrier. This crossing has potentially alienated approximately 1 km of habitable stream length. Within the culvert there is a transition between a wooden box culvert inlet and a circular cement culvert outlet. The cement culvert outlet is dated 1941. The culvert diameters were 550 and 600 mm respectively. Given that the average channel width was 2.02 m, this crossing was undersized. The average culvert velocity was 0.49 m/s. The culvert gradient of this culvert was 1%. There was no outfall drop at this crossing.

In addition, water was piping out from underneath the outlet and was contributing sediment to the stream.

5.7 Haggith Creek

Haggith Creek is a third order stream with an overall mainstem length of 14.5 km. It is also a direct tributary to the Fraser River. Its high habitat quality makes it very valuable as a rearing area for young fish. Fish known to be present in this stream include chinook salmon and northern pikeminnow (FISS). However, it is probable that more species are present since the stream flows directly into the Fraser River. Fish sampling was not conducted on this stream during the Fish and Fish Habitat Inventory.

Site 18 (Willow-Cale Road)

Site 18 was considered a **full** barrier, **high** priority crossing. The crossing was located 200 m from the Fraser River. Although this crossing is in close proximity to the Fraser it was not considered to have the conditions even seasonally to allow fish passage. The excessive outfall drop and water velocity were evaluated to be far beyond the fish passage criteria (3.2.1). Thus, backflooding events from the Fraser River would likely not alter the conditions at the crossing enough to allow fish passage. This crossing is alienating approximately 7.5 km of potential habitat. There is one non-embedded 2000 mm round corrugated metal culvert present at this site. Given that the average channel width is 6.87 m, this culvert is undersized. The average water velocity was 2.15 m/s. The outfall drop height was 125 cm.

This culvert was starting to fail as water was piping underneath the culvert. The water flowing underneath could potentially mobilize the soil and carry sediment into the stream channel.

6.0 DISCUSSION

The primary focus of the FPCI was to determine if surveyed stream crossings within the Prince George city limits were barriers to fish passage. The second goal was to determine if crossings had maintenance concerns that were impacting the habitat quality of the streams.

The Nechako River and Fraser River have several tributaries within the Prince George city limits that are very important for juvenile rainbow trout, adult rainbow trout and juvenile chinook salmon production. They provide refuge from larger predators, areas of lower water velocity and abundant food for growing juveniles. Once these areas become disconnected from the stream network, the available habitat for these populations may become reduced.

Fish passage barriers can also result in individuals being isolated from their respective gene pools as the stream crossings provide barriers to their migrational movements. Consequently, ensuring road crossings retain natural stream conditions can assist in maintaining healthy aquatic environments and thus healthy fish populations.

Stream Crossings and Fish Passage

Improper installation of culverts at crossings surveyed during this project created fish passage barriers and maintenance issues. Installation of undersized culverts at a higher than recommended gradient were the most common problems (Parker 2000). Culverts are extremely efficient at passing water so they were historically installed at one-third the width of the stream (Parker 2000). Eleven crossings were considered to be fish passage barriers or had maintenance concerns and all were found to have culvert diameters considerably smaller than the stream bankfull width. Of these eleven crossings eight were installed at higher than recommended gradient. These issues created a variety of problems by not only preventing fish passage but also contributing to the likelihood of a crossing failure during flood events.

Installing a culvert narrower than the stream bankfull width constricts the cross-sectional area available for water to flow, creating increased water velocities within the culvert and downstream of the crossing (Parker 2000). The increased water velocity can cause downcutting of the channel, leading to excessive outfall drop heights beyond the jumping abilities of fish (Parker 2000). Therefore, installing culverts that are the proper size for the stream is extremely important to maintain natural aquatic environments.

Stream Crossings and Deleterious Substances

The Northwood Pulpmill Road (Site 5) and the Noranda Road East (Site 6) crossings had high maintenance concerns. This problem was due to sediment entering the stream channel. The road fill had been recently excavated prior to the assessment. Exposed soil was present on the slopes. This soil could easily mobilize into the stream channel causing a reduction in water quality and potentially impacting downstream fish habitat. The Ministry of Water, Land and Air Protection's document titled *Standards and Best Practices for Instream Works* (2004) suggests that an increase in sediment within streams can have severe negative consequences on fish.

The Willow-Cale Road (Site 18) and Giscome Road (Site 17) crossings were determined to be full barriers. They also were contributing sediment to their respective streams. Water was piping underneath the culverts, and could contribute sediment to the stream as the water runs out of the culvert.

Rating the Barrier Sites

Individual crossings were rated based on site-specific characteristics. The criteria outlined in Section 3.2.1 were followed to determine if there was a barrier present (partial or full). Crossings were further examined for the likelihood of having suitable fish passage conditions during certain times of the year. Individual site characteristics such as proximity to the larger rivers, culvert water velocity and culvert outfall drop height were examined to determine if crossings could have more hospitable conditions during periods of higher flow.

As a result, four crossings were rated as seasonal full barriers. Thus, it is possible that fish could inhabit stream length above a crossing considered a full barrier. This was evident at Sites 12 and 13 (Indian Reserve Road), since they were rated as full barriers but juvenile rainbow trout were captured above the crossings. The close proximity to the Fraser River suggests that these crossings may experience

backflooding from the Fraser River, which would allow for fish passage during flood events. In comparison, Site 14 (Domano Road) is located on a direct tributary to the Fraser River 1.5 km from the mouth of the stream. Extensive sampling upstream of the crossing yielded no fish in this high quality habitat. This crossing is not influenced by backflooding events and remains a fish passage barrier throughout the year.

7.0 RECOMMENDATIONS

An estimated 37 km of potential mainstem stream length has been alienated by the fish passage barriers identified within the Prince George city limits. The FPCI scoring matrix was used to determine the restoration priority classes of individual sites. The crossings were located on larger streams with most flowing directly into the Fraser River or the Nechako River. Thus, multiple fish species have been documented in many of these systems and habitat value is often high. Stream connectivity is typically significantly impacted by the barrier crossings since they are located within close proximity to their confluence with larger systems. Therefore, habitat gained by replacing these structures could be extensive. Table 6 depicts sites assessed as barriers and their restoration priority ranking using the FPCI Scoring Matrix.

Note that the restoration priority rankings are based largely on the FPCI scoring matrix. Other factors may contribute to assignment of priority crossings, such as cost, municipal planning and development priorities or environmental agency input. These issues should be fully investigated prior to developing a fish passage restoration strategy.

Table 6: Fish Passage Culvert Inspection Scoring Matrix

Restoration Priority Rank	Score	Site Number	Barrier	Stream Length Gained (m)	% Stream Barred
High	55	1	Full Seasonal	14950	98
High	55	2	Full	14234	93
High	55	4	Full Seasonal	12788	84
High	50	12	Full Seasonal	3964	96
High	55	13	Full Seasonal	3964	96
High	50	14	Full	9231	71
High	42	17	Partial	1178	55
High	50	18	Full	7565	97

7.1 McMillan Creek

A total of eleven crossings were assessed in McMillan Creek. Three crossings were considered full barriers, with two constrained to be a seasonal full barriers. Two crossings were considered to have high maintenance concerns and six were considered to have unrestricted fish passage and no maintenance concerns.

Site 1 (Prince George Pulp Mill Road), Site 2 (Hoferkamp Road) and Site 4 (McMillan Ave)

Using the Fish Passage Culvert Inspection Scoring Matrix, the three sites considered barriers were rated as high priorities. It is recommended that the City consult with provincial and federal environmental agencies to obtain their input on fish passage restoration priorities in the lower reaches of McMillan Creek. Restoration of full fish passage at Sites 1 and 2 would directly benefit rainbow trout and juvenile chinook salmon, but may also open new habitat to non-target species such as northern pikeminnow and suckers. The resulting impacts on fish population dynamics from re-establishing full fish passage into McMillan Creek are currently unknown. If restoration of full fish passage is considered, these crossings should be replaced with larger structures able to accommodate the natural channel width and the maximum discharge at each particular site. Traffic flow would likely have to be maintained at Prince George Pulp Mill Road by building a temporary detour during construction.

Site 5 (Northwood Pulpmill Road) and Site 6 (Noranda Road East)

Site 5 and Site 6 have erosion problems on the fill slopes as a result of recent excavation. Hydroseeding these areas should provide an adequate level of erosion protection to prevent fine sediment from entering the stream.

7.2 Unnamed Stream

Site 12 (Indian Reserve Road) and Site 13 (Indian Reserve Road)

Two crossings were assessed on an unnamed stream intersecting Indian Reserve Road. Site 13 (Indian Reserve Road) is the road crossing and Site 12 (Indian Reserve Road) is the railway crossing. Both crossings were considered to be undersized and do not meet the recommended Q100 flood frequency estimate. Both crossings were considered full seasonal barriers and high priority crossings. However, electrofishing upstream of these crossings yielded juvenile rainbow trout presence above the barrier crossings. These fish are likely present due to seasonal backflooding events from the Fraser River. It is not currently known whether rainbow trout populations are self-sustaining above the crossings.

7.3 Parkridge Creek

Site 14 (Domano Road)

One crossing (Site 14) was assessed on Parkridge Creek and was rated as a full barrier. The two culverts at this crossing are undersized for this stream. Using the Fish Passage Culvert Inspection Scoring Matrix, this site was rated as a high priority. Although rainbow trout and chinook salmon have been documented downstream from Domano Road, fish have never actually been captured immediately below the crossing. Before replacing this culvert, additional investigations are recommended to ensure fish passage in Parkridge Creek is obstructed by the culvert, instead of a natural barrier farther downstream.

7.4 Bittner Creek Watershed

Three crossings were assessed in the Blackburn area. One crossing was considered a partial barrier to fish passage, one crossing was considered to have moderate maintenance concerns and the remaining

crossing was considered to allow unrestricted fish passage and had no maintenance issues. Using the Fish Passage Culvert Inspection Scoring Matrix the barrier crossing was rated as a high priority.

Site 15 (North Blackburn Road)

Site 15 is on a tributary to Bittner Creek and is a moderate priority for maintenance. There is the old corrugated metal culvert within the stream channel and this should be removed as it has affected the stream morphology. In addition, the culvert outlet was compressed vertically, reducing the volume of flow able to pass through this crossing.

Site 17 (Giscome Road)

Site 17 was considered a partial fish passage barrier. The crossing was considered to be undersized for the site conditions. The conditions at the site were close to the fish passage criteria outlined in Section 3.2.1 of this document, resulting in the rating of partial barrier. The structure was dated 1941 and consists of a wooden box culvert inlet and a cement culvert outlet with a transition in the middle of the crossing. Replacing this crossing with a structure suitably sized for the stream would restore full fish passage to a headwater segment of Bittner Creek that is presumably fish-bearing but that likely contributes marginally to overall fish production. Significant temporary disruption to traffic would have to occur during construction, since Giscome Road is a relatively busy corridor.

7.5 Haggith Creek

Site 18 (Willow-Cale Road)

One crossing (site 18) was assessed on Haggith Creek and was rated as a full barrier. Using the Fish Passage Culvert Inspection Scoring Matrix this site was rated as a high priority. The culvert at this site was undersized and was a definite barrier. This crossing is a barrier to approximately 7.5 km of potential fish habitat. The crossing was starting to fail with water piping underneath the culvert. The major constraint for replacing this crossing is the large amount of fill over the existing culvert.

8.0 GENERAL RECOMMENDATIONS

Prescriptions intended to restore fish passage at stream crossings identified as barriers to fish passage must take into consideration future road use requirements. The following general recommendations are presented in this regard.

1. Stream crossing structures that are barriers to fish passage, situated on roads where vehicular access is to be maintained, should be replaced with an appropriate structure. The new structure should ensure unobstructed fish passage and mitigate any fish habitat loss or disturbance.
2. When replacing any stream crossing structures (bridge superstructures, substructures and culverts) the use of techniques aimed at minimizing sediment input into the stream should be incorporated. An erosion and sediment control plan should be developed for each construction project. The same precautions that are utilized when installing a structure should be used when a structure is removed.

The *Stream Crossing Guidebook for Fish Streams* (B.C. Ministry of Forests 2002) should be referred to for information regarding bridge and culvert installation as well as recommended erosion and sediment control procedures. Check for updated versions of this manual before commencing work. The *Stream Crossing Guidebook for Fish Streams* and the *Land Development Guidelines for the Protection of Aquatic Habitat* (Chilibeck 1992) outline best management practices (BMPs) to mitigate environmental impacts associated with the construction, installation, removal and use of stream crossings. These BMPs include:

- Completing the work during the appropriate fisheries instream work window;
 - Eliminating or reducing sediment-related problems during installation or removal by utilizing the proper instream construction techniques and providing adequate supervision;
 - Isolating the site from the flow of water (work completed in the dry) which may involve the temporary diversion of stream flow;
 - Minimizing the duration of the instream activities;
3. Any construction activities conducted in and about a stream may negatively impact the aquatic environment. When instream work is required, the proponent of the work should consult with the necessary regulatory agencies (Fisheries and Oceans Canada, the British Columbia Ministry of Forests, and the Ministry of Water, Land and Air Protection) for any required approvals prior to commencing instream work. Note that the turn around time for such approval documents is approximately 45 days.

Recommended Stream Crossing Structures

The objective of installing stream crossing structures should be to maintain migratory fish movements in watercourses and ensure that the various life cycle phases of the fish species utilizing the streams can be carried out without difficulty. In this way, the productivity of present and future fish populations will be maintained. Barriers that prevent fish from moving upstream to spawning habitat or restrict access to rearing and feeding areas can include stream crossing structures, debris dams, increased flow velocities, lack of jump pools at drops in the stream channel and insufficient water depth because of sedimentation or channelization. Natural migratory fish movement should be maintained at road crossings by the installation of the appropriate structures since they minimize changes to the natural stream morphology and the associated hydraulic conditions.

Well designed and constructed stream crossing structures should require minimum maintenance. Frequent inspections, particularly during high runoff periods, are very important (Chillebeck 1992). Improper functioning of a structure during or after a major storm event may indicate the need for minor repairs or modifications.

The following stream crossing types are described in the order of preference with respect to minimizing impacts on the aquatic environment and the fisheries resource.

1. Bridges (permanent, semi-permanent and temporary)

When designed, constructed and installed properly, bridges have the least impact on fish passage. Refer to the *Stream Crossing Guidebook for Fish Streams* (B.C Ministry of Forests, 2002) and the *Forest Road Engineering Guidebook* (B.C Ministry of Forests, 2002) for recommended bridge installation procedures. A channel spanning bridge which maintains the natural stream bank and stream bed structure is preferred from the perspective of fish passage. A clear span permits the retention or replacement of riparian vegetation around the crossing site since the stream banks are retained at the crossing. Bridges allow unrestricted movement of bed load by maintaining the natural stream bottom and bed structure. Additionally, free passage of fish can be maintained at various water levels since the natural hydraulic conditions that existed before installation of the structure are retained. Encroachment of piers and footings can impact the stream by reducing the wetted perimeter causing local scour of the bed and erosion of the stream banks. If a bridge structure is going to be removed, the introduction of sediment into the stream must be minimized, therefore, the same procedures used for erosion control during bridge installation must also be applied when the bridge is being removed.

2. Open Bottom Culverts (steel, arch, concrete, log)

When installed properly with the width of the structure maintaining the natural channel width, open bottom culverts do not pose a risk to fish passage. For information regarding open bottom culverts and recommended installation methods, refer to the *Stream Crossing Guidebook for Fish Streams* (B. C Ministry of Forests, 2002) and the *Forest Road Engineering Guidebook* (B.C Ministry of Forests, 2002).

3. Embedded Metal Culverts

When closed-bottom culverts are embedded to a minimum of 0.4 m or 40% of their height, as well as maintain the natural channel width and are installed within a stream that has the appropriate bed material, they can permit fish passage. There are, however, recommended maximum gradients on which embedded culverts should be used. For pipe arch embedded culverts the maximum stream gradient guideline is 5% and for circular embedded culverts the maximum gradient is 3.5%. For higher gradient streams, an alternate structure (bridge or open bottomed culvert) is recommended. Refer to the *Stream Crossing Guidebook for Fish Streams* (B.C Ministry of Forests, 2002) and the *Forest Road Engineering Guidebook* (B.C Ministry of Forests, 2002) for recommended embedded culvert installation procedures.

4. Non – embedded Culverts

Non-embedded culverts rarely meet fish passage criteria. They are only recommended when they can be placed at a gradient of 0.5% or less or where rigorous engineering is applied, ensuring safe

fish passage requirements are met (B.C Ministry of Forests, 2002). The rationale for not recommending non-embedded culverts at gradients greater than 0.5% is attributed to their past performance regarding fish passage. Non-embedded culverts placed at bed elevation tend to cause fish passage problems by creating an excessive drop at the culvert outlet, high velocity within the culvert, high velocity or turbulence at the culvert inlet, debris accumulation at the inlet and underscoring due to piping (B.C Ministry of Forests, 2002).

5. Baffled Culverts

Baffled culverts can accommodate fish passage when installed at gradients of up to 12%. These structures can be costly, difficult to design and may only accommodate passage to certain life stages of fish. The baffled culvert should only be considered when it is not feasible to construct a bridge or install an open bottomed culvert.

6. Fords

The *Forest Bridge Engineering Guidebook* states that fords “are not suitable on fish bearing streams”. However, in reality, a deactivated road may still require limited vehicle access. Fords can be effective stream crossings when they are constructed properly and used on roads requiring only minimal vehicle use (B.C Ministry of Forests, 2002). For proper ford construction refer to the *Stream Crossing Guidebook for Fish Streams* (B. C Ministry of Forests, 2002) and the *Forest Road Engineering Guidebook* (B. C Ministry of Forests, 2002).

9.0 CONCLUSIONS

1. Non-embedded circular metal culverts were identified as the primary structure at which a barrier to fish passage existed.
2. Bridge structures are superior structures for accommodating fish passage and are less likely to pose sediment related concerns when sized and constructed properly.
3. Open-bottomed or embedded closed-bottomed culverts may be appropriate replacement structures at some sites.
4. Retrofitting existing problem culverts in the City of PG with outlet control structures or baffles is not recommended. All of the barrier culvert crossings assessed were already undersized compared to the stream channel width and do not qualify for retrofit.
5. If proper stream crossing selection and installation techniques are followed, many of the historical concerns relating to fish passage at stream crossings can be alleviated.
6. Restoring access to upstream habitats and mitigating sediment problems associated with stream crossings should be a high priority for future watershed restoration works.

7. It is evident that non-embedded round culverts most often result in fish passage problems despite diligent and careful installation. This is due primarily to the inherent characteristics of the structure and its impacts on stream flow and channel morphology. Alternative crossing structures are preferred from a fish passage perspective. Although the cost of installing a bridge or open-bottom culvert may be higher initially, the reduced impact to the fisheries resource and a presumably significant reduction in maintenance costs over the long term may make these alternate structures more attractive.

10.0 LITERATURE CITED

- B.C. Ministry of Forests. 2002.** Fish-Stream Crossing Guidebook. For. Prac. Br., Min. For., Victoria, B.C. Forest Practice Code of British Columbia guidebook.
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- B.C. Ministry of Water, Land and Air Protection. 2004.** Standards and Best Practices for Instream Works. Victoria, BC.
- Chilibeck, B. 1992.** Land Development Guidelines for the Protection of Aquatic Habitat. Prepared by the Department of Fisheries and Oceans and the Intergrated Management Branch of the Ministry of Environment, Lands, and Parks. Vancouver, BC.
- Parker, M. A. 2000.** Fish Passage - Culvert Inspection Procedures: Watershed Restoration Technical Circular No. 11. BC Ministry of Environment, Lands and Parks and BC Ministry of Forests, Vancouver, BC.
- Peterson, P.M. 2004.** Review of Aquatic Resource Values within the City of Prince George. Prepared by EDI Environmental Dynamics Inc., Prince George, BC, for the City of Prince George.

Appendix I

**Fish Passage Culvert Inspection – City of Prince George
Site Map**

Appendix II

Completed Fish Passage Culvert Inspection Form A and Individual Site Photos

Site 1 - McMillan Creek (Prince George Pulp Mill Road): Full Seasonal Barrier, High Priority



View of left bank inlet.



View of right bank inlet.

Site 1 - McMillan Creek (Prince George Pulp Mill Road): Full Seasonal Barrier, High Priority

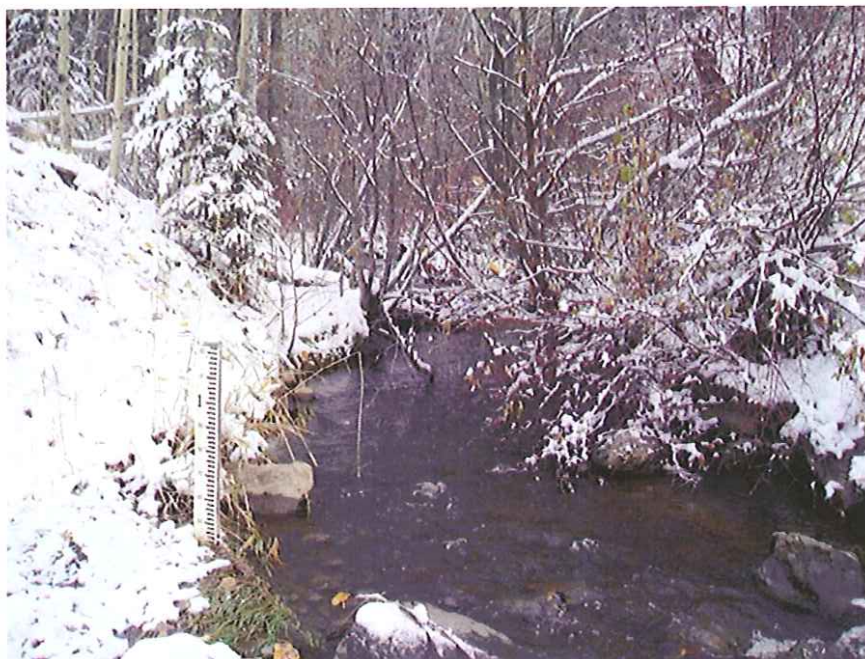


View of left bank outlet.



View of right bank outlet.

Site 1 - McMillan Creek (Prince George Pulp Mill Road): Full Seasonal Barrier, High Priority



View upstream of inlet.



View downstream of outlets. Note the close proximity to the Fraser River.

Form A - Fish Passage - Culvert Inspection

Date:	10/19/2004	Stream Name:	McMillan Creek
Road Name:	Prince George Pulp Mill Road	MoF District:	
Crossing Location:		WSC or ILP:	180-007200
1:20 000 Map Sheet:	093G.097	Crew:	LMC/SEA
UTM:	10.515362.5975539		
Site#:	1A		
Project Number:	04-BC-0104		

Culvert Characteristics: Double culverts-concrete retaining wall along US portion of culverts. Riprap at outfall of culverts. Some work done on left culvert. A different size of corrugated pipe used in the middle. Uniform flow through culverts.

Culvert Diameter (mm):	2000	Culvert Slope (%):	4.81
Culvert Length (m):	33.8	Culvert High Water (cm):	64
Culvert Material:	Metal	Culvert Water Depth(cm):	18
Culvert Velocity (m/s):	0.75 1.09 1.34	Culvert Outfall (cm):	46
Culvert Shape:	Circular	Culvert Maintenance:	No
Culvert Wet Width (cm):	60	Fill Slope Depth(m):	4.5

Stream Characteristics: Riffle-pool with cobbles and gravel. Good flow. The Nechako River is 30m downstream from outlet. There is garbage present in stream (Plywood, concrete slabs etc.).

Stream Reach #:	1	Stream Classification:	S2	Prelim. Class.:	☒
Pool Depth at Outfall (cm):	63	Blue Listed/Sign:			
Sediment Source/Degree:	No	Low			
Sediment Comment:	Well vegetated banks.				

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	5.85	4.05	3.6	4.7	2.7	3.05	3.99
Bankfull Width (m):	7.5	5.63	7.01	5.08	3.1	2.85	5.20
Water Depth (cm):	10	10	12	16	21	17	14.33
Bankfull Depth (cm):	97	98	94	75	55	52	78.50
Velocity (m/s):							
Stream Gradient (%):	2			4			3
Fish Present:	No survey			No survey			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Rainbow Trout, Chinook Salmon, North			Rainbow Trout, Chinook Salmon, North			NA
Beaver Activity:	None			None			

Barrier Evaluation

Barrier:	Full
Barrier Type:	Barrier to juvenile during high flow due to velocity and may be partial partial at low flow to bigger fish.

Site Photos

Roll#	Frame #	Direction	Comment
	1	Outlet upstrea	
	3	Outlet downst	

Form A - Fish Passage - Culvert Inspection

1501	8	U	Outlet
1501	9	D	Stream below crossing

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: Downstream outlet of culvert is on the Nechako River floodplain. There is large woody debris and small woody debris. The culvert has cobbles present from high flow.

The spawning habitat is moderate with isolated patches of suitable gravels. The rearing habitat is good with high variability. The overwintering habitat is moderate with limited pools but good undercutting. The fish would most likely use the Nechako River to overwinter. This is the record for the left culvert.

The average culvert velocity for the left culvert is 1.06 m/s. The average culvert velocity for the right culvert is 1.11m/s. This exceeds the swimming capabilities of fish (Parker 2000).

The left culvert is hanging by 46cm and the right culvert is hanging by 28.5 cm. This could pose a barrier to juvenile fish as it is near the upper limit of Rainbow Trout and Chinook Salmon juvenile jumping abilities (Parker 2000). The slope of the left culvert is 4.81%. The slope of the right culvert is 5.22%. This exceeds the maximum slope of 0.5% for a culvert without baffles greater than 24 m (Adams and Whyte 1990).

This site was rated as HIGH using the FPCI Scoring Matrix. The culverts at this size are undersized and do not meet the recommended Q100 diameter estimate. The total area required is 12.56 m². The current culverts provide a combined area of 6.28 m². A structure of this size should be engineered, and will require a further site visit by a qualified engineer to determine the appropriate structure required for this site.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):		Stream Length Above Barrier (m):	14950
Road Responsibility:		% Stream Barred:	98

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	10	H	10	Full	10	>= 1 km	10	> 70%	10	Yes	5
Single		M		Partial		< 1 km		51-70%		No	
Other		L		Undeter		< 500 m		< 50%			

Total Score:

Form A - Fish Passage - Culvert Inspection

Date:	10/19/2004	Stream Name:	McMillan Creek
Road Name:		MoF District:	
Crossing Location:		WSC or ILP:	180-007200
1:20 000 Map Sheet:	093G.097	Crew:	LC/EO
UTM:	10.515362.5975539		
Site#:	1B		
Project Number:	04-BC-0104		

Culvert Characteristics: Double culverts-concrete retaining wall along US portion of culverts. Riprap at outfall of culverts. Some work done on left culvert. A different size of corrugated pipe used in the middle. Uniform flow through culverts.

Culvert Diameter (mm):	2000	Culvert Slope (%):	5.22
Culvert Length (m):	33.8	Culvert High Water (cm):	51
Culvert Material:	Metal	Culvert Water Depth(cm):	5
Culvert Velocity (m/s):	1.06 1.15 0.79	Culvert Outfall (cm):	28.5
Culvert Shape:	Circular	Culvert Maintenance:	No
Culvert Wet Width (cm):	60	Fill Slope Depth(m):	4.5

Stream Characteristics: Riffle-pool with cobbles and gravel. Good flow. The Nechako River is 30m downstream from outlet. There is garbage present in stream (Plywood, concrete slabs etc.)

Stream Reach #:	1	Stream Classification:	S2	Prelim. Class.:	☒
Pool Depth at Outfall (cm):	25	Blue Listed/Sign:			
Sediment Source/Degree:	No Low				
Sediment Comment:	Well vegetated banks.				

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	5.85	4.05	3.6	4.7	2.7	3.05	3.99
Bankfull Width (m):	7.5	5.63	7.01	5.08	3.1	2.85	5.20
Water Depth (cm):	10	10	12	16	21	17	14.33
Bankfull Depth (cm):	97	98	94	75	55	52	78.50
Velocity (m/s):							
Stream Gradient (%):	2			4			3
Fish Present:	No survey			No survey			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Rainbow Trout, Chinook Salmon, North			Rainbow Trout, Chinook Salmon, North			NA
Beaver Activity:	None			None			

Barrier Evaluation

Barrier:	Full
Barrier Type:	Velocity barrier.

Site Photos

Roll#	Frame #	Direction	Comment
2		Outlet upstrea	Outlet downstream photo #3.

Form A - Fish Passage - Culvert Inspection

1501	10	d/s	Stream below crossing
1501	11	u/s	Outlet
1501	12	d/s	Inlet
1501	13	u/s	Inlet

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: Downstream outlet of culvert is on the Nechako River floodplain. There is large woody debris and small woody debris. The culvert has cobbles present from high flow.

The spawning habitat is moderate with isolated patches of suitable gravels. The rearing habitat is good with high variability. The overwintering habitat is moderate with limited pools but good undercutting. The fish would most likely use the Nechako River to overwinter. This is the record for the right culvert.

The average culvert velocity for the left culvert is 1.06m/s. The average culvert velocity for the right culvert is 1.11m/s. This exceeds the swimming capabilities of juvenile fish (Parker 2000). Since this culvert length is 33.8 m it is most likely a barrier to adult fish as well. A culvert greater than 24 m should have average water velocities not exceeding 1.2 m/s and 0.9 m/s (Adams and Whyte 1990).

The left culvert is hanging by 46 cm and the right culvert is hanging by 28.5 cm. This could pose a barrier to juvenile fish as it is near the upper limit of Rainbow Trout and Chinook Salmon juvenile jumping abilities. The slope of the left culvert is 4.8%1. The slope of the right culvert is 5.22%. This exceeds the maximum slope of 0.5% for a culvert without baffles greater than 24m (Adams and Whyte 1990).

The culverts at this size are undersized. The culverts do not meet the recommended Q100 diameter estimate. The total area required is 12.56 m². The current culverts provide a combined area of 6.28 m². A structure of this size should be engineered, and will require a further site visit by a qualified engineer to determine the appropriate structure required for this site.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):		Stream Length Above Barrier (m):	14950
Road Responsibility:		% Stream Barred:	98

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	10	H	10	Full	10	>= 1 km	10	> 70%	10	Yes	5
Single		M		Partial		< 1 km		51-70%		No	
Other		L		Undeter		< 500 m		< 50%			

Total Score: 55

Site 2 – McMillan Creek (Hoferkamp Road): Full Barrier, High Priority



View of inlet.



View of outlet.

Site 2 – McMillan Creek (Hoferkamp Road): Full Barrier, High Priority



View downstream of outlet.



View upstream of inlet.

Form A - Fish Passage - Culvert Inspection

Date:	10/19/2004	Stream Name:	McMillan Creek
Road Name:	Hoferkamp Road.	MoF District:	
Crossing Location:		WSC or ILP:	180-007200
1:20 000 Map Sheet:	093G.097	Crew:	LC/EO
UTM:	10.515955.5976181		
Site#:	2		
Project Number:	04-BC-0104		

Culvert Characteristics: Bend in middle - Compressed - 50cm.

Culvert Diameter (mm):	1800	Culvert Slope (%):	1.59
Culvert Length (m):	39.65	Culvert High Water (cm):	41
Culvert Material:	Metal	Culvert Water Depth(cm):	16
Culvert Velocity (m/s):	4.96 5.53 0.62	Culvert Outfall (cm):	14
Culvert Shape:	Circular	Culvert Maintenance:	No
Culvert Wet Width (cm):	103	Fill Slope Depth(m):	3.6

Stream Characteristics: Riffle/pool morphology with cobble and gravel substrate. Stable banks that are well vegetated with grass and alder and red - osier dogwood.

Stream Reach #:	2	Stream Classification:	S3	Prelim. Class.:	☒
Pool Depth at Outfall (cm):	54	Blue Listed/Sign:			
Sediment Source/Degree:	Yes Mod				
Sediment Comment:					

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	3.85	3	2.5	2.17	2.5	2.1	2.69
Bankfull Width (m):	4.2	3.5	5.1	4.6	4.1	3.2	4.12
Water Depth (cm):	12	17	14	12	24	22	16.83
Bankfull Depth (cm):	51	50	40	45	54	39	46.50
Velocity (m/s):	0.62	0.51		0.27	0.12	0.43	
Stream Gradient (%):	2.3			2.5			2.4
Fish Present:	No survey			No survey			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Rainbow Trout, Chinook Salmon, North			Rainbow Trout, Chinook Salmon, North			NA
Beaver Activity:	None			None			

Barrier Evaluation

Barrier:	Full
Barrier Type:	Velocity barrier to all fish.

Site Photos

Roll#	Frame #	Direction	Comment

Form A - Fish Passage - Culvert Inspection

1501	3	U	Stream downstream of crossing
1501	4	D	Stream upstream of crossing
1501	5	D	Inlet

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: Spawning - Moderate - Suitable gravels present but not abundant. Good flow and habitat complexity.
 Rearing - Good habitat variability and complexity.
 Overwintering - Limited number of pools but good flow.
 Half culvert is open in partially embeded on left bank of culvert inlet directing ditch water to stream, no baffles in culvert or ditch. Large rocks are present below to prevent or minimize erosion.

The average culvert velocity for the culvert is 5.25m/s. This exceeds the swimming capabilities of fish (Parker 2000).

This site was rated as HIGH using the FPCI Scoring Matrix. The culverts at this size are undersized. The culverts do not meet the recommended Q100 diameter estimate. The total area required is 5.25 m2. The current culvert provides an area of 2.36m2. A structure of this size should be engineered, and will require a further site visit by a qualified engineer.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):	2700	Stream Length Above Barrier (m):	14234
Road Responsibility:		% Stream Barred:	93

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	10	H	10	Full	10	>= 1 km	10	> 70%	10	Yes	5
Single		M		Partial		< 1 km		51-70%		No	
Other		L		Undeter		< 500 m		< 50%			

Total Score:

Site 3 McMillan Creek (Aberdeen Road): No Barrier, No Maintenance Concerns



View of inlets.



View of left bank outlet.

Site 3 McMillan Creek (Aberdeen Road): No Barrier, No Maintenance Concerns



View of middle outlet and right bank outlet.



View upstream of inlets.

Site 3 - McMillan Creek (Aberdeen Road): No Barrier, No Maintenance Concerns



View downstream of outlets.

Form A - Fish Passage - Culvert Inspection

Date:	10/19/2004	Stream Name:	McMillan Creek
Road Name:	Aberdeen Road	MoF District:	
Crossing Location:		WSC or ILP:	180-007200
1:20 000 Map Sheet:	093G.097	Crew:	LC/EO
UTM:	10.515839.5977355		
Site#:	3A		
Project Number:	04-BC-0104		

Culvert Characteristics: Three culverts, embedded high water mark measured from sediment. Left culvert 98cm height above embedded material. Right culvert 80cm height above embedded material. Middle culvert 76cm from embedded material.

Culvert Diameter (mm):	1200	Culvert Slope (%):	0.2
Culvert Length (m):	20.6	Culvert High Water (cm):	70
Culvert Material:	metal	Culvert Water Depth(cm):	26
Culvert Velocity (m/s):		Culvert Outfall (cm):	0
Culvert Shape:	circular	Culvert Maintenance:	Mod
Culvert Wet Width (cm):	120	Fill Slope Depth(m):	1

Stream Characteristics: Low velocity, fines dominant, low gradient, well vegetated banks, beaver activity. Instream vegetation present. Upstream has more gravels present and well defined channel with greater velocities.

Stream Reach #:	3	Stream Classification:	S3	Prelim. Class.:	☒
Pool Depth at Outfall (cm):	0	Blue Listed/Sign:			
Sediment Source/Degree:	Yes	Low			
Sediment Comment:					

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	4.8	3.3	4.24	2.57	3.7	3.1	3.62
Bankfull Width (m):	6.3	3.7	6.05	4.1	4.25	3.8	4.70
Water Depth (cm):	40	78	57	25	20	23	40.5
Bankfull Depth (cm):	80	102	85	54	65	65	75.17
Velocity (m/s):							
Stream Gradient (%):	1			1			1
Fish Present:	No survey			No Survey			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Rainbow Trout, Chinook Salmon, North			Rainbow Trout, Chinook Salmon, North			NA
Beaver Activity:	Partial Dam						

Barrier Evaluation

Barrier:	None
Barrier Type:	

Form A - Fish Passage - Culvert Inspection

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: The rearing habitat is good with instream complexity including: large woody debris, deep pools and variable substrate. The spawning habitat is moderate with isolated pockets of gravel in riffle sections upstream of culverts. The overwintering habitat is limited to deep pools. There was a beaver observed swimming downstream of culverts. A silt fence was installed on upstream and downstream side of ditches.

There are no concerns with fish passage. There is no outfall drop present at any of the three culverts. Left culvert has oily film on waters surface at outflow. However the oily substance is not present upstream of culvert.

There are three culverts at this site. This record is for the right culvert.

This crossing is undersized for the site. The recommended area is 10.88m². The current culverts have a combined area of 3.18 m².

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):		Stream Length Above Barrier (m):	0
Road Responsibility:		% Stream Barred:	0

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	0	H	0	Full	0	>= 1 km	0	> 70%	0	Yes	0
Single	0	M	0	Partial	0	< 1 km	0	51-70%	0	No	0
Other	0	L	0	Undeter	0	< 500 m	0	< 50%	0		

Total Score:

Form A - Fish Passage - Culvert Inspection

Date:	10/19/2004	Stream Name:	McMillan Creek
Road Name:	Aberdeen Road	MoF District:	
Crossing Location:	N/A	WSC or ILP:	180-007200
1:20 000 Map Sheet:	093J.087	Crew:	LC/EO
UTM:	10.556343.6068547		
Site#:	3B		
Project Number:	04-BC-0104		

Culvert Characteristics: Three culverts, embedded high water mark measured from sediment. Left culvert 98cm height above embedded material. Right culvert 80cm height above embedded material. Middle culvert 76cm from embedded material.

Culvert Diameter (mm):	1200	Culvert Slope (%):	0.09
Culvert Length (m):	20.7	Culvert High Water (cm):	90
Culvert Material:	Metal	Culvert Water Depth(cm):	39.5
Culvert Velocity (m/s):	0.25	Culvert Outfall (cm):	
Culvert Shape:	circular	Culvert Maintenance:	Mod
Culvert Wet Width (cm):	120	Fill Slope Depth(m):	1

Stream Characteristics: Low velocity, fines dominant, low gradient, well vegetated banks, beaver activity. Instream vegetation present. Upstream has more gravels present and well defined channel with greater velocities.

Stream Reach #:	3	Stream Classification:	S3	Prelim. Class.:	☒
Pool Depth at Outfall (cm):		Blue Listed/Sign:			
Sediment Source/Degree:	Yes	Low			
Sediment Comment:					

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	4.8	3.3	4.24	2.57	3.7	3.1	3.62
Bankfull Width (m):	6.3	3.7	6.05	4.1	4.25	3.8	4.70
Water Depth (cm):	40	78	57	25	20	23	40.5
Bankfull Depth (cm):	80	102	85	54	65	65	75.17
Velocity (m/s):							
Stream Gradient (%):	1			1			1
Fish Present:	No survey			No survey			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Rainbow Trout, Chinook Salmon, North			Rainbow Trout, Chinook Salmon, North			NA
Beaver Activity:	Partial Dam						

Barrier Evaluation

Barrier:	None
Barrier Type:	

Form A - Fish Passage - Culvert Inspection

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: The rearing habitat is good with instream complexity including: large woody debris, deep pools and variable substrate. The spawning habitat is moderate with isolated pockets of gravel in riffle sections upstream of culverts. The overwintering habitat is limited to deep pools. There was a beaver observed swimming downstream of culverts. A silt fence was installed on upstream and downstream side of ditches.

There are no concerns with fish passage. There is no outfall drop present at any of the three culverts. Left culvert has oily film on waters surface at outflow. However the oily substance is not present upstream of culvert.

There are three culverts at this site. This record is for the left culvert.

This crossing is undersized for the site. The recommended area is 10.88m². The current culverts have a combined area of 3.18 m².

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):		Stream Length Above Barrier (m):	0
Road Responsibility:		% Stream Barred:	0

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	0	H	0	Full	0	>= 1 km	0	> 70%	0	Yes	0
Single	0	M	0	Partial	0	< 1 km	0	51-70%	0	No	0
Other	0	L	0	Undeter	0	< 500 m	0	< 50%	0		

Total Score:

Form A - Fish Passage - Culvert Inspection

Date:	10/19/2004	Stream Name:	McMillan Creek
Road Name:	Aberdeen Road	MoF District:	
Crossing Location:		WSC or ILP:	180-007200
1:20 000 Map Sheet:	093G.097	Crew:	LC/EO
UTM:	10.515839.5977355		
Site#:	3C		
Project Number:	04-BC-0104		

Culvert Characteristics: Three culverts, embedded high water mark measured from sediment. Left culvert 98cm height above embedded material. Right culvert 80cm height above embedded material. Middle culvert 76cm from embedded material.

Culvert Diameter (mm):	1200	Culvert Slope (%):	0.29
Culvert Length (m):	20.6	Culvert High Water (cm):	73
Culvert Material:	metal	Culvert Water Depth(cm):	23
Culvert Velocity (m/s):	0.12	Culvert Outfall (cm):	
Culvert Shape:	circular	Culvert Maintenance:	Mod
Culvert Wet Width (cm):	120	Fill Slope Depth(m):	1

Stream Characteristics: Low velocity, fines dominant, low gradient, well vegetated banks, beaver activity. Instream vegetation present. Upstream has more gravels present and well defined channel with greater velocities.

Stream Reach #:	3	Stream Classification:	S3	Prelim. Class.:	☒
Pool Depth at Outfall (cm):	0	Blue Listed/Sign:			
Sediment Source/Degree:	Yes	Low			
Sediment Comment:					

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	4.8	3.3	4.24	2.57	3.7	3.1	3.62
Bankfull Width (m):	6.3	3.7	6.05	4.1	4.25	3.8	4.70
Water Depth (cm):	40	78	57	25	20	23	40.5
Bankfull Depth (cm):	80	102	85	54	65	65	75.17
Velocity (m/s):							
Stream Gradient (%):	1			1			1
Fish Present:	No survey			No survey			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Rainbow Trout, Chinook Salmon, North			Rainbow Trout, Chinook Salmon, North			NA
Beaver Activity:							

Barrier Evaluation

Barrier:	None
Barrier Type:	

Form A - Fish Passage - Culvert Inspection

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: The rearing habitat is good with instream complexity including: large woody debris, deep pools and variable substrate. The spawning habitat is moderate with isolated pockets of gravel in riffle sections upstream of culverts. The overwintering habitat is limited to deep pools. There was a beaver observed swimming downstream of culverts. A silt fence was installed on upstream and downstream side of ditches.

There are no concerns with fish passage. There is no outfall drop present at any of the three culverts. Left culvert has oily film on waters surface at outflow. However the oily substance is not present upstream of culvert.

There are three culverts at this site. This record is for the middle culvert.

This crossing is undersized for the site. The recommended area is 10.88m². The current culverts have a combined area of 3.18 m².

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):		Stream Length Above Barrier (m):	0
Road Responsibility:		% Stream Barred:	0

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	0	H	0	Full	0	>= 1 km	0	> 70%	0	Yes	0
Single	0	M	0	Partial	0	< 1 km	0	51-70%	0	No	0
Other	0	L	0	Undeter	0	< 500 m	0	< 50%	0		

Total Score:

Site 4 – McMillan Creek (McMillan Ave): Full Seasonal Barrier, High Priority



View of inlet. Note the anti-beaver devices.



View of outlet.

Site 4 - McMillan Creek (McMillan Ave): Full Barrier, High Priority



View upstream of inlets.



View downstream of outlets.

Form A - Fish Passage - Culvert Inspection

Date:	10/19/2004	Stream Name:	McMillan Creek
Road Name:	McMillan	MoF District:	
Crossing Location:		WSC or ILP:	180-007200
1:20 000 Map Sheet:	093G.097	Crew:	LC/EO
UTM:	10.515929.5977601		
Site#:	4A		
Project Number:	04-BC-0104		

Culvert Characteristics: Anti-beaver devices on both culverts. Right culvert has cobbles and gravel, 10cm at outlet. Left culvert has less cobble and gravel, less than 10cm deep.

Culvert Diameter (mm):	1200	Culvert Slope (%):	0.87
Culvert Length (m):	18.46	Culvert High Water (cm):	53
Culvert Material:	metal	Culvert Water Depth(cm):	25
Culvert Velocity (m/s):	0.84 0.8 0	Culvert Outfall (cm):	
Culvert Shape:	circular	Culvert Maintenance:	No
Culvert Wet Width (cm):	97	Fill Slope Depth(m):	0.7

Stream Characteristics: Riffle-pool morphology. Gravel and fines are the dominant substrate. The stream has a well defined channel with well vegetated banks.

Stream Reach #:		Stream Classification:	S3	Prelim. Class.:	☒
Pool Depth at Outfall (cm):		Blue Listed/Sign:			
Sediment Source/Degree:	Yes Low				
Sediment Comment:	Well vegetated banks.				

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	2.35	2.73	2.47	3.4	2.6	3.7	2.88
Bankfull Width (m):	2.6	2.47	2.37	3.6	2.9	4.1	3.01
Water Depth (cm):	29	17	33	25	30	21	25.83
Bankfull Depth (cm):	58	46	50	45	55	45	49.83
Velocity (m/s):							
Stream Gradient (%):	0.5			0.5			0.5
Fish Present:	No survey			No survey			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Rainbow Trout, Chinook Salmon, North			Rainbow Trout, Chinook Salmon, North			NA
Beaver Activity:							

Barrier Evaluation

Barrier:	Full
Barrier Type:	Velocity barrier.

Form A - Fish Passage - Culvert Inspection

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: The rearing habitat is good. There is suitable cover from overhanging vegetation and undercut banks. The flow is suitable. The spawning habitat is poor since gravels are plugged with fines downstream of the culvert. There is potential overwintering habitat in deep pools.

Fish passage is good through both culverts. Culverts are in good condition. Left culvert contained more of the flow. There are two culverts at the site and this is the record for the left culvert.

The average culvert velocity for the left culvert is 0.82m/s. The average culvert velocity for the right culvert is 0.77m/s. This exceeds the swimming capabilities of fish (Parker 2000).

This site was rated as HIGH using the FPCI Scoring Matrix. The culverts at this size are undersized. The culverts do not meet the recommended Q100 diameter estimate. The total area required is 5.12 m². The current culvert provides an area of 2.12 m². A structure of this size should be engineered, and will require a further site visit by a qualified engineer.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):	2700	Stream Length Above Barrier (m):	12788
Road Responsibility:		% Stream Barred:	84

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	10	H	10	Full	10	>= 1 km	10	> 70%	10	Yes	5
Single	0	M	0	Partial		< 1 km	0	51-70%	0	No	0
Other	0	L	0	Undeter	0	< 500 m	0	< 50%	0		

Total Score: 55

Form A - Fish Passage - Culvert Inspection

Date:	10/19/2004	Stream Name:	McMillan Creek
Road Name:	McMillan	MoF District:	
Crossing Location:		WSC or ILP:	180-007200
1:20 000 Map Sheet:	093G.097	Crew:	LC/EO
UTM:	10.515929.5977601		
Site#:	4B		
Project Number:	04-BC-0104		

Culvert Characteristics: Anti-beaver devices on both culverts. Right culvert has cobble and gravel. 10cm at outlet. Left culvert has less cobble and gravel. Less than 10cm deep.

Culvert Diameter (mm):	1200	Culvert Slope (%):	1.33
Culvert Length (m):	18.46	Culvert High Water (cm):	55
Culvert Material:	metal	Culvert Water Depth(cm):	16.5
Culvert Velocity (m/s):	0.77	Culvert Outfall (cm):	
Culvert Shape:	circular	Culvert Maintenance:	No
Culvert Wet Width (cm):	100	Fill Slope Depth(m):	0.7

Stream Characteristics: Riffle-pool morphology. Gravel and fines are dominant substrate. This stream has a well defined channel with well vegetated banks.

Stream Reach #:		Stream Classification:	S3	Prelim. Class.:	☒
Pool Depth at Outfall (cm):		Blue Listed/Sign:			
Sediment Source/Degree:	Yes	Low			
Sediment Comment:	Well vegetated ditch.				

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	2.35	2.73	2.47	3.4	2.6	4.7	3.04
Bankfull Width (m):	2.6	2.47	2.37	3.6	2.9	4.1	3.01
Water Depth (cm):	29	17	33	25	30	21	25.83
Bankfull Depth (cm):	58	46	50	45	55	45	49.83
Velocity (m/s):							
Stream Gradient (%):	0.5			0.5			0.5
Fish Present:	No survey			No survey			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Rainbow Trout, Chinook Salmon, North			Rainbow Trout, Chinook Salmon, North			NA
Beaver Activity:							

Barrier Evaluation

Barrier:	Full
Barrier Type:	Velocity barrier

Form A - Fish Passage - Culvert Inspection

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: The rearing habitat is good. There is suitable cover from overhanging vegetation and undercut banks. The flow is suitable. The spawning habitat is poor since gravels are plugged with fines downstream of the culvert. There is potential overwintering habitat in deep pools.

Fish passage is good through both culverts. Culverts are in good condition. Left culvert contained more of the flow. There are two culverts at the site and this is the record for the right culvert.

The average culvert velocity for the left culvert is 0.82m/s. The average culvert velocity for the right culvert is 0.77m/s. This exceeds the swimming capabilities of fish (Parker 2000).

This site was rated as HIGH using the FPCI Scoring Matrix. The culverts at this size are undersized. The culverts do not meet the recommended Q100 diameter estimate. The total area required is 5.12 m². The current culvert provides an area of 2.12m². A structure of this size should be engineered, and will require a further site visit by a qualified engineer.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):	2700	Stream Length Above Barrier (m):	12788
Road Responsibility:		% Stream Barred:	84

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	10	H	10	Full	10	>= 1 km	10	> 70%	10	Yes	5
Single	0	M	0	Partial		< 1 km	0	51-70%	0	No	0
Other	0	L	0	Undeter	0	< 500 m	0	< 50%	0		

Total Score: 55

Site 5 – McMillan Creek (Northwood Pulpmill Road): No Barrier, High Maintenance Issues



View of inlet



View of outlet

Site 5 – McMillan Creek (Northwood Pulpmill Road): No Barrier, High Maintenance Issues



View upstream of inlet.



View downstream of outlet

Site 5 - McMillan Creek (Northwood Pulpmill Road): No Barrier, High Maintenance Issues



View upstream of inlet.

Form A - Fish Passage - Culvert Inspection

Date:	10/19/2004	Stream Name:	McMillan Creek
Road Name:	Northwood Pulpmill Road	MoF District:	
Crossing Location:		WSC or ILP:	180-007200
1:20 000 Map Sheet:	093G.097	Crew:	LC/EO
UTM:	10.515980.5977901		
Site#:	5		
Project Number:	04-BC-0104		

Culvert Characteristics: Open at outlet (no top and angled). Beaver guard at inlet. Recent work done to inlet area (beaver dam removal maybe). Small woody debris with cobbles and boulders in the upper culvert.

Culvert Diameter (mm):	2000	Culvert Slope (%):	0.18
Culvert Length (m):	28.2	Culvert High Water (cm):	84
Culvert Material:	steel	Culvert Water Depth(cm):	37
Culvert Velocity (m/s):	0.36 0.47 0	Culvert Outfall (cm):	
Culvert Shape:	circular	Culvert Maintenance:	High
Culvert Wet Width (cm):	147	Fill Slope Depth(m):	2.2

Stream Characteristics: Beaver activity noted throughout the site. High organic component to bed material. Riffle-pool with very embedded gravels that are difficult to separate.

Stream Reach #:		Stream Classification:	S3	Prelim. Class.: ☒
Pool Depth at Outfall (cm):	84	Blue Listed/Sign:		
Sediment Source/Degree:	yes mod			
Sediment Comment:	Inlet area recently excavated, no vegetation in areas.			

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	4.1	4.1	3.6	3.6	3.3		
Bankfull Width (m):	5.1	6.5	4.3	4.6	3		
Water Depth (cm):	11	28	21	30	0	0	15
Bankfull Depth (cm):	54	70	61	90	70		
Velocity (m/s):							
Stream Gradient (%):	1			0.5			0.75
Fish Present:	No survey			No survey			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Rainbow Trout, Chinook Salmon, North			Rainbow Trout, Chinook Salmon, North			NA
Beaver Activity:	Trails/dams/fallen trees.			Trails/dams/fallen trees.			

Barrier Evaluation

Barrier:	None
Barrier Type:	Good depth and flow in culvert.

Form A - Fish Passage - Culvert Inspection

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: The spawning habitat is poor since gravels are present but strongly embedded in fines and organic present in the channel bed. The rearing habitat is moderate due to beaver activity, but good habitat complexity. The overwintering habitat is good since there is good flow and deep pools associated with beaver activity.

This inlet area of the culvert has been recently excavated with no vegetation in areas. Since this is contributing to sediment eroding into the stream some form of erosion control should be placed in these areas.

This crossing is undersized for the site. The Q100 recommended area is 10.13 m². The current culvert has an area of 3.14 m².

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):		Stream Length Above Barrier (m):	0
Road Responsibility:		% Stream Barred:	0

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	0	H	0	Full	0	>= 1 km	0	> 70%	0	Yes	0
Single	0	M	0	Partial	0	< 1 km	0	51-70%	0	No	0
Other	0	L	0	Undeter	0	< 500 m	0	< 50%	0		

Total Score:

Site 6 - McMillan Creek (Noranda Road East): No Barrier, High Maintenance Issues



View of inlet.



View of outlet.

Site 6 - McMillan Creek (Noranda Road East): No Barrier, High Maintenance Issues



View of inlet and upstream area.



View downstream of outlet.

Form A - Fish Passage - Culvert Inspection

Date:	10/20/2004	Stream Name:	McMillan Creek
Road Name:	Noranda Road	MoF District:	
Crossing Location:	N/A	WSC or ILP:	180-007200
1:20 000 Map Sheet:	093G.097	Crew:	SA/LC, SES/LMC
UTM:	10.516559.5979349		
Site#:	6		
Project Number:	04-BC-0104		

Culvert Characteristics: This culvert has an open bottom structure. There is a dip in culvert under road. The culvert has a natural stream bottom.

Culvert Diameter (mm):	2500	Culvert Slope (%):	0.47
Culvert Length (m):	30	Culvert High Water (cm):	58
Culvert Material:	metal	Culvert Water Depth(cm):	32
Culvert Velocity (m/s):	0.09 0.1 0	Culvert Outfall (cm):	
Culvert Shape:	Open bottom structure	Culvert Maintenance:	High
Culvert Wet Width (cm):	250	Fill Slope Depth(m):	4

Stream Characteristics: Upstream wetland, no defined channel. Downstream has wetland characteristics (Willow, low lying area, multiple channels may be present at higher water) Water at time of survey appears to be at bankfull depth of single channel-like depression.

Stream Reach #:		Stream Classification:	S3	Prelim. Class.:	☒
Pool Depth at Outfall (cm):	20	Blue Listed/Sign:			
Sediment Source/Degree:	Yes High				
Sediment Comment:	Recent work on upstream fill so that its no longer vegetated.				

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	4.7	6.2					
Bankfull Width (m):	6.1	6.9					
Water Depth (cm):	0	0	0	0	0	0	0
Bankfull Depth (cm):	51	34	69				
Velocity (m/s):							
Stream Gradient (%):	0.75						
Fish Present:	No survey			No survey			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Rainbow Trout, Chinook Salmon, North			Rainbow Trout, Chinook Salmon, North			NA
Beaver Activity:	Yes - dams upstream and downstream.			Recently removed upstream to lower w			

Barrier Evaluation

Barrier:	None.
Barrier Type:	Good depth and flow through culvert.

Site Photos

Roll#	Frame #	Direction	Comment
2	17	Inlet Upstrea	Outlet upstream photo = 11, Outlet downstream photo = 12. Natural channel downstream = 13, Downstream v
2	18	Inlet Downstr	

Form A - Fish Passage - Culvert Inspection

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: This culvert is an open bottom structure. The LL = 1300 and the width is 2500mm. There has been recent work on upstream beaver guard. Rearing habitat is moderate since there is sufficient depth, lots of cover with instream vegetation. However, beaver activity in area may impede movement. Spawning habitat is fair to moderate with suitable substrates present but fines have clogged interstitial spaces. The overwintering habitat is moderate with sufficient water depths but relatively few pools.

The upstream slope has had recent work done and is no longer vegetated. Thus, it is a high sediment source to the stream and should be seeded or some erosion control measure placed on the bank. In addition this crossing is undersized and does not meet the recommended Q100 diameter estimate. The Q100 area is 10.61 m². This structure has an open bottom structure with an approximate area of 3.25 m².

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):		Stream Length Above Barrier (m):	0
Road Responsibility:		% Stream Barred:	0

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	0	H	0	Full	0	>= 1 km	0	> 70%	0	Yes	0
Single	0	M	0	Partial	0	< 1 km	0	51-70%	0	No	0
Other	0	L	0	Undeter	0	< 500 m	0	< 50%	0		

Total Score:

**Site 7 - McMillan Creek(Old Summit Lake Road): No Barrier, No
Maintenance Issues**



View of inlet.



View of outlet.

Site 7 - McMillan Creek (Old Summit Lake Road): No Barrier, No Maintenance Issues



View upstream of inlet.



View downstream of outlet.

Form A - Fish Passage - Culvert Inspection

Date:	10/20/2004	Stream Name:	McMillan Creek
Road Name:	Old Summit Road	MoF District:	
Crossing Location:		WSC or ILP:	180-007200
1:20 000 Map Sheet:	093G.097	Crew:	LMC/SEA
UTM:	10.516982.5983630		
Site#:	7		
Project Number:	04-BC-0104		

Culvert Characteristics: Corrugated metal pipe, placed askew to road, constriction of channel. 2m downstream of outlet may cause backwatering of channel.

Culvert Diameter (mm):	1200	Culvert Slope (%):	0.52
Culvert Length (m):	61.6	Culvert High Water (cm):	57
Culvert Material:	metal	Culvert Water Depth(cm):	29
Culvert Velocity (m/s):	0.17	Culvert Outfall (cm):	0
Culvert Shape:	circular	Culvert Maintenance:	Mod
Culvert Wet Width (cm):	152	Fill Slope Depth(m):	1.5

Stream Characteristics: Well defined channel both upstream and downstream.

Stream Reach #:		Stream Classification:	S3	Prelim. Class.: ☒
Pool Depth at Outfall (cm):	30	Blue Listed/Sign:		
Sediment Source/Degree:	Yes	Low		
Sediment Comment:				

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	1.57	1.53	1.48	1.33	1.16	1.19	1.38
Bankfull Width (m):	2.05	1.46	1.59	1.6	1.23	1.55	1.58
Water Depth (cm):	38	33	420	23	22	15	91.83
Bankfull Depth (cm):	54	40	45	32	33	27	38.50
Velocity (m/s):							
Stream Gradient (%):	1			0.5			0.75
Fish Present:	No survey			No survey			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Rainbow Trout, Chinook Salmon, North			Rainbow Trout, Chinook Salmon, North			NA
Beaver Activity:	None			None			

Barrier Evaluation

Barrier:	None
Barrier Type:	

Site Photos

Roll#	Frame #	Direction	Comment
2	19	Outlet upstrea	Frame 20 is also outlet upstream. Outlet downstream photo is 21. Roll L3 frame 2 is inlet from road.
2	23	Inlet upstream	Roll L2. Also Roll L3 frame 1 has inlet upstream photo. Roll L2 frame 22 is inlet downstream photo.

Form A - Fish Passage - Culvert Inspection

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: The rearing habitat is fair with limited amount of cover, high turbidity but sufficient water depths. The spawning habitat is poor with no suitable substrate. Bed material is dominated by fines. The overwintering habitat is fair with an abundance of deep pools.

This culvert does not meet the recommended Q100 diameter estimate. A 1800 mm round culvert is recommended. The current culvert diameter is 1200 mm.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):	1800	Stream Length Above Barrier (m):	0
Road Responsibility:		% Stream Barred:	0

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	0	H	0	Full	0	>= 1 km	0	> 70%	0	Yes	0
Single	0	M	0	Partial	0	< 1 km	0	51-70%	0	No	0
Other	0	L	0	Undeter	0	< 500 m	0	< 50%	0		

Total Score:

Site 8 - McMillan Creek(Old Summit Lake Road): No Barrier, No Maintenance Issues



View upstream of inlet



View downstream of outlet.

Site 8 – McMillan Creek (Old Summit Lake Road): No Barrier, No Maintenance Issues



View of old culvert within the stream channel upstream of inlet.



View of old culvert within the stream channel facing inlet.

Form A - Fish Passage - Culvert Inspection

Date:	10/1/2004	Stream Name:	McMillan Creek
Road Name:	Old Summit Road	MoF District:	
Crossing Location:		WSC or ILP:	180-007200
1:20 000 Map Sheet:	093G.097	Crew:	LMC/SEA
UTM:	10.517032.5983894		
Site#:	8A		
Project Number:	04-BC-0104		

Culvert Characteristics: Two corrugated pipes. Right bank culvert compressed at inlet. Left bank compressed at outlet to a diameter of 58cm. Old culvert date 1937 removed in the past (cement blocks). Corrugated metal pipes remain in pond

Culvert Diameter (mm):	600	Culvert Slope (%):	1.47
Culvert Length (m):	16	Culvert High Water (cm):	
Culvert Material:	Metal	Culvert Water Depth (cm):	52
Culvert Velocity (m/s):	0.09	Culvert Outfall (cm):	0
Culvert Shape:	circular	Culvert Maintenance:	No
Culvert Wet Width (cm):	58	Fill Slope Depth (m):	2

Stream Characteristics: Pool at outlet is 3.7m (wetted width). Poorly defined channel (not confined). Downstream of culverts, there are multiple channels. Wetland exists upstream of culvert due to beaver dam 15m upstream of inlets.

Stream Reach #:		Stream Classification:	S3	Prelim. Class.:	☒	
Pool Depth at Outfall (cm):	76	Blue Listed/Sign:				
Sediment Source/Degree:	Yes	Low				
Sediment Comment:						

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	1.38	2.82	2.8				
Bankfull Width (m):	2.44	3.6	3.2				
Water Depth (cm):	19	13	10	0	0	0	7
Bankfull Depth (cm):	32	28	19				
Velocity (m/s):							
Stream Gradient (%):	5						
Fish Present:	No survey			No survey			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Rainbow Trout, Chinook Salmon, North			Rainbow Trout, Chinook Salmon, North			NA
Beaver Activity:	No			Dam 15 m upstream of inlet			

Barrier Evaluation

Barrier:	None
Barrier Type:	Water levels within the right culvert are too high to assess whether free space exists in culvert. Water velocity appears to be very slow (not assessed, see above). Possibility of blockage within culvert.

Site Photos

Roll#	Frame #	Direction	Comment
3	4	Inlet upstream	from road. Inlet downstream photo #7. Outlet upstream photo #6. Outlet downstream photo #3 from road. N

Form A - Fish Passage - Culvert Inspection

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: The measurements above culvert were not taken as there was a beaver dam 15m upstream. This created multiple channels above culvert.
The culvert water velocity may be irrelevant since culvert outlets are submerged in a large pond. The water depth is higher than the midpoint. The right bank velocity was not assessed as water level were too high.
Rearing habitat is moderate since lots of cover downstream of culvert but very high turbidity, low habitat complexity. Spawning habitat is poor since there is a limited amount of suitable substrate and abundant fine material. Overwintering habitat is poor with shallow water depths downstream of pool at outlet.
Culvert wetted width may be irrelevant since the water depth is higher than the midpoint. The culvert outlets are submerged in large pond.
This is the record for the left culvert.

The current culvert at the road crossing does not meet the recommended Q100 diameter estimate. The total culvert area required is 2.45m². The current culverts have a combined area of 0.54. The recommended Q100 estimated diameter for a replacement structure is a 2060 x 1520 elliptical/pipe arch culvert or a 2000mm round culvert. A structure of this size should be engineered, and will require a further site visit by a qualified engineer to determine the appropriate structure required for this site.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):	2000	Stream Length Above Barrier (m):	0
Road Responsibility:		% Stream Barred:	0

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant		H	0	Full	0	>= 1 km	0	> 70%	0	Yes	0
Single	0	M	0	Partial	0	< 1 km	0	51-70%	0	No	0
Other	0	L	0	Undeter		< 500 m	0	< 50%	0		

Total Score:

Comments:

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):	2450	Stream Length Above Barrier (m):	0
Road Responsibility:		% Stream Barred:	0

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	0	H	0	Full	0	>= 1 km	0	> 70%	0	Yes	0
Single	0	M	0	Partial	0	< 1 km	0	51-70%	0	No	0
Other	0	L	0	Undeter	0	< 500 m	0	< 50%	0		

Total Score:

Form A - Fish Passage - Culvert Inspection

Date:	10/20/2004	Stream Name:	McMillan Creek
Road Name:	Old Summit Road	MoF District:	
Crossing Location:		WSC or ILP:	180-007200
1:20 000 Map Sheet:	093G.097	Crew:	LMC/SEA
UTM:	10.517032.5983894		
Site#:	8B		
Project Number:	04-BC-0104		

Culvert Characteristics: Two corrugated pipes. Right bank culvert compressed at inlet. Left bank compressed at outlet to a diameter of 58cm. Old culvert date 1937 removed in the past (cement blocks). Corrugated metal pipes remain in pond

Culvert Diameter (mm):	600	Culvert Slope (%):	0.3
Culvert Length (m):	16	Culvert High Water (cm):	
Culvert Material:	Metal	Culvert Water Depth (cm):	43
Culvert Velocity (m/s):		Culvert Outfall (cm):	
Culvert Shape:	circular	Culvert Maintenance:	No
Culvert Wet Width (cm):	60	Fill Slope Depth (m):	2

Stream Characteristics: Pool at outlet is 3.7m (wetted width). Poorly defined channel (not confined). Downstream of culverts, there are multiple channels. Wetland exists upstream of culvert due to beaver dam 15m upstream of inlets.

Stream Reach #:		Stream Classification:	S3	Prelim. Class.:	☒
Pool Depth at Outfall (cm):	76	Blue Listed/Sign:			
Sediment Source/Degree:	Yes	Low			
Sediment Comment:					

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	1.38	1.82	2.8				
Bankfull Width (m):	2.44	3.6	3.2				
Water Depth (cm):	19	13	10	0	0	0	7
Bankfull Depth (cm):	32	28	19				
Velocity (m/s):							
Stream Gradient (%):	5			1			3
Fish Present:	No survey			No survey			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Rainbow Trout, Chinook Salmon, North			Rainbow Trout, Chinook Salmon, North			NA
Beaver Activity:	None observed.			Dam 15m upstream of inlet.			

Barrier Evaluation

Barrier:	None
Barrier Type:	Water levels within right culvert are too high to assess whether free space exists in culvert. Water velocity appears to be very slow (not assessed, see above). Possibility of blockage within culvert.

Site Photos

Roll#	Frame #	Direction	Comment
3	4	Inlet upstream	rom road. Inlet downstream photo #7. Outlet upstream photo #6. Outlet downstream photo #3 from road. Na

Form A - Fish Passage - Culvert Inspection

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: The measurements above culvert were not taken as there was a beaver dam 15m upstream. This created multiple channels above culvert.
 The culvert water velocity may be irrelevant since culvert outlets are submerged in a large pond. The water depth is higher than the midpoint. The right bank velocity was not assessed as water level were too high.
 Rearing habitat is moderate since lots of cover downstream of culvert but very high turbidity, low habitat complexity. Spawning habitat is poor since there is a limited amount of suitable substrate and abundant fine material. Overwintering habitat is poor with shallow water depths downstream of pool at outlet.
 Culvert wetted width may be irrelevant since the water depth is higher than the midpoint. The culvert outlets are submerged in large pond.
 This is the record for the right culvert.

The current culvert at the road crossing does not meet the recommended Q100 diameter estimate. The total culvert area required is 2.45m². The current culverts have a combined area of 0.54. The recommended Q100 estimated diameter for a replacement structure is a 2060 x 1520 elliptical/pipe arch culvert or a 2000mm round culvert. A structure of this size should be engineered, and will require a further site visit by a qualified engineer to determine the appropriate structure required for this site.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):	2000	Stream Length Above Barrier (m):	0
Road Responsibility:		% Stream Barred:	0

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	0	H	0	Full	0	>= 1 km	0	> 70%	0	Yes	0
Single	0	M	0	Partial	0	< 1 km	0	51-70%	0	No	0
Other	0	L	0	Undeter	0	< 500 m	0	< 50%	0		

Total Score:

Site 9 - McMillan Creek (Old Summit Lake Road): No Barrier, No Maintenance Issues



View of inlets.



View of outlets

Form A - Fish Passage - Culvert Inspection

Date:	10/20/2004	Stream Name:	McMillan Creek
Road Name:	Old Summit Road	MoF District:	
Crossing Location:		WSC or ILP:	180-007200
1:20 000 Map Sheet:	093G.097	Crew:	LMC/SEA
UTM:	10.516966.5984504		
Site#:	9A		
Project Number:	04-BC-0104		

Culvert Characteristics: Two corrugated metal pipes. Right culvert is dry (except for small amount of ice at inlet). Beaver guards both on inlet and outlets. Outlet guard may impede fish movement.

Culvert Diameter (mm):	900	Culvert Slope (%):	0.71
Culvert Length (m):	18.4	Culvert High Water (cm):	58
Culvert Material:	Metal	Culvert Water Depth(cm):	8.5
Culvert Velocity (m/s):	0.43	Culvert Outfall (cm):	9
Culvert Shape:	circular	Culvert Maintenance:	No
Culvert Wet Width (cm):	54	Fill Slope Depth(m):	1

Stream Characteristics: Culverts not aligned with stream. Stream is in ditchline both upstream and downstream of culverts.

Stream Reach #:		Stream Classification:	S3	Prelim. Class.: ☒
Pool Depth at Outfall (cm):	27	Blue Listed/Sign:		
Sediment Source/Degree:	Yes	Low		
Sediment Comment:				

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	1.25	0.98	1.56	1.48	1.62	1.52	1.40
Bankfull Width (m):	1.51	1.46	1.89	1.63	1.73	1.8	1.67
Water Depth (cm):	15	16	11	22	29	19	18.67
Bankfull Depth (cm):	41	43	30	35	42	34	37.50
Velocity (m/s):							
Stream Gradient (%):	1.5			1			1.25
Fish Present:	No survey			No survey			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Rainbow Trout, Chinook Salmon, North			Rainbow Trout, Chinook Salmon, North			NA
Beaver Activity:	None			None			

Barrier Evaluation

Barrier:	None
Barrier Type:	

Site Photos

Roll#	Frame #	Direction	Comment
3	12	Inlet Upstrea	10, 11 outlet upstream photo. 9 Outlet downstream from road. 11 Natural downstream channel. 14 Natural u
3	13	Inlet downstre	

Form A - Fish Passage - Culvert Inspection

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: Rearing habitat is moderate with lots of cover but low habitat complexity due to channel lying in ditchline.
Spawning habitat is poor since limited suitable substrates with abundant fine material. Overwintering habitat is poor since shallow water depths and lack of pools except at inlet and outlet.
This record is for the left culvert.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):		Stream Length Above Barrier (m):	0
Road Responsibility:		% Stream Barred:	0

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	0	H	0	Full	0	>= 1 km	0	> 70%	0	Yes	0
Single	0	M	0	Partial	0	< 1 km	0	51-70%	0	No	0
Other	0	L	0	Undeter	0	< 500 m	0	< 50%	0		

Total Score:

Form A - Fish Passage - Culvert Inspection

Date:	10/20/2004	Stream Name:	McMillan Creek
Road Name:	Old Summit Road	MoF District:	
Crossing Location:		WSC or ILP:	180-007200
1:20 000 Map Sheet:	093G.097	Crew:	LMC/SEA
UTM:	10.516966.5984504		
Site#:	9B		
Project Number:	04-BC-0104		

Culvert Characteristics: Two corrugated metal pipes. Right culvert is dry (except for small amount of ice at inlet). Beaver guards both on inlet and outlets. Outlet guard may impede fish movement.

Culvert Diameter (mm):	900	Culvert Slope (%):	0.33
Culvert Length (m):	18.4	Culvert High Water (cm):	37
Culvert Material:	Metal	Culvert Water Depth(cm):	
Culvert Velocity (m/s):	0.44	Culvert Outfall (cm):	
Culvert Shape:	circular	Culvert Maintenance:	No
Culvert Wet Width (cm):	0	Fill Slope Depth(m):	1

Stream Characteristics: Culverts not aligned upstream. Stream is in ditchline both upstream and downstream of culverts.

Stream Reach #:		Stream Classification:	S3	Prelim. Class.:	☒
Pool Depth at Outfall (cm):	27	Blue Listed/Sign:			
Sediment Source/Degree:	Yes	Low			
Sediment Comment:					

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	1.25	0.98	1.56	1.48	1.62	1.52	1.40
Bankfull Width (m):	1.51	1.46	1.89	1.63	1.73	1.8	1.67
Water Depth (cm):	15	16	11	22	29	19	18.67
Bankfull Depth (cm):	41	43	30	35	42	34	37.50
Velocity (m/s):							
Stream Gradient (%):	1.5			1			1.25
Fish Present:	No survey			No survey			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Rainbow Trout, Chinook Salmon, North			Rainbow Trout, Chinook Salmon, North			NA
Beaver Activity:	No			No			

Barrier Evaluation

Barrier:	None
Barrier Type:	

Site Photos

Roll#	Frame #	Direction	Comment
3	12	Inlet upstream	10, 11 outlet upstream photo. 9 Outlet downstream from road. 11 Natural downstream channel. 14 Natural u

Form A - Fish Passage - Culvert Inspection

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: Rearing habitat is moderate with lots of cover but low habitat complexity due to channel lying in ditchline.
Spawning habitat is poor since limited suitable substrates with abundant fine material. Overwintering habitat is poor since shallow water depths and lack of pools except at inlet and outlet.
This record is for the right culvert.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):		Stream Length Above Barrier (m):	0
Road Responsibility:		% Stream Barred:	0

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	0	H	0	Full	0	>= 1 km	0	> 70%	0	Yes	0
Single	0	M	0	Partial	0	< 1 km	0	51-70%	0	No	0
Other	0	L	0	Undeter	0	< 500 m	0	< 50%	0		

Total Score:

Site 10 - McMillan Creek (Goose Country Road): No Barrier, No Maintenance Issues



View of inlets.



View of outlets.

Site 10 - McMillan Creek (Goose Country Road): No Barrier, No Maintenance Issues



View upstream of inlet.



View downstream of outlet.

Form A - Fish Passage - Culvert Inspection

Date:	10/20/2004	Stream Name:	McMillan Creek
Road Name:	Old Summit Road	MoF District:	
Crossing Location:		WSC or ILP:	180-007200
1:20 000 Map Sheet:	093G.097	Crew:	LMC/SEA
UTM:	10.517060.5984732		
Site#:	10A		
Project Number:	04-BC-0104		

Culvert Characteristics: Two corrugated metal pipes. There are beaver guards on left and right bank culvert. There is a small amount of deformation on inlet and outlet of left bank culvert. On the right bank culvert the beaver guard has been pulled off.

Culvert Diameter (mm):	800	Culvert Slope (%):	2.28
Culvert Length (m):	9	Culvert High Water (cm):	39
Culvert Material:	Metal	Culvert Water Depth(cm):	10
Culvert Velocity (m/s):	0.73 0.79 0.08	Culvert Outfall (cm):	0
Culvert Shape:	Circular	Culvert Maintenance:	No
Culvert Wet Width (cm):	48	Fill Slope Depth(m):	0.5

Stream Characteristics: This stream is unconfined with vascular vegetation within the channel. There is a lot of overhanging vegetation. It appears that ditch water also enters the stream at inlets.

Stream Reach #:		Stream Classification:	S3	Prelim. Class.: ☒
Pool Depth at Outfall (cm):	0	Blue Listed/Sign:		
Sediment Source/Degree:	Yes Low			
Sediment Comment:				

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	1.87	1.86	1.8	1.73	2.19	1.92	1.89
Bankfull Width (m):	2.7	1.76	2.11	1.87	2.43	2.3	2.20
Water Depth (cm):	11	7	6	30	28	25	17.83
Bankfull Depth (cm):	26	21	26	35	35	32	29.17
Velocity (m/s):							
Stream Gradient (%):	1			1			1
Fish Present:	No survey			No survey			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Rainbow Trout, Chinook Salmon, North			Rainbow Trout, Chinook Salmon, North			NA
Beaver Activity:	None			None			

Barrier Evaluation

Barrier:	None
Barrier Type:	

Site Photos

Roll#	Frame #	Direction	Comment
3	20	Inlet upstrea	Inlet downstream photo. Outlet upstream photo 16. Outlet downstream photo 15. Downstream from road 17.

Form A - Fish Passage - Culvert Inspection

1501	17	d/s	Outlet
1501	18	d/s	Inlet
1501	19	u/s	View of stream channel above crossing

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: The rearing habitat is fair with lots of cover but low habitat complexity and high amounts of fines. Upstream is dominated by silts and downstream is dominated by clays.
The spawning habitat is poor with limited suitable substrate but high amount of fines.
The overwintering habitat is poor since flows are generally low.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):		Stream Length Above Barrier (m):	
Road Responsibility:		% Stream Barred:	

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant		H		Full		>= 1 km		> 70%		Yes	
Single		M		Partial		< 1 km		51-70%		No	0
Other		L		Undeter		< 500 m		< 50%			

Total Score:

Form A - Fish Passage - Culvert Inspection

Date:	10/20/2004	Stream Name:	McMillan Creek
Road Name:	Old Summit Road	MoF District:	
Crossing Location:		WSC or ILP:	180-007200
1:20 000 Map Sheet:	093G.097	Crew:	LMC/SEA
UTM:	10.517060.5984732		
Site#:	10B		
Project Number:	04-BC-0104		

Culvert Characteristics: Two corrugated metal pipes. There are beaver guards on left and right bank culvert. There is a small amount of deformation on inlet and outlet of left bank culvert. On the right bank culvert the beaver guard has been pulled off.

Culvert Diameter (mm):	600	Culvert Slope (%):	0.93
Culvert Length (m):	9.7	Culvert High Water (cm):	39
Culvert Material:	Metal	Culvert Water Depth(cm):	18.5
Culvert Velocity (m/s):	0.33 0.35 0.23	Culvert Outfall (cm):	0
Culvert Shape:	Circular	Culvert Maintenance:	No
Culvert Wet Width (cm):	53	Fill Slope Depth(m):	0.5

Stream Characteristics: This stream is unconfined with vascular vegetation within the channel. There is a lot of overhanging vegetation. It appears that ditch water also enters the stream at inlets.

Stream Reach #:		Stream Classification:	S3	Prelim. Class.:	☒
Pool Depth at Outfall (cm):		Blue Listed/Sign:			
Sediment Source/Degree:	Yes Low				
Sediment Comment:					

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	1.87	1.86	1.8	1.73	2.19	1.92	1.89
Bankfull Width (m):	2.7	1.76	2.11	1.87	2.43	2.3	2.20
Water Depth (cm):	11	7	6	30	28	25	17.83
Bankfull Depth (cm):	26	21	26	35	35	32	29.17
Velocity (m/s):							
Stream Gradient (%):	1			1			1
Fish Present:	No survey			No survey			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Rainbow Trout, Chinook Salmon, North			Rainbow Trout, Chinook Salmon, North			NA
Beaver Activity:	None			None			

Barrier Evaluation

Barrier:	None
Barrier Type:	

Site Photos

Roll#	Frame #	Direction	Comment
3	20	Inlet upstream	Inlet downstream 19, Outlet upstream 16, Outlet downstream 15, Downstream from road 17, Upstream from road 18

Form A - Fish Passage - Culvert Inspection

1501	21	u/s	Inlet
1501	22	d/s	Outlet
1501	23	u/s	Outlet

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: The rearing habitat is fair with lots of cover but low habitat complexity and high amounts of fines. Upstream is dominated by silts and downstream is dominated by clays.
The spawning habitat is poor with limited suitable substrate but high amount of fines.
The overwintering habitat is poor since flows are generally low.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):		Stream Length Above Barrier (m):	
Road Responsibility:		% Stream Barred:	

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant		H		Full		>= 1 km		> 70%		Yes	
Single		M		Partial		< 1 km		51-70%		No	0
Other		L		Undeter		< 500 m		< 50%			

Total Score:

Site 11 - McMillan Creek (Old Summit Lake Road): No Barrier, No Maintenance Issues



View of inlets



View of right bank outlet.

Site 11 - McMillan Creek (Old Summit Lake Road): No Barrier, No Maintenance Issues



View upstream of inlet.



View downstream of outlet.

Form A - Fish Passage - Culvert Inspection

Date:	10/21/2004	Stream Name:	McMillan Creek
Road Name:	Old Summit Lake Road	MoF District:	
Crossing Location:		WSC or ILP:	180-007200
1:20 000 Map Sheet:	093G.097	Crew:	LMC/SEA
UTM:	10.516969.5985170		
Site#:	11A		
Project Number:	04-BC-0104		

Culvert Characteristics: Two corrugated metal pipes. Right bank culvert has a small amount of water (6cm). It does not appear to be flowing as top 2cm is frozen. The majority of flow uses the left bank culvert.

Culvert Diameter (mm):	900	Culvert Slope (%):	0.94
Culvert Length (m):	17	Culvert High Water (cm):	43
Culvert Material:	Metal	Culvert Water Depth(cm):	8
Culvert Velocity (m/s):	0.4	Culvert Outfall (cm):	7
Culvert Shape:	Circular	Culvert Maintenance:	No
Culvert Wet Width (cm):	55	Fill Slope Depth(m):	2

Stream Characteristics: There is no measureable flow due to ice cover of the right bank culvert. The left bank culvert flow could not be measured since a stick jam existed midway through the culvert.

Stream Reach #:		Stream Classification:	S4	Prelim. Class.:	☒
Pool Depth at Outfall (cm):	15	Blue Listed/Sign:			
Sediment Source/Degree:	Yes	Low			
Sediment Comment:					

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	1.02	1.01	1.13	2.01	1.16	1.43	1.29
Bankfull Width (m):	1.04	1.09	1.24	2.09	1.32	1.46	1.37
Water Depth (cm):	15.5	8	11	17	16	16	13.92
Bankfull Depth (cm):	21	16	19	27	28	22	22.17
Velocity (m/s):							
Stream Gradient (%):	0.5			1			0.75
Fish Present:	No survey			No survey			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Rainbow Trout, Chinook Salmon, North			Rainbow Trout, Chinook Salmon, North			NA
Beaver Activity:	None			None			

Barrier Evaluation

Barrier:	None
Barrier Type:	

Site Photos

Roll#	Frame #	Direction	Comment
4	7	Inlet upstream	Inlet downstream 6, Outlet upstream 1(Right bank), Outlet upstream (Both) 2, Outlet downstream 3, Downstre

Form A - Fish Passage - Culvert Inspection

1501	24	d/s	Outlet
1501	25	u/s	Outlet
12601	17	d/s	Outlet at railway d/s of site
12601	18	u/s	View of outlet d/s of site

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: The culvert water velocity could not be measured since there was ice cover on the right bank culvert. The left bank culvert had a stick jam midway through the culvert.

The spawning habitat is moderate with sufficient water depths and moderate cover. The spawning habitat is poor with no suitable substrate. The overwintering habitat is poor with no deep pools.

This record is for the left culvert.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):		Stream Length Above Barrier (m):	
Road Responsibility:		% Stream Barred:	

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant		H		Full		>= 1 km		> 70%		Yes	
Single		M		Partial		< 1 km		51-70%		No	0
Other		L		Undeter		< 500 m		< 50%			

Total Score:

Form A - Fish Passage - Culvert Inspection

Date:	10/21/2004	Stream Name:	McMillan Creek
Road Name:	Old Summit Lake Road	MoF District:	
Crossing Location:		WSC or ILP:	180-007200
1:20 000 Map Sheet:	093G.097	Crew:	LMC/SEA
UTM:	10.516969.5985170		
Site#:	11B		
Project Number:	04-BC-0104		

Culvert Characteristics: Two corrugated metal pipes. Right bank culvert has a small amount of water (6cm). It does not appear to be flowing as top 2cm is frozen. The majority of flow uses the left bank culvert.

Culvert Diameter (mm):	1200	Culvert Slope (%):	0.92
Culvert Length (m):	16.8	Culvert High Water (cm):	30
Culvert Material:	Metal	Culvert Water Depth(cm):	6
Culvert Velocity (m/s):		Culvert Outfall (cm):	
Culvert Shape:	Circular	Culvert Maintenance:	No
Culvert Wet Width (cm):	79	Fill Slope Depth(m):	2

Stream Characteristics: There is no measureable flow due to ice cover of the right bank culvert. The left bank culvert flow could not be measured since a stick jam existed midway through the culvert.

Stream Reach #:		Stream Classification:	S4	Prelim. Class.:	☒
Pool Depth at Outfall (cm):		Blue Listed/Sign:			
Sediment Source/Degree:	Yes	Low			
Sediment Comment:					

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	1.02	1.01	1.13	2.01	1.16	1.43	1.29
Bankfull Width (m):	1.04	1.09	1.24	2.09	1.32	1.46	1.37
Water Depth (cm):	15.5	8	11	17	16	16	13.92
Bankfull Depth (cm):	21	16	19	27	28	22	22.17
Velocity (m/s):							
Stream Gradient (%):	0.5			1			0.75
Fish Present:	No survey			No survey			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Rainbow Trout, Chinook Salmon, North			Rainbow Trout, Chinook Salmon, North			NA
Beaver Activity:	None			None			

Barrier Evaluation

Barrier:	None
Barrier Type:	

Site Photos

Roll#	Frame #	Direction	Comment
4	7	Inlet upstream	Inlet downstream 6, Outlet upstream 1(Right bank), Outlet upstream (Both) 2, Outlet downstream 3, Downstre

Form A - Fish Passage - Culvert Inspection

1901	8	d/s	Inlet
1901	9	d/s	Outlet

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: The culvert water velocity could not be measured since there was ice cover on the right bank culvert. The left bank culvert had a stick jam midway through the culvert.

The spawning habitat is moderate with sufficient water depths and moderate cover. The spawning habitat is poor with no suitable substrate. The overwintering habitat is poor with no deep pools.

This record is for the right culvert.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):		Stream Length Above Barrier (m):	
Road Responsibility:		% Stream Barred:	

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant		H		Full		≥ 1 km		> 70%		Yes	
Single		M		Partial		< 1 km		51-70%		No	0
Other		L		Undeter		< 500 m		< 50%			

Total Score:

Site 12 - Unnamed Stream (Indian Reserve Road): Full Seasonal Barrier, High Priority



View of inlets



View of outlets.

Site 12 - Unnamed Stream (Indian Reserve Road): Full Seasonal Barrier, High Priority



View upstream of inlets.



View downstream of outlets.

Form A - Fish Passage - Culvert Inspection

Date:	10/21/2004	Stream Name:	Unnamed Stream
Road Name:	Indian Reserve Road (near Canfor)	MoF District:	
Crossing Location:		WSC or ILP:	100-58340-31000
1:20 000 Map Sheet:	093G.097	Crew:	LMC/SEA
UTM:	10.520486.5984396		
Site#:	12A - Railway culverts		
Project Number:	04-BC-0104		

Culvert Characteristics: Two corrugated metal pipes are present. Left bank culvert carries the majority of flow. The right bank culvert water is frozen within culvert. No measureable flow at time of survey. It likely only carries significant flow during

Culvert Diameter (mm):	1200	Culvert Slope (%):	3
Culvert Length (m):	19	Culvert High Water (cm):	26
Culvert Material:	Metal	Culvert Water Depth(cm):	9
Culvert Velocity (m/s):	0.74 1.03 1	Culvert Outfall (cm):	49
Culvert Shape:	Circular	Culvert Maintenance:	No
Culvert Wet Width (cm):	58	Fill Slope Depth(m):	1

Culvert Characteristics: The left culvert has a significant bend part way through. Bed material has been deposited in the last half of the culvert. Steep gradient below inlet.

Culvert Diameter (mm):	1200	Culvert Slope (%):	5.1
Culvert Length (m):	21.7	Culvert High Water (cm):	20
Culvert Material:	Corrugated Metal	Culvert Water Depth(cm):	5
Culvert Velocity (m/s):	0.7 0.7	Culvert Outfall (cm):	5
Culvert Shape:	Circular	Culvert Maintenance:	low
Culvert Wet Width (cm):	100	Fill Slope Depth(m):	5

Stream Characteristics:

Stream Reach #:		Stream Classification:	S3	Prelim. Class.:	☒
Pool Depth at Outfall (cm):	52	Blue Listed/Sign:			
Sediment Source/Degree:	Yes Mod				
Sediment Comment:	Lack of vegetation on railway fill.				

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	2.65	1.95	2.3	1.9	1.67	3.13	2.27
Bankfull Width (m):	2.84	2.7	3.2	2.3	3.7	3.6	3.06
Water Depth (cm):	13	13	11	14	13	14	13
Bankfull Depth (cm):	51	37	38	26	26	23	33.50
Velocity (m/s):							
Stream Gradient (%):	5			5			5
Fish Present:	Yes			Yes			NA
Fish_Method:	Not sampled			Electrofishing			NA
Sampling Effort (t):				805			NA
Species Present:	Rainbow Trout			Rainbow Trout			NA
Beaver Activity:	None			None			

Barrier Evaluation

Barrier:	Full
Barrier Type:	There is a substantial outfall drop. It is also a velocity barrier.

Form A - Fish Passage - Culvert Inspection

Barrier Evaluation

Barrier:	Full
Barrier Type:	Velocity / Water depth at inlet.

Site Photos

Roll#	Frame #	Direction	Comment
4	12	Inlet upstream	Inlet downstream 13, Outlet upstream 8 (Right bank) 9 (Left bank), 10 (both). Outlet downstream 11.
1901	22	d/s	Outlet
1901	23	u/s	Outlet

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: The culverts at this site are undersized. Although fish were captured upstream of the crossing, it is felt that this culvert may pose a velocity barrier at certain times of the year. The average culvert velocity was 0.875 m/s which exceeds the maximum swimming speed of juvenile fish (Parker 2000). The left culvert outfall is 46 cm and the outfall pool depth is 27cm. This exceeds the jumping ability of adult and juvenile fish since the outfall pool depth is quite shallow (Parker 2000). The right culvert outfall is 49 cm and the outfall pool depth is 52 cm.

The spawning habitat is fair with suitable gravels present. However, currently gravels are clogged with fines/clay. The rearing habitat is moderate to good with high habitat complexity but not much variety in depths throughout sites. The overwintering habitat is poor since there are no deep pools. This site is close to the Fraser River so the fish would probably overwinter there.

This record is the left culvert.

This site was ranked as HIGH priority using the FPCI Scoring Matrix. The current culvert does not meet the recommended Q100 estimated diameter. The recommended Q100 estimated diameter for a replacement structure is a 2000 mm round culvert or a 2440 x 1750 mm elliptical/pipe arch culvert. The total culvert area required is 3.11 m². The two culverts at the site give a combined area of 2.12 m². A structure of this size should be engineered, and will require a further site visit by a qualified engineer to determine the appropriate structure for this site.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):	2000	Stream Length Above Barrier (m):	3964
Road Responsibility:		% Stream Barred:	96

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	10	H	10	Full	10	>= 1 km	10	> 70%	10	Yes	
Single		M		Partial		< 1 km		51-70%		No	0
Other		L		Undeter		< 500 m		< 50%			

Total Score: 50

Comments: Values below are for the Left Culvert.

Office Calculations: (* to be completed for full and partial barriers only)

Form A - Fish Passage - Culvert Inspection

Q100 Diameter Estimate (mm):	1200	Stream Length Above Barrier (m):	300
Road Responsibility:	The Pas Lumber Ltd.	% Stream Barred:	36

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	10	H		Full	10	>= 1 km		> 70%		Yes	
Single		M	6	Partial		< 1 km		51-70%		No	0
Other		L		Undeter		< 500 m	3	< 50%	3		

Total Score: 32

Form A - Fish Passage - Culvert Inspection

Date:	10/21/2004	Stream Name:	Unnamed Stream
Road Name:	Indian Reserve Road (near Canfor)	MoF District:	
Crossing Location:		WSC or ILP:	100-58340-31000
1:20 000 Map Sheet:	093G.097	Crew:	LMC/SEA
UTM:	10.520486.5984396		
Site#:	12B - Railway culverts		
Project Number:	04-BC-0104		

Culvert Characteristics: Two corrugated metal pipes are present. Left bank culvert carries the majority of flow. The right bank culvert water is frozen within culvert. No measureable flow at time of survey. It likely only carries significant flow during

Culvert Diameter (mm):	1200	Culvert Slope (%):	4.15
Culvert Length (m):	19.5	Culvert High Water (cm):	22
Culvert Material:	Metal	Culvert Water Depth(cm):	
Culvert Velocity (m/s):	0.74 1.01 0.5	Culvert Outfall (cm):	46
Culvert Shape:	Circular	Culvert Maintenance:	No
Culvert Wet Width (cm):	43	Fill Slope Depth(m):	1

Culvert Characteristics: Two culverts are present at this crossing. Both culverts have substrate built up at inlets, creating drops of 30 cm into inlets. This is the Right culvert.

Culvert Diameter (mm):	1200	Culvert Slope (%):	5
Culvert Length (m):	14.5	Culvert High Water (cm):	30
Culvert Material:	Corrugated Metal	Culvert Water Depth(cm):	45
Culvert Velocity (m/s):	1.2 1.2	Culvert Outfall (cm):	0.65
Culvert Shape:	Circular	Culvert Maintenance:	low
Culvert Wet Width (cm):	60	Fill Slope Depth(m):	2.5

Stream Characteristics:

Stream Reach #:		Stream Classification:	S3	Prelim. Class.: ☒
Pool Depth at Outfall (cm):	27	Blue Listed/Sign:		
Sediment Source/Degree:	Yes Mod			
Sediment Comment:	Lack of vegetation on railway fill.			

Stream Characteristics: See record 1.

Stream Reach #:	N/A	Stream Classification:	PS3	Prelim. Class.: ☒
Pool Depth at Outfall (cm):	0.5	Blue Listed/Sign:	BT and GR in Table River	
Sediment Source/Degree:	Yes Low			
Sediment Comment:	Road run off.			

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	2.65	1.95	2.3	1.9	1.67	3.13	2.27
Bankfull Width (m):	2.84	2.7	3.2	2.3	3.7	3.6	3.06
Water Depth (cm):	13	13	11	14	13	14	13
Bankfull Depth (cm):	51	37	38	26	26	23	33.50
Velocity (m/s):							
Stream Gradient (%):	5			5			5
Fish Present:	Yes			Yes			NA
Fish_Method:				Electrofishing			NA
Sampling Effort (t):				805			NA
Species Present:	Rainbow Trout			Rainbow Trout			NA
Beaver Activity:	None			None			

Form A - Fish Passage - Culvert Inspection

Barrier Evaluation

Barrier:	Full
Barrier Type:	There is a substantial outfall drop. It is a velocity barrier.

Site Photos

Roll#	Frame #	Direction	Comment
4	12	Inlet upstream	Inlet downstream 13, Outlet upstream 8(Right bank) 9(Left bank), 10 (both). Outlet downstream 11.
12601	15	u/s	Inlet
12601	16	d/s	Inlet

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: The culverts at this site are undersized. Although fish were captured upstream of the crossing, it is felt that this culvert may pose a velocity barrier at certain times of the year. The average culvert velocity was 0.875m/s which exceeds the maximum swimming speed of juvenile fish (Parker 2000). The left culvert outfall is 46 cm and the outfall pool depth is 27cm. This exceeds the jumping ability of adult and juvenile fish since the outfall pool depth is quite shallow (Parker 2000). The right culvert outfall is 49cm and the outfall pool depth is 52cm.

The spawning habitat is fair with suitable gravels present. However, currently gravels are clogged with fines/clay. The rearing habitat is moderate to good with high habitat complexity but not much variety in depths throughout sites. The overwintering habitat is poor since there are no deep pools. This site is close to the Fraser River so the fish would probably overwinter there. This record is the right culvert.

This site was ranked as HIGH priority using the FPCI Scoring Matrix. The current culvert does not meet the recommended Q100 estimated diameter. The recommended Q100 estimated diameter for a replacement structure is a 2000 mm round culvert or a 2440 x 1750 mm elliptical/pipe arch culvert. The total culvert area required is 3.11m². The two culverts at the site give a combined area of 2.12 m². A structure of this size should be engineered, and will require a further site visit by a qualified engineer to determine the appropriate structure for this site.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):	2000	Stream Length Above Barrier (m):	3964
Road Responsibility:		% Stream Barred:	96

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	10	H	10	Full	10	>= 1 km	10	> 70%	10	Yes	
Single		M		Partial		< 1 km		51-70%		No	0
Other		L		Undeter		< 500 m		< 50%			

Total Score: 50

Comments:

Office Calculations: (* to be completed for full and partial barriers only)

Form A - Fish Passage - Culvert Inspection

Q100 Diameter Estimate (mm):	2400	Stream Length Above Barrier (m):	2600
Road Responsibility:		% Stream Barred:	79

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	10	H		Full	10	>= 1 km	10	> 70%	10	Yes	
Single		M	6	Partial		< 1 km		51-70%		No	0
Other		L		Undeter		< 500 m		< 50%			

Total Score: 46

Site 13 – Unnamed Stream (Indian Reserve Road): Full Seasonal Barrier, High Priority



View of inlets.



View of outlets.

Site 13 – Unnamed Stream (Indian Reserve Road): Full Seasonal Barrier, High Priority



View upstream of inlets.



View downstream of outlets.

Form A - Fish Passage - Culvert Inspection

Date:	10/21/2004	Stream Name:	Unnamed Stream
Road Name:	Indian Reserve Road	MoF District:	
Crossing Location:		WSC or ILP:	100-583400-31000
1:20 000 Map Sheet:	093G.097	Crew:	LMC/SEA
UTM:	10.520486.5984396		
Site#:	13A - Road culverts		
Project Number:	04-BC-0104		

Culvert Characteristics: Two corrugated metal pipes. Water is flowing through both culverts. A dip exists in left bank culvert. Both culverts are backwatered through entire length.

Culvert Diameter (mm):	900	Culvert Slope (%):	3.03
Culvert Length (m):	18.5	Culvert High Water (cm):	24
Culvert Material:	Metal	Culvert Water Depth(cm):	11
Culvert Velocity (m/s):	0.37 0.37 0.12	Culvert Outfall (cm):	0
Culvert Shape:	Circular	Culvert Maintenance:	No
Culvert Wet Width (cm):	87	Fill Slope Depth(m):	2.5

Stream Characteristics:

Stream Reach #:		Stream Classification:	S3	Prelim. Class.:	☒
Pool Depth at Outfall (cm):	0	Blue Listed/Sign:			
Sediment Source/Degree:	Low				
Sediment Comment:					

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	1.75	2.5	3.2	2.65	1.95	2.3	2.39
Bankfull Width (m):	4.6	3.5	3.55	2.84	2.7	3.2	3.40
Water Depth (cm):	12	9	10	13	13	11	11.33
Bankfull Depth (cm):	32	34	25	51	37	38	36.17
Velocity (m/s):							
Stream Gradient (%):				5			
Fish Present:							NA
Fish_Method:							NA
Sampling Effort (t):							NA
Species Present:							NA
Beaver Activity:	None			None			
				Measure(s) Above Culvert			Average Measurement
	1.1	0.85	0.8	1.1	0.85	0.8	1.70
	1.35	1	1	1.35	1	1	2.50
	10	10	10	10	10	10	10.17
	30	28	26	30	28	26	29.17
	0.1	0.35		0.1	0.35		
	3						
	No						NA
	EF						NA
	171						NA
	NFC						NA
	None						

Form A - Fish Passage - Culvert Inspection

Barrier Evaluation

Barrier:	Full
Barrier Type:	Velocity barrier.

Site Photos

Roll#	Frame #	Direction	Comment
4	16	Inlet upstream	From road. Inlet downstream 14, 15. Outlet upstream 18. Outlet downstream 17 (from road), 19.
1901	12	d/s	Inlet
1901	13	u/s	Inlet, left stream.
1901	14	u/s	Inlet, right stream.

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: The spawning habitat is fair with suitable gravels present. However, currently gravels are clogged with fines/clay. The rearing habitat is moderate to good with good habitat complexity but not much variety in depths throughout sites. The overwintering habitat is poor since there are no deep pools. This site is close to the Fraser river so the fish would probably overwinter there. This record is for the left culvert.

The culverts at this site are undersized. Although fish were captured upstream of the crossing, it is felt that this culvert is a barrier. The average culvert velocity was 0.37 m/s which exceeds the maximum swimming speed of juvenile rainbow trout (Parker 2000). The slope of the left culvert is 3.03% and the slope of the right culvert is 3.3%.

This site was ranked as HIGH priority using the FPCI Scoring Matrix. The current culvert does not meet the recommended Q100 estimated diameter. The recommended Q100 estimated diameter for a replacement structure is a 2200 mm round culvert or a 2440 mm x 1750 mm elliptical/pipe arch culvert. The total culvert area required is 3.14 m². The two culverts at the site give a combined area of 1.22 m². A structure of this size should be engineered, and will require a further site visit by a qualified engineer to determine the appropriate structure for this site.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):	2200	Stream Length Above Barrier (m):	3964
Road Responsibility:		% Stream Barred:	96

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	10	H	10	Full	10	>= 1 km	10	> 70%	10	Yes	5
Single		M		Partial		< 1 km		51-70%		No	0
Other		L		Undeter		< 500 m		< 50%			

Total Score: 55

Form A - Fish Passage - Culvert Inspection

Date:	10/21/2004	Stream Name:	Unnamed Stream
Road Name:	Indian Reserve Road	MoF District:	
Crossing Location:		WSC or ILP:	100-583400-31000
1:20 000 Map Sheet:	093G.097	Crew:	LMC/SEA
UTM:	10.520486.5984396		
Site#:	13B - Road culverts		
Project Number:	04-BC-0104		

Culvert Characteristics: Two corrugated metal pipes. Water is flowing through both culverts. A dip exists in left bank culvert. Both culverts are backwatered through entire length.

Culvert Diameter (mm):	900	Culvert Slope (%):	3.3
Culvert Length (m):	18.5	Culvert High Water (cm):	30
Culvert Material:	Metal	Culvert Water Depth(cm):	15
Culvert Velocity (m/s):	0.37 0.37 0.83	Culvert Outfall (cm):	0
Culvert Shape:	Circular	Culvert Maintenance:	No
Culvert Wet Width (cm):	90	Fill Slope Depth(m):	2.5

Stream Characteristics:

Stream Reach #:		Stream Classification:	S3	Prelim. Class.:	☒
Pool Depth at Outfall (cm):		Blue Listed/Sign:	r		
Sediment Source/Degree:	Low				
Sediment Comment:					

Measure	Measure(s) Below Culvert	Measure(s) Above Culvert	Average Measurement
Wetted Width (m):	1.75 2.5 3.2	2.65 1.95 2.3	2.39
Bankfull Width (m):	4.6 3.5 3.55	2.84 2.7 3.2	3.40
Water Depth (cm):	12 9 10	13 13 11	11.33
Bankfull Depth (cm):	32 34 25	51 37 38	36.17
Velocity (m/s):			
Stream Gradient (%):		5	
Fish Present:	Yes	Yes	NA
Fish_Method:	Electrofishing	Electrofishing	NA
Sampling Effort (t):		805	NA
Species Present:	Rainbow Trout	Rainbow Trout	NA
Beaver Activity:	None	None	

Barrier Evaluation

Barrier:	Full
Barrier Type:	Velocity barrier

Site Photos

Roll#	Frame #	Direction	Comment
4	16	Inlet upstream	From road. Inlet downstream 14, 15. Outlet upstream 18. Outlet downstream 17 (from road), 19.

Form A - Fish Passage - Culvert Inspection

1901	17	u/s	Fill slope failure (Sediment Source)
1901	18	d/s	Inlet
1901	19	u/s	Inlet

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: The spawning habitat is fair with suitable gravels present. However, currently gravels are clogged with fines/clay. The rearing habitat is moderate to good with good habitat complexity but not much variety in depths throughout sites. The overwintering habitat is poor since there are no deep pools. This site is close to the Fraser river so the fish would probably overwinter there. This record is the right culvert.

The culverts at this site are undersized. Although fish were captured upstream of the crossing, it is felt that this culvert is a barrier. The average culvert velocity was 0.37 m/s which exceeds the maximum swimming speed of juvenile rainbow trout (Parker 2000). The slope of the left culvert is 3.03 % and the slope of the right culvert is 3.3%.

This site was ranked as HIGH priority using the FPCI Scoring Matrix. The current culvert does not meet the recommended Q100 estimated diameter. The recommended Q100 estimated diameter for a replacement structure is a 2200 mm round culvert or a 2440 mm x 1750 mm elliptical/pipe arch culvert. The total culvert area required is 3.14 m². The two culverts at the site give a combined area of 1.22 m². A structure of this size should be engineered, and will require a further site visit by a qualified engineer to determine the appropriate structure for this site.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):	2200	Stream Length Above Barrier (m):	3964
Road Responsibility:		% Stream Barred:	96

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	10	H	10	Full	10	>= 1 km	10	> 70%	10	Yes	5
Single		M		Partial		< 1 km		51-70%		No	0
Other		L		Undeter		< 500 m		< 50%			

Total Score: 55

Site 14 - Parkridge Creek (Domano Road): Full Barrier, High Priority



View of inlets.



View of outlets.

Site 14 – Parkridge Creek (Domano Road): Full Barrier, High Priority



View upstream of inlets.



View downstream of outlets.

Form A - Fish Passage - Culvert Inspection

Date:	10/21/2004	Stream Name:	Parkridge Creek
Road Name:	Domano Road	MoF District:	
Crossing Location:		WSC or ILP:	100-562800
1:20 000 Map Sheet:	093G.097	Crew:	LMC/SEA
UTM:	10.515025.5966557		
Site#:	14A		
Project Number:	04-BC-0104		

Culvert Characteristics: There are two corrugated metal pipes. Culverts have a vertical bend about midway through creating a gradient change (steeper at inlets than outlets). Culverts also have slight horizontal bend. Right bank culvert has holes on

Culvert Diameter (mm):	600	Culvert Slope (%):	4.17
Culvert Length (m):		Culvert High Water (cm):	20
Culvert Material:	Metal	Culvert Water Depth(cm):	2
Culvert Velocity (m/s):		Culvert Outfall (cm):	49
Culvert Shape:	Circular	Culvert Maintenance:	High
Culvert Wet Width (cm):	34	Fill Slope Depth(m):	7.5

Stream Characteristics: The stream has gravel bars, cobbles and boulders. There are pools at inlet and outlets of the culvert. The stream banks are well defined. Algae is present on rocks.

Stream Reach #:		Stream Classification:	S3	Prelim. Class.:	☒
Pool Depth at Outfall (cm):	52	Blue Listed/Sign:			
Sediment Source/Degree:	Yes	High			
Sediment Comment:	Several erosional depressions on outlet side of road bank creating sources of sediment.				

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	2.06	2.35	2.44	2.05	1.7	1.47	2.01
Bankfull Width (m):	2.97	2.9	2.87	3.4	1.8	2	2.66
Water Depth (cm):	13	10	11	15	11	16	12.67
Bankfull Depth (cm):	34	30	35	43	30	33	34.17
Velocity (m/s):							
Stream Gradient (%):	4			3.5			3.75
Fish Present:	Not Sampled			Not sampled			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Rainbow Trout, Chinook Salmon			Rainbow Trout, Chinook Salmon			NA
Beaver Activity:	None			None			

Barrier Evaluation

Barrier:	Full
Barrier Type:	Both culverts have outlet drops which may prevent fish movement upstream. However, during higher flows water volume may be sufficient to allow fish passage through lower right bank culvert.

Site Photos

Roll#	Frame #	Direction	Comment
4	3	Inlet upstream	Inlet downstream 2, 4. Outlet upstream 20, 21, 23 (including fill). Outlet downstream 22.
5	1		Log upstream of right bank inlet (40cm in height).

Form A - Fish Passage - Culvert Inspection

12601	1	u/s	outlet
12601	2	d/s	outlet
12601	5		Rainbow trout caught downstream of crossing
12601	6		Rainbow trout caught upstream of crossing

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: The rearing habitat is considered good, with abundant overhanging vegetation, undercut banks and boulders. The habitat complexity is good for this site. The spawning habitat within the stream is moderate, some suitable substrate but mostly larger cobble substrates are dominant. Overwintering habitat is poor since deep pools are not present. This record is for the left bank culvert.

The outfall from the left culvert is 49 cm. The left culvert outfall pool depth is 52 cm. This exceeds the maximum jumping height of juvenile fish and the outfall pool depth is not deep enough to allow adults to jump their maximum jumping height (Parker 2000). Therefore, the culvert is a full barrier to all fish. The outfall from the right culvert is 31cm. The right culvert outfall pool depth is 52 cm. The left culvert velocity could not be measured but the right culvert velocity is 1.15 m/s. This exceeds the maximum swimming speeds of juvenile rainbow trout and chinook salmon (Parker 2000).

There is 7.5 m of fill above the culvert at this site. Road fill failure at the outlet is contributing continual sediment to the stream.

This site was rated as HIGH using the FPCI Scoring Matrix. The current culvert at the road crossing does not meet the recommended Q100 diameter estimate. The total culvert area of the present culvert is less than half the total culvert area required. The recommended diameter is for a 2000mm round culvert. A structure of this size should be engineered, and will require a further site visit by a qualified engineer before replacement.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):	2000	Stream Length Above Barrier (m):	9231
Road Responsibility:		% Stream Barred:	71

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	10	H	10	Full	10	>= 1 km	10	> 70%	10	Yes	0
Single		M		Partial		< 1 km		51-70%		No	0
Other		L		Undeter		< 500 m		< 50%			

Total Score:

Form A - Fish Passage - Culvert Inspection

Date:	10/21/2004	Stream Name:	Parkridge Creek
Road Name:	Domano Road	MoF District:	
Crossing Location:		WSC or ILP:	100-562800
1:20 000 Map Sheet:	093G.087	Crew:	LMC/SEA
UTM:	10.515025.5966557		
Site#:	14B		
Project Number:	04-BC-0104		

Culvert Characteristics: There are two corrugated metal pipes. Culverts have a vertical bend about midway through creating a gradient change (steeper at inlets than outlets). Culverts also have slight horizontal bend. Right bank culvert has holes on

Culvert Diameter (mm):	1200	Culvert Slope (%):	4.17
Culvert Length (m):	39	Culvert High Water (cm):	36
Culvert Material:	Metal	Culvert Water Depth(cm):	7
Culvert Velocity (m/s):	0.87 0.82 0.72	Culvert Outfall (cm):	31
Culvert Shape:	Circular	Culvert Maintenance:	No
Culvert Wet Width (cm):	58	Fill Slope Depth(m):	7.5

Stream Characteristics: The stream has gravel bars, cobbles and boulders. There are pools at inlet and outlets of the culvert. The stream banks are well defined. Algae is present on rocks.

Stream Reach #:		Stream Classification:	S3	Prelim. Class.:	☒
Pool Depth at Outfall (cm):	52	Blue Listed/Sign:			
Sediment Source/Degree:	Yes High				
Sediment Comment:	Several erosional depressions on outlet side of road bank creating sources of sediment..				

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	2.06	2.35	2.44	2.05	1.7	1.47	2.01
Bankfull Width (m):	2.97	2.9	2.87	3.4	1.8	2	2.66
Water Depth (cm):	13	10	11	15	11	16	12.67
Bankfull Depth (cm):	34	30	35	43	30	33	34.17
Velocity (m/s):							
Stream Gradient (%):	4			3.5			3.75
Fish Present:	Not sampled			Not sampled			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Rainbow Trout, Chinook Salmon			Rainbow Trout, Chinook Salmon			NA
Beaver Activity:	No			No			

Barrier Evaluation

Barrier:	Full
Barrier Type:	Both culverts have outlet drops which may prevent fish movement upstream. However, during higher flows water volume may be sufficient to allow fish passage through lower right bank culvert.

Site Photos

Roll#	Frame #	Direction	Comment
4	3	Inlet upstream	Inlet downstream 2, 4. Outlet upstream 20, 21, 23 (including fill). Outlet downstream 22.
5	1		Log upstream of right bank inlet (40cm in height).

Form A - Fish Passage - Culvert Inspection

12601	7	d/s	Outlet
12601	8	u/s	Outlet
12601	9	u/s	Erosion downstream of CV
12601	10		Confluence of stream and Table River.

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: The rearing habitat is considered good, with abundant overhanging vegetation, undercut banks and boulders. The habitat complexity is good for this site. The spawning habitat within the stream is moderate, some suitable substrate but mostly larger cobble substrates are dominant. Overwintering habitat is poor since deep pools are not present. This record is for the right bank culvert.

The outfall from the left culvert is 49 cm. The left culvert outfall pool depth is 52 cm. This exceeds the maximum jumping height of juvenile fish and the outfall pool depth is not deep enough to allow adults to jump their maximum jumping height (Parker 2000). The outfall from the right culvert is 31cm. The right culvert outfall pool depth is 52 cm. The left culvert velocity could not be measured but the right culvert velocity is 1.15 m/s. This exceeds the maximum swimming speeds of juvenile rainbow trout and chinook salmon (Parker 2000).

There is 7.5 m of fill above the culvert at this site. Road fill failure at the outlet is contributing continual sediment to the stream.

This site was rated as HIGH using the FPCI Scoring Matrix. The current culvert at the road crossing does not meet the recommended Q100 diameter estimate. The total culvert area of the present culvert is less than half the total culvert area required. The recommended diameter is for a 2000mm round culvert. A structure of this size should be engineered, and will require a further site visit by a qualified engineer before replacement.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):	2000	Stream Length Above Barrier (m):	5101
Road Responsibility:		% Stream Barred:	77

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	10	H	10	Full	10	>= 1 km	10	> 70%	10	Yes	
Single		M		Partial		< 1 km		51-70%		No	0
Other		L		Undeter		< 500 m		< 50%			

Total Score:

**Site 15 – Unnamed Stream (North Blackburn Road): No Barrier,
Moderate Maintenance Issues**



View of inlet.



View of outlet.

**Site 15 – Unnamed Stream (North Blackburn Road): No Barrier,
Moderate Maintenance Issues**



View upstream of inlet.



View downstream of outlet.

**Site 15 – Unnamed Stream (North Blackburn Road): No Barrier,
Moderate Maintenance Issues**



View of old corrugated metal pipe within stream channel.

Form A - Fish Passage - Culvert Inspection

Date:	10/27/2004	Stream Name:	Unnamed Creek
Road Name:	Blackburn Road	MoF District:	
Crossing Location:	N/A	WSC or ILP:	100-572700-52100
1:20 000 Map Sheet:	093.097	Crew:	EO/LC
UTM:	10.523599.5973421		
Site#:	15		
Project Number:	04-BC-0104		

Culvert Characteristics: One culvert. Culvert may have been replaced (not recently) as old non-corrugated steel culvert remains discarded in channel. Partial beaver guard remains in inlet. Culvert outlet may be compressed vertically. 25m downstream

Culvert Diameter (mm):	1200	Culvert Slope (%):	1.14
Culvert Length (m):	17	Culvert High Water (cm):	98
Culvert Material:	metal	Culvert Water Depth(cm):	81
Culvert Velocity (m/s):	0.06	Culvert Outfall (cm):	
Culvert Shape:	circular	Culvert Maintenance:	Mod
Culvert Wet Width (cm):	930	Fill Slope Depth(m):	2.5

Stream Characteristics: Lots of instream vascular vegetation (Photo #2) downstream of culvert. Upstream of culvert the channel loses form and becomes more of a floodable area.

Stream Reach #:		Stream Classification:		Prelim. Class.:	☐
Pool Depth at Outfall (cm):	65	Blue Listed/Sign:			
Sediment Source/Degree:	Yes	Low			
Sediment Comment:					

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	1.66	2.09	2.93	2.46	2.28	3.8	2.54
Bankfull Width (m):	2.37	2.78	3.29	1.87	3.3	4.6	3.04
Water Depth (cm):	30	19	29	53	75	62	44.67
Bankfull Depth (cm):	48	51	44	65	97	70	62.50
Velocity (m/s):							
Stream Gradient (%):	3			1.5			2.25
Fish Present:	Yes			Yes			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Chinook Salmon, Longnose Sucker, M			Chinook Salmon, Longnose Sucker, M			NA
Beaver Activity:	None			Possibly in past.			

Barrier Evaluation

Barrier:	None
Barrier Type:	

Site Photos

Roll#	Frame #	Direction	Comment
0	6	Inlet upstream	Digital camera - Inlet upstream 6, 7. Inlet downstream 8, Outlet upstream 3,4. Outlet downstream 1, 10. Outl

Form A - Fish Passage - Culvert Inspection

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: The rearing habitat is moderate with deep water and instream vegetation for cover. However, water is turbid and stream does not have a lot of cover at outfall. The spawning is poor since the stream lacks suitable substrate and has a poorly defined channel. The overwintering habitat is poor with suspected minimal flow during winter months due to wetland characteristics upstream and downstream of the culvert.

This culvert was considered to have moderate maintenance concerns as the culvert outlet is compressed vertically. This constricts the capacity of the culvert. Also there is an old culvert discarded in the stream.

This culvert is undersized with a recommended area of 6.09 m2. The current culvert has an area of 1.06 m2.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):		Stream Length Above Barrier (m):	0
Road Responsibility:		% Stream Barred:	0

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	0	H	0	Full	0	>= 1 km	0	> 70%	0	Yes	0
Single	0	M	0	Partial	0	< 1 km	0	51-70%	0	No	0
Other	0	L	0	Undeter	0	< 500 m	0	< 50%	0		

Total Score:

Site 16 - Bittner Creek (Giscome Road): No Barrier, No Maintenance Issues



View of left bank inlet.



View of right bank inlet.

Site 16 – Bittner Creek (Giscome Road): No Barrier, No Maintenance Issues



View of outlets.



View downstream of outlets.

Form A - Fish Passage - Culvert Inspection

Date:	10/27/2004	Stream Name:	Bittner Creek
Road Name:	Giscome Road	MoF District:	
Crossing Location:		WSC or ILP:	100-5727000
1:20 000 Map Sheet:	093G.087	Crew:	LMC/SEA
UTM:	10.523880.5972286		
Site#:	16A		
Project Number:	04-BC-0104		

Culvert Characteristics: Two corrugated metal pipes are present at the site. 10cm of fine material and rock in outlet of right bank culvert. 30cm of fine material and rock in left bank culvert. A third culvert drains into this stream at culvert outlets.

Culvert Diameter (mm):	1000	Culvert Slope (%):	0.25
Culvert Length (m):	20	Culvert High Water (cm):	58
Culvert Material:	metal	Culvert Water Depth(cm):	49
Culvert Velocity (m/s):	0.11 0.1	Culvert Outfall (cm):	0
Culvert Shape:	round	Culvert Maintenance:	No
Culvert Wet Width (cm):	100	Fill Slope Depth(m):	2

Stream Characteristics: The stream is characterized by a large low lying area downstream of the culverts. The channel has widened significantly at the inlets of the culverts (almost a large pool area). The bed material is dominated by fines.

Stream Reach #:		Stream Classification:	Prelim. Class.: ☐
Pool Depth at Outfall (cm):	51	Blue Listed/Sign:	
Sediment Source/Degree:	Yes Mod		
Sediment Comment:			

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	4.2	2.66	2.4	3.22	2.24	1.85	2.76
Bankfull Width (m):	6.75	5.5	6	4.6	5.25	4.4	5.42
Water Depth (cm):	65	68	93	76	90	51	73.83
Bankfull Depth (cm):	93	106	120	97	120	83	103.17
Velocity (m/s):							
Stream Gradient (%):	0.5			1.5			1
Fish Present:	Yes			Yes			NA
Fish_Method:	Electrofishing			Electrofishing			NA
Sampling Effort (t):	379						NA
Species Present:	Chinook Salmon, Longnose Sucker, No			Chinook Salmon, Longnose Sucker, No			NA
Beaver Activity:	None			None			

Barrier Evaluation

Barrier:	None
Barrier Type:	

Site Photos

Roll#	Frame #	Direction	Comment
16		Inlet upstream	Inlet downstream left bank 17, Inlet upstream right bank 18, Outlet upstream 12, Outlet downstream 14, 13. D

Form A - Fish Passage - Culvert Inspection

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: These might be new culverts as there is an absence of a high water mark. The water levels appeared to be high for time of inspection. Terrestrial vegetation was underwater at the time of inspection. The rearing habitat was considered fair with minimal habitat complexity but good depth. The dominant cover was overhanging vegetation. There was a lack of boulders, large woody debris and small woody debris. Spawning habitat was poor since there was no suitable substrates present. Overwintering habitat was fair with good depth but low velocities and flow. This record is for the left bank culvert.

The culverts at this site are over half full of water. Thus, it is probable that they could fail at high flows.

The current culvert at this site does not meet the recommended Q100 diameter estimate. The recommended Q100 estimated culver area is 14.66 m². The current culverts have a combined area of 3.80 m². A structure this site should be engineered, and will require a further site visit by a qualified engineer before replacement.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):		Stream Length Above Barrier (m):	
Road Responsibility:		% Stream Barred:	

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	0	H	0	Full	0	>= 1 km	0	> 70%	0	Yes	0
Single	0	M	0	Partial	0	< 1 km	0	51-70%	0	No	0
Other	0	L	0	Undeter	0	< 500 m	0	< 50%	0		

Total Score:

Form A - Fish Passage - Culvert Inspection

Date:	10/27/2004	Stream Name:	Bittner Creek
Road Name:	Giscome Road	MoF District:	
Crossing Location:		WSC or ILP:	100-572700
1:20 000 Map Sheet:	093G.087	Crew:	LMC/SEA
UTM:	10.523880.5972286		
Site#:	16B		
Project Number:	04-BC-0104		

Culvert Characteristics: Two corrugated metal pipes are present at the site. 10cm of fine material and rock in outlet of right bank culvert. 30cm of fine material and rock in left bank culvert. A third culvert drains into this stream at culvert outlets.

Culvert Diameter (mm):	1200	Culvert Slope (%):	0.14
Culvert Length (m):	21	Culvert High Water (cm):	83
Culvert Material:	metal	Culvert Water Depth(cm):	83
Culvert Velocity (m/s):	0.1 0.1 0.62	Culvert Outfall (cm):	0
Culvert Shape:	circular	Culvert Maintenance:	No
Culvert Wet Width (cm):		Fill Slope Depth(m):	2

Stream Characteristics: The stream is characterized by a large low lying area downstream of the culverts. The channel has widened significantly at the inlets of the culverts (almost a large pool area). The bed material is dominated by fines.

Stream Reach #:		Stream Classification:	Prelim. Class.: ☐
Pool Depth at Outfall (cm):	51	Blue Listed/Sign:	
Sediment Source/Degree:	Yes Mod		
Sediment Comment:			

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	4.2	2.66	2.4	3.22	2.24	1.85	2.76
Bankfull Width (m):	6.75	5.5	6	4.6	5.25	4.4	5.42
Water Depth (cm):	65	68	93	76	90	51	73.83
Bankfull Depth (cm):	93	106	120	97	120	83	103.17
Velocity (m/s):							
Stream Gradient (%):	0.5			1.5			1
Fish Present:	Yes			Yes			NA
Fish_Method:	Electrofishing, FISS			Electrofishing, FISS			NA
Sampling Effort (t):	379						NA
Species Present:	Chinook Salmon, Longnose Sucker, No			Chinook Salmon, Longnose Sucker, No			NA
Beaver Activity:	None			None			

Barrier Evaluation

Barrier:	None
Barrier Type:	

Site Photos

Roll#	Frame #	Direction	Comment
16		Inlet upstream	Inlet downstream left bank 17, Inlet upstream right bank 18, Outlet upstream 12, Outlet downstream 14, 13. D

Form A - Fish Passage - Culvert Inspection

1501	2	U/S	outlet
1501	3		Stream D/S of crossing shooting up.
1501	5	D/S	inlet

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: These might be new culverts as there is an absence of a high water mark. The water levels appeared to be high for time of inspection. Terrestrial vegetation was underwater at the time of inspection. The rearing habitat was considered fair with minimal habitat complexity but good depth. The dominant cover was overhanging vegetation. There was a lack of boulders, large woody debris and small woody debris. Spawning habitat was poor since there was no suitable substrates present. Overwintering habitat was fair with good depth but low velocities and flow. This record is for the right bank culvert.

The culverts at this site are over half full of water. Thus, it is probable that they could fail at high flows.

The current culvert at this site does not meet the recommended Q100 diameter estimate. The recommended Q100 estimated culver area is 14.66 m². The current culverts have a combined area of 3.80m². A structure this site should be engineered, and will require a further site visit by a qualified engineer before replacement.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):	0	Stream Length Above Barrier (m):	0
Road Responsibility:	0	% Stream Barred:	0

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	0	H	0	Full	0	>= 1 km	0	> 70%	0	Yes	0
Single	0	M	0	Partial	0	< 1 km	0	51-70%	0	No	0
Other	0	L	0	Undeter	0	< 500 m	0	< 50%	0		

Total Score:

Site 17 - Unnamed Stream (Giscome Road): Partial Barrier, High Priority



View of inlet

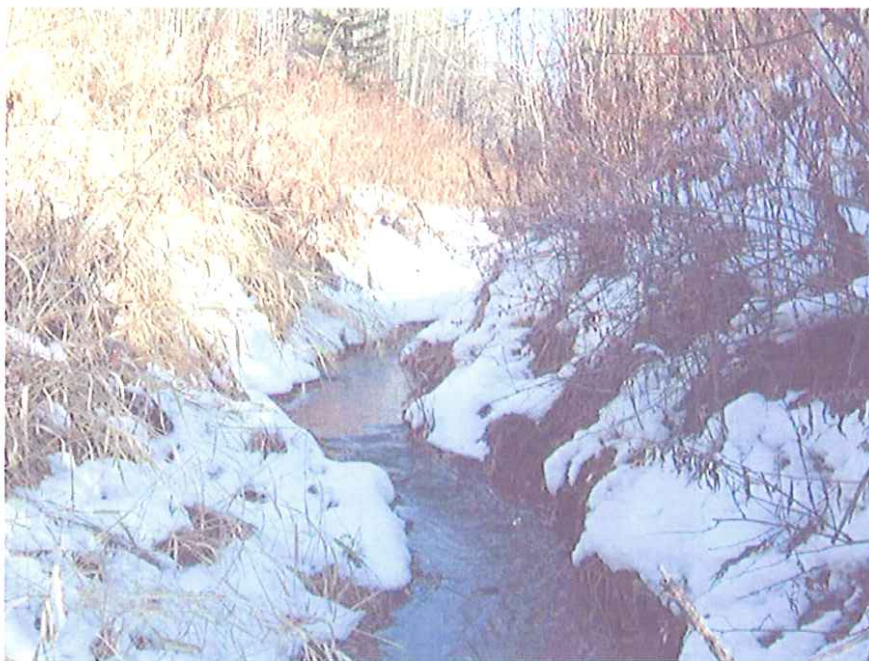


View of outlet.

Site 17 - Unnamed Stream (Giscome Road): Partial Barrier, High Priority



View upstream of inlets.



View downstream of outlets.

Form A - Fish Passage - Culvert Inspection

Date:	10/27/2004	Stream Name:	Unnamed
Road Name:	Giscome Road	MoF District:	
Crossing Location:		WSC or ILP:	100-572700-75500
1:20 000 Map Sheet:	093G.087	Crew:	LMC/SEA
UTM:	10.524928.5972259		
Site#:	17		
Project Number:	04-BC-0104		

Culvert Characteristics: Wooden box culvert at downstream end. Water appears to drain around culvert fill creating erosional ditches on downstream side. Upstream end has cement "cap" culvert. The cement circular grades into wooden box

Culvert Diameter (mm):	575	Culvert Slope (%):	1
Culvert Length (m):	35.3	Culvert High Water (cm):	59
Culvert Material:	wood and cement	Culvert Water Depth(cm):	21.5
Culvert Velocity (m/s):	0.5 0.48 0	Culvert Outfall (cm):	0
Culvert Shape:	box and circular	Culvert Maintenance:	No
Culvert Wet Width (cm):	55	Fill Slope Depth(m):	6

Stream Characteristics: This stream has a variety of substrates including fines and cobbles. The upstream side has undercut banks.

Stream Reach #:		Stream Classification:	S3	Prelim. Class.:	☒
Pool Depth at Outfall (cm):		Blue Listed/Sign:			
Sediment Source/Degree:	Yes High				
Sediment Comment:	Water is draining from around the culvert creating erosion on downstream side.				

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	2.13	1.17	1.28	0.9	0.74	1.5	1.29
Bankfull Width (m):	2.68	2.22	2.05	1.49	2.23	1.48	2.02
Water Depth (cm):	9.5	14	16	26	15	25	17.58
Bankfull Depth (cm):	37	38	31	40	27	41	35.67
Velocity (m/s):							
Stream Gradient (%):	1			1			1
Fish Present:	No			No			NA
Fish_Method:	Electrofishing			Electrofishing			NA
Sampling Effort (t):	50 seconds			100 seconds			NA
Species Present:	NFC			NFC			NA
Beaver Activity:	None			None			

Barrier Evaluation

Barrier:	Full
Barrier Type:	Velocity barrier

Site Photos

Roll#	Frame #	Direction	Comment
	21	Inlet upstream	Inlet downstream 22, Outlet upstream 19, Outlet downstream 20.

Form A - Fish Passage - Culvert Inspection

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: This site has a culvert that is wooden on the downstream end and cement on the upstream side. Therefore, the culvert diameter is different at each end. The upstream diameter is 600mm and the downstream diameter is 550mm. The culvert is dated to be built in 1941. The culvert is failing on the downstream side with water flowing around the culvert creating a source of sediment to the stream.

Rearing habitat is considered moderate with a variety of cover types. However, turbidity is high. Spawning habitat is fair, patches of suitable substrate but some are clogged with fines. The overwintering habitat is poor with moderate water velocities but shallow depths. Although no fish were caught at this site, this does not confirm absence. It is likely that fish use this stream since it is a tributary to Bittner Creek which has multiple species. Bittner Creek has the following species present: Chinook Salmon, Longnose Sucker, Northern Pikeminnow, Mountain Whitefish, Rainbow Trout, Redside Shiner, Sucker, Minnow (General).

The average water velocity in the culvert is 0.49m/s. It is probable that this is a velocity barrier to juvenile fish given the length of the culvert (Parker 2000).

The FPCI Scoring Matrix rates this crossing as MODERATE priority. The current culvert at this site does not meet the recommended Q100 diameter estimate. The recommended Q100 estimated diameter for a replacement structure is 1800 mm round culvert or a 2130 x 1400 mm elliptical/pipe arch culvert. A structure this size should be engineered, and will require a further site visit by a qualified engineer before replacement.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):	1800	Stream Length Above Barrier (m):	1178
Road Responsibility:		% Stream Barred:	55

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	10	H	0	Full	10	>= 1 km	10	> 70%	0	Yes	0
Single	0	M	6	Partial	0	< 1 km	0	51-70%	6	No	0
Other	0	L	0	Undeter	0	< 500 m	0	< 50%	0		

Total Score:

Site 18 - Haggith Creek (Willow-Cale Road): Full Barrier, High Priority



View of inlet.



View of outlet.

Site 18 - Haggith Creek (Willow-Cale Road): Full Barrier, High Priority



View upstream of inlet.



View downstream of outlet.

Site 18 – Haggith Creek (Willow-Cale Road): Full Barrier, High Priority



View of outlet. Note the water flowing under the culvert.



View of outlet and right bank slope.

Form A - Fish Passage - Culvert Inspection

Date:	10/27/2004	Stream Name:	Haggith Creek
Road Name:	Willow-Cale Road	MoF District:	
Crossing Location:		WSC or ILP:	100-56010
1:20 000 Map Sheet:	093G.087	Crew:	LMC/SEA
UTM:	10.518142.5963335		
Site#:	18		
Project Number:	04-BC-0104		

Culvert Characteristics: One corrugated metal pipe that carries a large flow of water and a large outfall drop. This culvert is very undersized for this site. There is some water trickling from under the culvert.

Culvert Diameter (mm):	2000	Culvert Slope (%):	
Culvert Length (m):	60	Culvert High Water (cm):	88
Culvert Material:	Metal	Culvert Water Depth(cm):	32
Culvert Velocity (m/s):	2.29 1.87 2.28 0	Culvert Outfall (cm):	125
Culvert Shape:	circular	Culvert Maintenance:	High
Culvert Wet Width (cm):	161	Fill Slope Depth(m):	17.5

Stream Characteristics: Likely a rifle-pool morphology at lower flows. There is a variety of substrates and cover types (fines and boulders). The water is quite turbid but could be attributed to high flows.

Stream Reach #:		Stream Classification:	S2	Prelim. Class.:	☒
Pool Depth at Outfall (cm):		Blue Listed/Sign:			
Sediment Source/Degree:	Yes High				
Sediment Comment:	Very steep fill bank and cutbanks present on downstream right bank.				

Measure	Measure(s) Below Culvert			Measure(s) Above Culvert			Average Measurement
Wetted Width (m):	7.85	6.3	4.75	4.22	5.2	4.4	5.45
Bankfull Width (m):	7.85	9.1	6.95	6.4	6.3	4.6	6.87
Water Depth (cm):	19	23	26	27	30	31	26
Bankfull Depth (cm):	40	45	48	51	51	40	45.83
Velocity (m/s):							
Stream Gradient (%):	3			2.5			2.75
Fish Present:	Yes			Yes			NA
Fish_Method:	FISS			FISS			NA
Sampling Effort (t):							NA
Species Present:	Chinook Salmon, Northern Pikeminnow			Chinook Salmon, Northern Pikeminnow			NA
Beaver Activity:							

Barrier Evaluation

Barrier:	Full
Barrier Type:	1.25m outfall drop that plunges into large boulders. The velocity is also very high through the culvert.

Site Photos

Roll#	Frame #	Direction	Comment
	32	Inlet upstream	Digital camera - Inlet downstream 36 (fill), 35. Outlet upstream 26, 27, 28. Outlet downstream 25. Water und
	37		Railway culvert upstream (38 also)

Form A - Fish Passage - Culvert Inspection

Form A - Fish Passage - Culvert Inspection - Side 2

Comments: The slope is steep at the inlet then it flattens out. Some maintenance was done by placing riprap into erosional scour and on downstream left bank. Upstream banks were also maintained by placing riprap on both banks. The pool depth was not recorded since large boulders which water falls onto prevents significant pool development.

Spawning habitat is considered poor with limited suitable substrate, mainly boulders and large cobbles present. The rearing habitat is good with lots of habitat variability (mainly boulders).

The culvert at this site is a definite barrier to all fish. The culvert is hanging by 125 cm. This created a full barrier to all fish since it is beyond their jumping capabilities (Parker 2000). The average velocity of the culvert is 2.15 m/s. This exceeds the maximum swimming speed of juvenile salmon and given the length of the culvert it is probable that it is a velocity barrier to all fish (Parker 2000). There is 17.5 m of fill above the culvert. The culvert is already starting to fail with water flowing around it.

The FPCI Scoring Matrix rates this crossing as a HIGH priority. The average channel width of this stream at the site is 6.87 m. The culverts at the site does not meet the recommended Q100 diameter estimate. The Q100 recommendation for this site is 9.86 m². The site currently holds 6.28 m². Due to the size of the structure necessary, we recommend that a further site assessment be conducted by an engineer to determine the type of replacement structure required for the crossing.

Office Calculations: (* to be completed for full and partial barriers only)

Q100 Diameter Estimate (mm):		Stream Length Above Barrier (m):	7564
Road Responsibility:		% Stream Barred:	97

Prioritization Calculations - FPCI Scoring Matrix:

Fish Species		Habitat Value		Barrier Value		Length of New Habitat		Stream Barred (%)		Limiting to Upstream Barrier	
Multiple or Significant	10	H	10	Full	10	>= 1 km	10	> 70%	10	Yes	0
Single	0	M	0	Partial	0	< 1 km	0	51-70%	0	No	0
Other	0	L	0	Undeter	0	< 500 m	0	< 50%	0		

Total Score: