

North River Consulting Ltd.

FISH PASSAGE ASSESSMENTS

Prince George Forest District: Willow, Tabor and
Bowron Watersheds – 787 locations

Contract: PD14TGB003



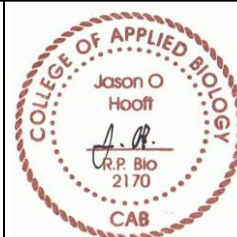
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EXECUTIVE SUMMARY

North River Consulting Ltd. performed 787 fish passage culvert inspections in the Willow, Tabor and Bowron watersheds from July to November, 2014. A large number of the office based mapped crossings did not exist, many were already deactivated, and the rest were inaccessible due to the washouts, and heavily brushed in roads. The results of the assessments in the Willow watershed found that for closed bottom culverts (302 sites) 69% of sites were barriers, 28% potential barriers, and 3% were passable. The results of the Tabor watershed assessments found that for closed bottom culverts (214 sites) 55% of sites were barriers, 36% potential barriers, and 9% were passable. The results of the assessments in the Bowron watershed found that for closed bottom culverts (74 sites) 78% of sites were barriers, 16% potential barriers, and 6% were passable. In total, 182 high/medium value habitat closed bottom crossing sites were found to be barriers. Of the high/medium value habitat sites in which closed bottom culverts were classified as barriers to fish passage, 15 priority sites (5 in each watershed) are recommended for immediate replacement or removal, with priority given to sites with high to medium value habitat, greater than 2m width streams, a high habitat gain index, and confirmed fish presence. In addition to the 15 identified priority removal sites, there are 167 remaining high/moderate value habitat closed bottom culvert sites that are classified as barriers or partial barriers which should be considered for future replacement/removal.

1. INTRODUCTION

North River Consulting Ltd. was retained by the Prince George Business Area of BC Timber Sales of the Ministry of Forests Lands and Natural Resource Operations (FLNRO) to perform fish passage assessments in the Prince George Forest District within the Willow, Tabor and Bowron Watershed. The field assessments were conducted from July – November, 2014.

1.1. Project Scope/Objectives

The overall objective of this project was to assess road stream crossings for fish passage in accordance with the methodology identified in the document “Field Assessment for Determining Fish Passage Status of CBS, Ministry of Environment August 2011”. The assessment results would then be prioritized such that the highest value streams could have fish passage restored. Site assessment locations were previously identified by the MFLNRO via office based GIS assessment. The required project outputs/deliverables included the following in the final report:

- Digital copy of working maps, clearly identifying known or suspected fish streams, road networks and identified sites for field data collection
- Work Completed
- Methods Used
- Data collected (include Excel spreadsheet of data collected from assessments)
- Description of Fish Presence Determination
- Determination of Habitat Gained Index (HGI)
- Proposal of fish passage restoration works of sampled crossings
- Maps describing crossing sampled and recommended for restoration of fish passage works
- All works must be signed off by a qualified Registered Professional.
- The data analysis, final mapping and report completion and submission is to be developed in accordance with the requirements specified in the document “Field Assessment for determining Fish Passage Status of CBS, Ministry of Environment August 2011”. Data and reporting must be successfully submitted into the Provincial Stream Crossing Inventory System (PSCIS)
- Separately to the above report, a digital copy of working maps, clearly identifying GPS’d road network identified barriers to access as discovered

1.2. Project Location

The project sites are located within the Prince George Forest District primarily east of Prince George within the Willow, Tabor, and Bowron River watersheds.

1.2.1. Access

The sites were accessed by 4x4 pickup and ATV. Many of the roads within the survey area were heavily brushed in to the extent that they were unsafe to travel and impassable. In addition, many washouts were encountered which prevented access to areas.

2. METHODS

The methods employed are consistent with the Field Assessment for Determining Fish Passage Status Of Closed Bottom Structures (2011) which include the following Phases:

- Phase 1: Planning
- Phase 2: Data Collection
- Phase 3: Analysis
- Phase 4: Restoration
- Phase 5: Reporting

Phase 1 was completed by the MFLNRO for the project and North River Consulting Ltd. completed Phases 2 and 3. Phases 4 and 5 will be implemented in the future based on the recommendations and data in this report.

2.1. Crew Training

Field crews were office trained by reviewing the Field Assessment for Determining Fish Passage Status of Closed Bottom Structures (2011) and completing the online fish passage training (http://www.for.gov.bc.ca/hfp/fish/Fish_Passage_Training/player.html). In addition, in the field initial assessments were completed as a group with an experienced biologist to provide training on field assessment methods.

2.2. Data Collection

The information collected through the Assessment Methodology falls into five broad categories as follows:

1. Location and Overview Information (i.e. date, UTM Co-ordinates in ZEN format, stream name, road name, etc.)
2. Field Observations and Assessment Measurements (i.e. crossing types, culvert size, outlet drop, slope, channel width, etc.)
3. Stream Information – (i.e. stream width, stream slope, habitat value, etc.)
4. Scoring Data – these values are automatically calculated by the spreadsheet to determine the pass / fail status of the crossings
5. Recommendations – (i.e. crossing fix, comments, etc.). See Appendix 3 for the summary table of all data collected.

2.3. Sampling Equipment

The Sampling equipment included the following:

- GPS Location: Garmin GPSmap76Cx
- Camera: Fujifilm Finepix AX300
- Gradient: Suunto handheld clinometer
- Bearing: Suunto MC-2 Compass at 21 degrees E declination
- Distance: 50m Eslon tape, and 5m handheld tape measure
- Laser Range Finder
- Safety vest
- Dry erase board for photo labels
- Flagging tape and marker for marking site locations

2.4. Data Input and Analysis

All data was entered into the FPCI data spreadsheets provided by the Ministry of Environment (MOE). This data was then verified and uploaded into the government database for input into the provincial database. Maps showing site locations and barriers to access were also uploaded.

The habitat gain index (HGI) was pre-determined for each site by the MOE by GIS modelling the available upstream habitat and then rating the HGI from non-fish habitat to very high.

3. RESULTS AND DISCUSSION

A total of 787 fish passage culvert inspections were completed in the Willow, Tabor, and Bowron watersheds. A large number of the mapped crossing locations were found to not exist or be inaccessible due to brushed in conditions or washouts, particularly in the Bowron watershed. In addition, many of the mapped crossing locations were mapping errors and the roads did not exist.

3.1. Site Assessments - Willow

Table 1 shows a summary of all surveyed sites in the Willow watershed and the respective number of high, medium and low priority crossings and the total barrier results for all crossings. The results of the assessments found that for closed bottom culverts (302 sites) 69% of sites were barriers, 28% potential barriers, and 3% were passable. In total, 118 high/medium value habitat closed bottom crossing sites were found with assessment results showing that 97 were barriers, 19 were potential barriers and 2 were passable. 106 open bottom structures were assessed and none were found to be barriers.

Table 1. Willow Watershed Site Classification Summary Table.

Crossing Structure	Habitat Rating	# Sites	# of sites with fish observed	# /% Passable	# / % Potential Barrier	# / % Barrier
Closed Bottom	High	14	6	0/0%	3/21%	11/79%
	Med	104	19	2/2%	16/15%	86/83%
	Low	184	0	8/4%	64/35%	112/61%
	Total	302 (302 round)	25	10/3%	83/28%	209/69%
Open Bottom Structure		106 – (80 bridges, 2 pipe arches, 7 wood box, 17 fords)	20			

3.2. Site Assessments - Tabor

Table 2 shows a summary of all surveyed sites in the Tabor watershed and the respective number of high, medium and low priority crossings and the total barrier results for all crossings. The results of the assessments found that for closed bottom culverts (214 sites) 55% of sites were barriers, 36% potential barriers, and 9% were passable. In total, 62 high/medium value habitat closed bottom crossing sites were found with assessment results showing that 44 were barriers, 12 were potential barriers and 6 were passable. 51 open bottom structures were assessed and none were found to be barriers.

Table 2. Tabor Watershed Site Classification Summary Table.

Crossing Structure	Habitat Rating	# Sites	# of sites with fish observed	# /% Passable	# / % Potential Barrier	# / % Barrier
Closed Bottom	High	4	3	0/0%	0/0%	4/100%
	Med	58	12	6/10%	12/21%	40/69%
	Low	152	0	13/9%	66/43%	73/48%
	Total	214 (205 round, 9 oval)	15	19/9%	78/36%	117/55%
Open Bottom Structure		51 – (26 bridges, 1 pipe arch, 2 wood boxes, 22 fords)	7			

3.3. Site Assessments - Bowron

Table 3 shows a summary of all surveyed sites in the Bowron watershed and the respective number of high, medium and low priority crossings and the total barrier results for all crossings. The results of the assessments found that for closed bottom culverts (74 sites) 78% of sites were barriers, 16% potential barriers, and 6% were passable. In total, 44 high/medium value habitat closed bottom crossing sites were found with assessment results showing that 41 were barriers, 2 were potential barriers and 1 was passable. 40 open bottom structures were assessed and none were found to be barriers.

Table 3. Bowron Watershed Site Classification Summary Table.

Crossing Structure	Habitat Rating	# Sites	# of sites with fish observed	# /% Passable	# / % Potential Barrier	# / % Barrier
Closed Bottom	High	3	0	0/0%	0/0%	3/100%
	Med	41	1	1/2%	2/05%	38/93%
	Low	30	0	3/10%	10/33%	17/57%
	Total	74 (74 round)	1	4/6%	12/16%	58/78%
Open Bottom Structure		40 – (34 bridges, 6 fords)	5			

3.4. Top 15 Recommended Replacement Sites

The top 15 sites recommended for replacement are the sites that were found to be barriers and had high to moderate rated habitat. Streams that exceeded 2m in width or were found to have fish present (observed) were given the highest priority. Consideration was also given to the habitat gain index for each site. See Appendix 1 for a map of the top 15 site locations.

Table 4 shows a summary of the 15 top recommended candidates for replacement. See Appendix 2 for photos of the priority sites.

Table 4. Priority Replacement Site Summary Table.

My Crossing Reference	Watershed	Diameter or Span (m)	Outlet Drop (meters)	Downstream Channel Width (m)	Stream Slope	Fish Observed? Yes / No	Habitat Value	Barrier Final Score (>20 = barrier)	Assessment Comment	Habitat Gain index
4655	Bowron	1.8	0.48	4.2	5	No	Medium	34		Very Low
5266	Bowron	1.8	1	4	3	No	Medium	34	2 culverts. Tributary to Wendle Lake	Medium
9196	Bowron	1.8	0.5	8	3	No	High	36		High
9190A	Bowron	1.1	1.5	2.3	12	No	Medium	39	Road KM not recorded	Very Low
13068	Bowron	1.1	0.4	3	2	No	Medium	37	Inlet buried, beaver dam.	Moderate
514	Tabor	1.4	0.38	3	2	No	Medium	37	Pipe warped.	Very Low
1130	Tabor	1.2	0.7	1.8	4	Yes	Medium	37	Outlet rusted through	High
4056	Tabor	1.7	0.3	4	3	Yes	High	37	Outlet control.	Moderate
9112	Tabor	1.2	0.61	1.7	3	Yes	Medium	34	Fish D/S.	Moderate
10012	Tabor	2.4	0.3	5	3	Yes	High	42	High priority. 15m fill depth.	High
784	Willow	2.1	1	2.5	6	No	Medium	36	Map indicates Rb and Bt present immediately downstream	Moderate
1951	Willow	1.8	1.1	2	5	No	Medium	36	RB present according to map	Moderate
4017	Willow	1.4	0.6	2.5	6	No	Medium	39	Map indicates Rb and Bt present	Moderate
5142	Willow	1.2	0.6	2.5	6	No	Medium	39	Map indicates Rb and Bt present	Moderate
7944A	Willow	1.5	1.2	4	4	No	Medium	42		Moderate

3.4.1. Site 4655 Bowron Watershed – 4.2m Saw Creek

The current crossing structure constricts the stream with a 1.8m closed bottom culvert on a 4.2m stream (see Appendix 2, photos 1-2). The large scoured outlet pool provides evidence that the stream is severely constricted and the 0.48m outlet drop prevents fish access to the culvert. The stream contains medium value fish habitat. The stream has a medium habitat gain index. The stream contains moderate spawning, rearing and overwintering habitat.

It is recommended that the current crossing structure is replaced with an open bottom structure such as a clear span bridge.

3.4.2. Site 5266 Bowron Watershed – Unnamed 4.0m stream

The current 1.8m culverts (two) constrict the 4m stream channel (see Appendix 2, photos 3-4). This has caused scouring of the outlet which has created a large pool and resulted in the culvert outlet being perched 1.0m resulting in the crossing structure being a barrier to fish passage. This stream is a tributary to fish-bearing Wendle lake. The stream contains medium value habitat and the habitat gain index for this stream is medium.

It is recommended that the current crossing structure is replaced with a clear span bridge.

3.4.3. Site 9196 Bowron Watershed – 8m Tsus Creek

The current crossing structure constricts the stream with a 1.8m closed bottom culvert on an 8m stream (see Appendix 2, photos 5-6). The cobble and gravel in the stream provide good spawning habitat, with good rearing habitat provided by pools and overhanging vegetation. Overall, the stream contains high value habitat.

It is recommended that the current crossing structure is replaced with an open bottom structure such as a clear span bridge.

3.4.4. Site 9190A Bowron Watershed – Unnamed 2.3m stream

The current crossing structure constricts the stream with a 1.1m closed bottom culvert on a 2.3m stream (see Appendix 2, photos 7-8). The culvert has an outlet drop of 1.5m. Medium value fish habitat is provided by overhanging vegetation and cobble and gravel substrate. The stream has a very low habitat gain index rating.

It is recommended that the current crossing structure is replaced with an open bottom structure such as a clear span bridge.

3.4.5. Site 13068 Bowron Watershed – Unnamed 3.0m stream

The current crossing structure constricts the stream with a 1.1m closed bottom culvert on a 3.0m stream (see Appendix 2, photos 9-10). Upstream there is a large beaver pond created by the partial beaver dam on the upstream side of the crossing. This has partially buried the culvert inlet, which results in potential for a washout at the site. Overall, the stream contains medium value habitat.

It is recommended that the current crossing structures are replaced with an open bottom structure such as a clear span bridge.

3.4.6. Site 514 Tabor Watershed - Unnamed 3.0m stream

The current crossing structure constricts the stream with a 1.7m closed bottom culvert on a 3.0m stream (see Appendix 2, photos 11-12). The inside of the culvert is partially collapsed. The stream has a very low habitat gain index rating. Gravel and cobble substrate provides suitable spawning habitat, and overhanging vegetation and pools provide suitable rearing habitat. Overall, the stream contains medium value habitat.

It is recommended that the current crossing structures are replaced with an open bottom structure such as a clear span bridge.

3.4.7. Site 1130 Tabor Watershed - Unnamed 1.8m stream

The current crossing structure constricts the stream with a 1.2m closed bottom culvert on a 1.8m stream (see Appendix 2, photos 13-14). The culvert outlet has rusted through resulting in water not flowing to the end of the pipe which contributes to this structure being a fish barrier. This stream has a high habitat gain potential and with fish observed in the outlet pool this site is a high priority for replacement. Overall, the stream contains medium value habitat.

It is recommended that the current crossing structures are replaced with an open bottom structure such as a clear span bridge.

3.4.8. Site 4056 Tabor Watershed - 4.0m Hudson Bay Slough

The current crossing structure constricts the stream with a 1.7m closed bottom culvert on a 4.0m stream (see Appendix 2, photos 15-16). The culvert is perched 0.3m, however this height is likely influenced by the level of the Fraser River. The outlet has a backflow valve which would prevent fish ascent during high flow periods. This stream is located in an urban area in the City of Prince George with a paved road which would make it costly to replace and it is unknown if there is a fish passable solution to replace the backflow structure. Additional investigation should be conducted prior to completing replacement works. However this stream would likely provides very high value rearing habitat for various salmonids including Chinook as it is located close to the Fraser River confluence. It would provide important backwater rearing habitat and overwintering. The stream has a moderate habitat gain index rating and contains overall high value habitat. Fish were observed at the crossing.

It is recommended that the current crossing structures are replaced with an open bottom structure such as a clear span bridge.

3.4.9. Site 9112 Tabor Watershed - 1.7m Swede Creek

The current crossing structure slightly constricts the stream with a 1.2m closed bottom culvert on a 1.7m stream (see Appendix 2, photos 17-18). The culvert is perched 0.61m which hinders fish ascent. Fish were observed in the outlet pool and the stream contains suitable spawning and rearing habitat with an overall contains moderate value habitat rating.

It is recommended that the current crossing structure is replaced with a clear span bridge.

3.4.10. Site 10012 Tabor Watershed – 5.0m Hagith Creek

The current crossing structure constricts the stream with a 2.4m closed bottom culvert on a 5.0m stream (see Appendix 2, photos 19-20). The culvert outlet has rusted through and is perched 0.3m which hinders fish ascent. The stream crossing has a high habitat gain index rating. The stream contains good rearing and spawning habitat, and overall contains high value habitat. Fish were observed on the downstream side of the crossing.

It is recommended that the current crossing structure is replaced with an open bottom structure such as a clear span bridge. It should be noted that this crossing has a deep 15m fill depth which will increase costs for replacement.

3.4.11. Site 784 Willow Watershed - Unnamed 2.5m stream

The current crossing structure constricts the stream with a 2.1m closed bottom culvert on a 2.5m stream (see Appendix 2, photos 21-22). The culvert is perched 1.0m which prevents fish ascent. The stream has a moderate habitat gain index rating. The stream contains good rearing habitat provided by dense overhanging vegetation and boulders, and overall contains medium value habitat.

It is recommended that the current crossing structure is removed and replaced with a clear span bridge.

3.4.12. Site 1951 Willow Watershed - Unnamed 2.0m stream

The current crossing structure slightly constricts the stream with a 1.8m closed bottom culvert on a 2.0m stream (see Appendix 2, photos 23-24). The culvert is perched 1.1m which prevents any fish ascent. The stream has a moderate habitat gain index rating. The stream contains good spawning habitat, and overall contains medium value habitat. A notation on the FPCI maps indicates that Rb are present in this stream.

It is recommended that the current crossing structure is removed and replaced with a clear span bridge.

3.4.13. Site 4017 – 2.5m Hyde Creek

The current crossing structure constricts the stream with a 1.4m closed bottom culvert on a 2.5m stream (see Appendix 2, photos 25-26). The culvert is perched 0.6m. The stream has a moderate habitat gain index rating. The stream has good rearing habitat with cover provided by large woody debris, boulders, and overhanging vegetation. The stream has an overall rating of medium value habitat. A notation on the FPCI maps indicates that Rb and Bt are present in this stream.

It is recommended that the current crossing structure is removed and replaced with an open bottom structure such as a bridge.

3.4.14. Site 5142 Willow Watershed – 2.5m Archer Creek

The current crossing structure constricts the stream with a 1.2m closed bottom culvert on a 2.5m stream (see Appendix 2, photos 27-28). The culvert is perched 0.6m. A notation on the FPCI map indicates that Rb and Bt are present. The stream has a moderate habitat gain index and an overall rating of medium value habitat.

It is recommended that the current crossing structure is removed and replaced with an open bottom structure such as a bridge.

3.4.15. Site 7944A Willow Watershed - 4.0m S. Yuzkli Creek

The current crossing structure constricts the stream with a 1.5m closed bottom culvert on a 4.0m stream (see Appendix 2, photos 29-30). The culvert is perched 1.2m which prevents fish ascent. The stream has a moderate habitat gain index. The stream has gravel/cobble substrate that is suitable for spawning and good rearing habitat with an overall rating of medium value habitat.

It is recommended that the current crossing structure is removed and replaced with an open bottom structure such as a bridge.

4. CONCLUSIONS AND RECOMMENDATIONS

The majority of the assessment area has seen little forestry and road maintenance activity in the last 15 years which has resulted in a large percentage of the access roads being overgrown and poorly maintained with many culverts partially or completely washed out. This made it difficult to access many of the areas proposed for assessment.

The assessment results indicate that the majority of the closed bottom culverts are a barrier to fish passage. Candidates for replacement or removal should include the identified high/moderate value habitat closed bottom structures that were found to be barriers (182 sites total) or potential barriers with priority given to the top 15 identified sites. Given the lack of use of many of the roads in the area it is recommended that many of the roads that have culverts which are barriers to fish passage should have full deactivation considered and all culverts removed, not just the identified high priority sites. This should be completed as soon as possible given that many areas are already no longer accessible unless extensive brushing and road repair is completed.

5. DISCLAIMER

This report is an independent report requested by and prepared for BC Timber Sales – Prince George Business Area.

The observations and recommendations presented in this report were based on observed and existing background biological information. This report was prepared in accordance with generally accepted biological principles and practice. No other warranty expressed or implied is made.

6. REFERENCES

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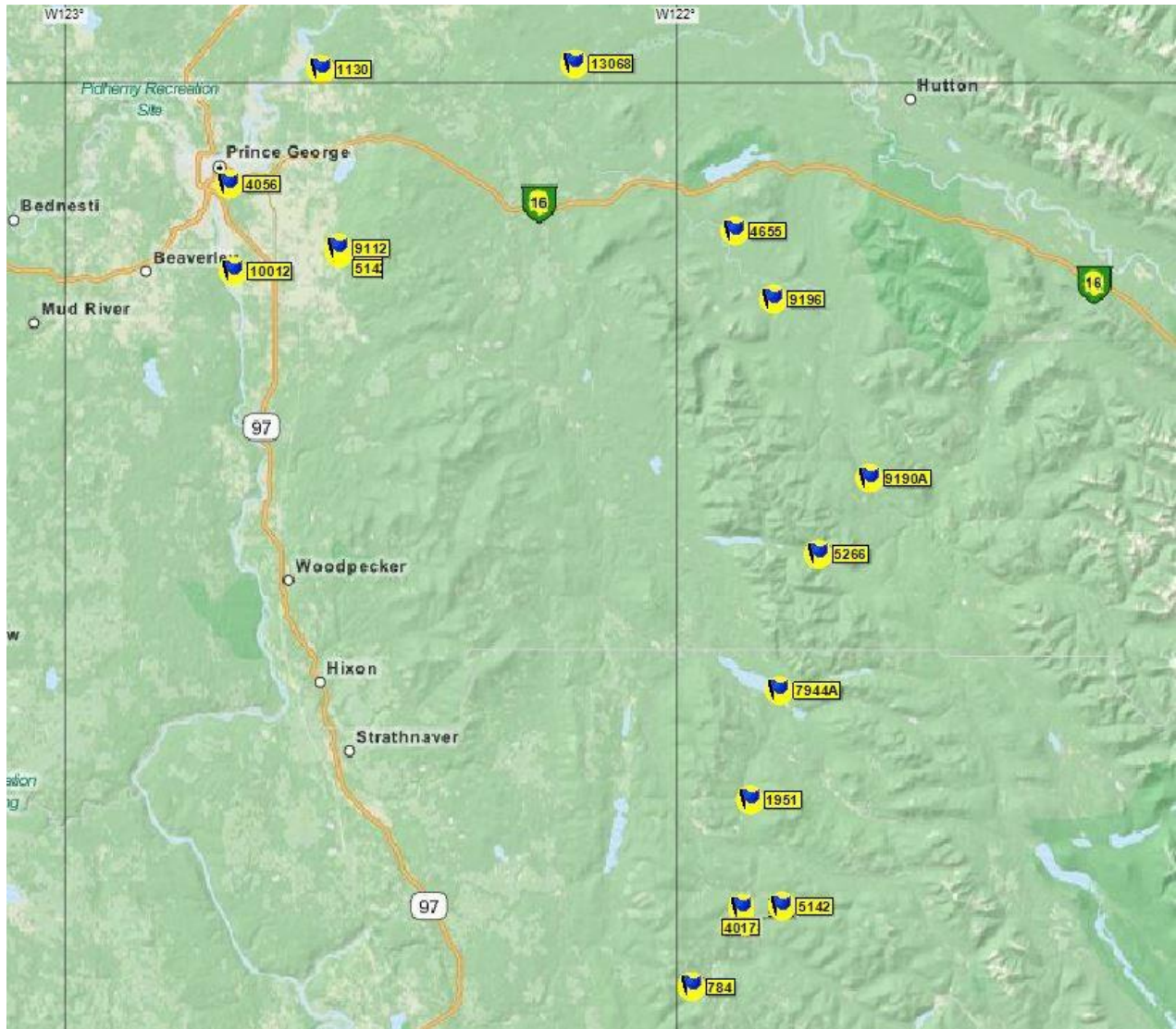
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APPENDIX 1 – PRIORITY REPLACEMENT SITES OVERVIEW MAP



APPENDIX 2 – PHOTOS



Photo 1, Site 4655 – Medium value habitat and barrier score of 34. 0.48m outlet drop.



Photo 2, Site 4655 – Upstream view of good rearing and spawning habitat with cover provided by boulders and vegetation.



Photo 3, Site 5266 – Medium value habitat, 1m outlet drop.



Photo 4, Site 5266 – Upstream view of cover provided by overhanging vegetation. Suitable spawning substrate.



Photo 5, Site 9196 – High value habitat, perched culvert 0.5m



Photo 6, Site 9196 – Culvert inlets partially washed out.



Photo 7, Site 9190A – Downstream view of stream channel.



Photo 8, Site 9190A – Upstream view of stream channel.



Photo 9, Site 13068 – Outlet drop of 0.4m.



Photo 10, Site 13068 – Culvert inlet obstructed with large beaver pond upstream.



Photo 11, Site 514 - Culvert outlet drop of 0.34m



Photo 12, Site 514 – Upstream view of stream channel showing medium value habitat.



Photo 13, Site 1130 – Culvert outlet perched and rusted through resulting in no flow at the end of



Photo 14, Site 1130 – Medium value habitat downstream from site.



Photo 15, Site 4056 – 0.3m perched culvert with outlet backflow control structure (for Fraser River).



Photo 16, Site 4056 – Downstream view of inlet. Good rearing and overwintering potential.



Photo 17, Site 9112 – 0.61m perched outlet.



Photo 18, 9112 – Downstream overview showing overhanging vegetation and outlet pool.



Photo 19, Site 10012 – Outlet perched 0.3m and rusted.



Photo 20, Site 10012 – Upstream view of high value fish habitat with cover provided by boulders and overhanging vegetation.



Photo 21, Site 784 – Culvert outlet perched 1.0m,



Photo 22, Site 784 – Upstream view of dense overhanging vegetation.



Photo 23, Site 1951 – Culvert outlet perched 1.1m.



Photo 24, Site 1951 – Upstream view of good rearing habitat with cover provided by overhanging vegetation. Cobble substrate.



Photo 25, Site 4017 – Outlet perched 0.6m.



Photo 26, Site 4017 – Downstream view of instream large woody debris.



Photo 27, Site 5142 – Outlet perched 0.6m.



Photo 28, Site 5142 – Upstream overview of cobble substrate and overhanging vegetation.



Photo 29, Site 7944A – 1.2m perched culvert.



Photo 30, Site 7944A – Upstream view of cobble and gravel substrate.

APPENDIX 3 - SITE ASSESSMENT SUMMARY TABLE

Insert Here (Excel data summary table)