# Sarita Fish Passage Assessment

Forest Investment Account (FIA)
Land Based Investment Program
Project No. 7008005

Prepared for
Western Forest Products Inc.

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# Executive Summary

A fish passage assessment was completed on the Sarita River watershed group in TFL 44 on the west side of Vancouver Island *[refer to overview map]*. The system was surveyed to determine if closed bottom drainage structures (metal culverts) occur on fish bearing streams and if so what effect are they having on fish passage and how can the situation be improved. The project area falls within the Alberni (ALBN) drainage unit; a number one priority for assessment according to the BC Ministry of Environment (MoE). The Sarita watershed was selected for assessment within this unit by Western Forest Products Ltd. (WFP) based on local knowledge and experience.

The following fish species are known to occur in the project area: chinook, chum, coho, pink, Kokanee, and sockeye salmon, rainbow and cutthroat trout, Dolly Varden char, and steelhead. The most important areas for fish in the project area are the Sarita River and lower reaches of the main tributaries. The assessment was focused on these areas. A large falls exists downstream from Sarita Lake and is a known barrier to anadromous fish passage.

Crossing and stream data provided by the MoE was used in combination with road, stream, and contour data provided by WFP to produce a set a planning maps to determine priority roads for review. Roads were prioritized and included for review if they had any crossings where fish presence was known or inferred based on the MoE data provided. Those roads were then driven or walked and each structure encountered was reviewed or assessed until the last fish-inferred or fish-known crossing was reached.

Four hundred and ninety-nine (499) crossings were reviewed in the fall of 2010. The following types and numbers of structures were observed:

| | |
|---|---|
| Round Metal Culverts | 421 |
| Wood Box Culverts | 52 |
| Fords | 11 |
| Bridges | 15 |

Open bottom structures were encountered on all of the mainstem channels in the project area. On tributaries, 421 round metal culverts were identified; thirty-seven (37) were fully assessed based on their potential effect on fish passage and habitat that could be gained through replacement. Twelve of the structures assessed are recommended for replacement.

## Study Area

This project covers priority areas within the Sarita watershed group located on the southeast side of the Alberni inlet on Vancouver Island, 30 km southwest of Port Alberni (NTS mapsheets 92C.096 - 92C.097 and 92C.085 – 92C.087). An overview map of the project area, including the location of potential fish crossings, has been included as part of the deliverables for this project. Filename: 7008005_Planning_Maps.pdf.

## Scope

Project scope was determined through a GIS exercise that plotted **stream** fish distribution (where fish presence was observed or inferred) and stream **crossings** provided by the BC Ministry of Environment (MoE) on a base map consisting of roads, drainages, and contours provided by Western Forest Products (WFP). Roads were selected for review if they had crossings where fish presence was known or inferred (indicated by red circles and triangles on planning maps).

## Methods

Field assessment maps were created using the GIS exercise described above. The WFP road network and MoE Road Stream Crossing point data features were also pre-loaded onto a Trimble GeoXT GPS receiver to assist the field crew in determining their location and to determine if they were at a known or inferred fish habitat crossing (from MoE data). Priority roads were driven or walked until the last fish-inferred or fish-known crossing was reached. The locations of all structures encountered were recorded using the same GPS receiver. While the planning maps and data were used as a guide to assist in identifying where fish presence was likely to occur, observations and common sense in the field determined whether or not a structure would be fully assessed according to the posted protocol. Closed bottom structures were fully assessed only where fish habitat existed on both sides of the road and access to additional habitat could be gained through replacement.

Data was gathered, assembled, and delivered according to the "**Data Submission Standards for Closed Bottom Culvert Assessment Projects 2009-10**" and **Field Assessment for Fish Passage Determination of Closed Bottom Structures. 3rd Edition. May 2009**

All structures (including sites where crossings had been removed) were assigned a unique ID number and locations were captured using the Trimble GeoXT GPS receiver. UTM coordinates for each structure were exported and appended to the Excel file template provided (**Field Data Submission Form, October 2009**) and shape files were exported to produce a final map. Pink "RESEARCH" flagging was hung on both sides of the road to identify each structure and/or crossing location. A standardized labeling method was used employed: "FP" followed by the unique crossing ID number (Eg. FP 003, FP 248, etc.).

Where full assessments were performed, structure inlet and outlet elevations were measured with a Trimble LL100 laser level for calculating slopes. Photos were named as per posted guidelines with unique Crossing ID#, location, and original photo number to link back to field notes if necessary (Eg. 003-Barrel-2435.jpg)

A full assessment was not performed if structures were already fish passable (i.e. bridges, wood box culverts, culvert removal sites), or fish were not able to reach the site as a result of known downstream barriers and their replacement would not result in any benefit to fish or fish habitat. Structures were not fully assessed if there was no water at the crossing. Most of the structures that met these criteria were cross drains – round metal culverts in place to maintain natural drainage patterns that are dry for most of the year. To obtain a complete inventory of structures along candidate roads in this project area these structures were flagged in the field, mapped using the GPS, assigned a unique crossing ID number, and photographed to illustrate condition and ability to pass fish.

## Results

A total of four hundred and ninety-nine (499) crossings were identified on priority roads in the Sarita watershed group in the fall of 2010. The following types of structures were encountered:

| | |
|---|---|
| Round Metal Culverts | 421 |
| Wood Box Culverts | 52 |
| Fords | 11 |
| Bridges | 15 |

Most of the structures encountered that were identified as fish-observed or fish-inferred by the MoE model were either open bottom wood box culverts, bridges, or sites where structures had been removed (NCS = no crossing structure). The Bamfield Mainline, a major artery connecting the town of Port Alberni with the Village of Bamfield is largely passable as a result of open bottom structure use but some opportunities remain for culvert replacement that could benefit fish. Most of the structures recommended for replacement occur on this road.

Of the 421 round metal culverts identified, thirty-seven (37) were fully assessed. A full assessment was only performed if potential fish habitat existed on both the inlet and outlet sides of the road. Assessment scores for these are provided in Table 1 below.

**Table 1. Barrier Determination Values, Scoring, and Replacement Priorities**

| High Priority for Replacement (none) | | | | | | | |
|---|---|---|---|---|---|---|---|
| ***ID #*** | ***Embedded*** | ***Outlet Drop*** | ***SWR*** | ***Slope*** | ***Length*** | ***Score*** | ***Result*** |
| **Moderate Priority for Replacement (recommended)** | | | | | | | |
| ***ID #*** | ***Embedded*** | ***Outlet Drop*** | ***SWR*** | ***Slope*** | ***Length*** | ***Score*** | ***Result*** |
| 283 | 10 | 5 | 6 | 10 | 0 | 31 | Barrier |
| 288 | 10 | 10 | 6 | 5 | 0 | 31 | Barrier |
| 335 | 10 | 10 | 3 | 10 | 3 | 39 | Barrier |
| 349 | 10 | 10 | 6 | 10 | 3 | 39 | Barrier |
| 380 | 10 | 0 | 6 | 5 | 0 | 21 | Barrier |
| 384 | 10 | 10 | 6 | 5 | 0 | 21 | Barrier |
| 400 | 10 | 0 | 6 | 5 | 0 | 21 | Barrier |
| 406 | 10 | 0 | 6 | 5 | 0 | 21 | Barrier |
| 407 | 10 | 0 | 6 | 5 | 0 | 21 | Barrier |
| 484 | 10 | 5 | 3 | 5 | 0 | 23 | Barrier |
| 485 | 10 | 0 | 6 | 5 | 3 | 24 | Barrier |
| 603 | 10 | 10 | 6 | 0 | 0 | 26 | Barrier |

| Low Priority for Replacement (not recommended) | | | | | | | |
|---|---|---|---|---|---|---|---|
| ***ID #*** | ***Embedded*** | ***Outlet Drop*** | ***SWR*** | ***Slope*** | ***Length*** | ***Score*** | ***Result*** |
| 190 | 10 | 0 | 3 | 10 | 3 | 26 | Barrier |
| 191 | 10 | 5 | 6 | 10 | 9 | 31 | Barrier |
| 265 | 10 | 0 | 3 | 5 | 3 | 21 | Barrier |
| 266 | 10 | 0 | 3 | 0 | 0 | 13 | Passable |
| 281 | 10 | 0 | 6 | 10 | 0 | 26 | Barrier |
| 287 | 10 | 0 | 6 | 10 | 0 | 26 | Barrier |
| 364 | 10 | 0 | 6 | 0 | 0 | 16 | Potential |
| 365 | 10 | 0 | 6 | 0 | 0 | 16 | Potential |
| 367 | 10 | 5 | 6 | 10 | 0 | 31 | Barrier |
| 374 | 10 | 10 | 6 | 5 | 0 | 31 | Barrier |
| 376 | 10 | 0 | 6 | 10 | 3 | 29 | Barrier |
| 377 | 10 | 0 | 6 | 5 | 0 | 21 | Barrier |
| 386 | 10 | 10 | 0 | 5 | 0 | 25 | Barrier |
| 409 | 5 | 0 | 6 | 0 | 3 | 14 | Passable |
| 411 | 10 | 10 | 6 | 10 | 3 | 39 | Barrier |
| 420 | 10 | 10 | 6 | 10 | 3 | 39 | Barrier |
| 421 | 10 | 5 | 6 | 10 | 3 | 34 | Barrier |
| 423 | 10 | 10 | 6 | 10 | 0 | 36 | Barrier |
| 455 | 10 | 10 | 6 | 10 | 0 | 36 | Barrier |
| 457 | 10 | 10 | 6 | 5 | 0 | 31 | Barrier |
| 480 | 10 | 5 | 6 | 10 | 0 | 31 | Barrier |
| 539 | 10 | 10 | 6 | 10 | 0 | 36 | Barrier |
| 550 | 10 | 10 | 6 | 10 | 0 | 36 | Barrier |
| 553 | 10 | 0 | 6 | 5 | 0 | 21 | Barrier |
| 656 | 10 | 5 | 3 | 10 | 0 | 28 | Barrier |

Moderate priority structures are full barriers to fish passage with some habitat to be gained through replacement. Low priority structures are full or partial barriers to fish passage but habitat value is low at the site, and little to no habitat would be gained by replacement.

The habitat gained index (m) was calculated for the twelve moderate priority structures recommended for replacement (Table 2). If the structures occurred on a mapped stream then habitat to be gained (m) was measured using the GIS based on distance upstream to a barrier as determined by gradient. If a structure did not occur along a mapped stream or tributary (site ID #283, #349, #380, #384, #400, and #484) then habitat gained (m) was estimated using topography, ortho photos, and Google Earth. Based on known GIS limitations, the actual length of channel accessible to fish upstream of any structure recommended for replacement should be confirmed in the field before any further planning is done.

**Table 2. Habitat Gained Index (HGI) and Cost Benefit Summary.**

| Site # | Road name | HGI | Channel width (m) | Solution #1 | Cost estimate | Solution #2 | Cost estimate | Cost-benefit 1 | Cost-benefit 2 |
|---|---|---|---|---|---|---|---|---|---|
| 283 | Bamfield Main | 300 | 3.0 | EM | $18,000 | CB | $25,000 | 17 | 10 |
| 288 | Bamfield Main | 180 | 2.0 | EM | $12,000 | CB | $20,000 | 15 | 9 |
| 335 | Bamfield Main | 635 | 5.0 | CB | $35,000 | - | - | 18 | - |
| 349 | Bamfield Main | 224 | 4.0 | CB | $32,000 | EM | $20,000 | 7 | 11 |
| 380 | Bamfield Main | 460 | 3.0 | CB | $25,000 | EM | $12,000 | 15 | 38 |
| 384 | Bamfield Main | 1,884 | 4.0 | CB | $32,000 | EM | $22,000 | 54 | 86 |
| 400 | Bamfield Main | 4,216 | 4.0 | CB | $32,000 | - | - | 120 | - |
| 406 | Bamfield Main | 450 | 3.0 | EM | $18,000 | CB | $25,000 | 25 | 15 |
| 407 | Bamfield Main | 450 | 3.0 | EM | $18,000 | CB | $25,000 | 25 | 15 |
| 484 | BM1500 | 557 | 3.0 | EM | $18,000 | CB | $25,000 | 31 | 19 |
| 485 | BM1500 | 550 | 4.0 | EM | $24,000 | CB | $32,000 | 23 | 16 |
| 603 | HC200 | 444 | 2.0 | EM | $12,000 | CB | $20,000 | 37 | 22 |

CB – concrete bridge, EM – embedded culvert

## Recommendations

Structures recommended for replacement are listed in order of priority in Table 3. Priorities are based on field observations and cost-benefit information provided above. Recommended replacement structure types are also provided along with a brief rationale.

As mentioned above, the actual length of channel accessible to fish upstream of any structure recommended for replacement should be confirmed in the field before any further planning is done. Natural barriers could be encountered that would reduce potential habitat gained and revise replacement priorities.

**Table 3. Replacement Priorities with Recommended Structure Type and Rationale**

| Site # | Priority | Recommended structure type | Estimated cost to replace | Rationale |
|---|---|---|---|---|
| 484 | 1 | New embedded culvert | $18,000 | Existing culvert constricts channel, larger unit required. Cost effective solution. |
| 335 | 2 | Concrete bridge | $32,000 | Active sediment and debris transport, will allow unrestricted passage for these materials. Too large and steep for embedded culvert. |
| 400 | 3 | Concrete bridge | $32,000 | Active sediment and debris transport, will allow unrestricted passage for these materials. Embedded culvert could work but will be less effective. |

| Site # | Priority | Recommended structure type | Estimated cost to replace | Rationale |
|---|---|---|---|---|
| 384 | 4 | Concrete bridge | $32,000 | Active sediment and debris transport, will allow unrestricted passage for these materials. Embedded culvert could work but will be less effective. |
| 603 | 5 | New embedded culvert | $12,000 | Existing culvert constricts channel, larger unit required. Cost effective solution. |
| 406 | 6 | New embedded culvert | $18,000 | Existing culvert constricts channel, larger unit required. Cost effective solution. |
| 407 | 7 | New embedded culvert | $18,000 | Existing culvert constricts channel, larger unit required. Cost effective solution. |
| 485 | 8 | New embedded culvert | $24,000 | Embedded structure will work on low gradient channel. Cost effective solution. |
| 288 | 9 | New embedded culvert | $12,000 | Existing culvert constricts channel, larger unit required. Cost effective solution. |
| 380 | 10 | Concrete bridge | $25,000 | Active sediment and debris transport, will allow unrestricted passage for these materials. Embedded culvert could work but will be less effective. |
| 349 | 11 | Concrete bridge | $25,000 | Active sediment and debris transport, will allow unrestricted passage for these materials. Embedded culvert could work but will be less effective. |
| 283 | 12 | New embedded culvert | $18,000 | Existing culvert constricts channel, larger unit required. Cost effective solution. |

## Further Work Required

Six crossings on potential fish streams on Harrison Main in the vicinity of HC300 to HC500 were not assessed due to snow. These sites may be worthwhile reviewing in a subsequent fiscal year.

## Conclusions

Out of 499 crossings identified in the Sarita watershed group, 421 were round metal culverts. Most of the structures encountered that were identified as fish-observed or fish-inferred by the MoE model were either open bottom wood box culverts, bridges, or sites where structures had been removed. Of the 421 round metal culverts identified, thirty-seven (37) were fully assessed based fish habitat value. Of the 37 assessed, 12 structures were determined to be full barriers to fish passage and are recommended for replacement.