Stoney Creek

Preliminary Watershed Health Assessment

Submitted By:

Nechako Environment & Water Stewardship Society

NEWSS

Prepared by:

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Abstract

In the fall of 2013 the Department of Fisheries and Oceans funded the Nechako Environment and Water Stewardship Society (NEWSS) to initiate a watershed health assessment in the Stoney Creek watershed.

Work on this project in began in October 2013 by initially identifying 9 crossings that may potential be barriers to fish. Of these 9 crossings, 6 were culverts and were assessed using the guidelines from the BC Ministry of Environment's "Field Assessment for Determining Fish Passage Status of Closed Bottom Structures". Of the 6 culverts assessed, 4 were considered to be barriers to fish passage, and 2 were assessed to be potential barriers to fish passage.

Additional GIS analysis identified a total of 49 crossings in the watershed. The majority of these sites are believed to be closed bottom culverts, some crossing sites do however appear to be livestock watering and crossing locations, and through stream vehicular crossings. Future work will include assessing the remaining 40 crossings for fish passage and erosion issues.

A total of 353 riparian buffers in the Stoney Creek watershed were analyzed. Seventy seven (77) riparian buffers were identified as problematic meaning that out of a total of 20 possible points used in the analysis, these sites only scored between 5 and 8 total points. These are riparian buffers that are in need of improved management practices, and are likely to need some restoration projects to restore functionality. Another 10 riparian buffers were identified as unhealthy this means that out of a total of 20 possible points used in the analysis, these sites scored less than 5 points. These are riparian buffers that have a high probability of needing restoration work and improved management practices to restore functionality. Future should include developing relationships with landowners, initiating and develop prescriptions for restoration projects in riparian buffers, suggesting improved management practices in and around streams, and begin carrying out restoration projects in identified riparian buffers and streams.

1 Background

Members and partners of the NEWSS have been successfully working to restore streams in the Nechako River watershed starting with Murray Creek since 2006. The recognition that environmental degradation in the Nechako Plateau had led to visible and obvious consequences in many of the streams in the region has been the inspiration to develop and move forward with NEWSS. Early agricultural clearing practices where it was considered acceptable to clear riparian areas and reshape stream channels without consideration to the stream ecosystem drove much of the degradation. Subsequent land practices in the flood plains of these streams and the changes in the upstream hydrology imposed by the Mountain Pine Beetle epidemic have accelerated stream bank erosion and made it increasingly difficult, if not impossible, for the riparian areas of many of these streams to restore themselves. The absence of a functioning riparian zone, in combination with incorrectly sized/placed culverts and various other land management decisions have led to decreased water quality and reduced high quality fish habitat in the small and medium sized streams across the agricultural region.

In the fall of 2013 the Department of Fisheries and Oceans funded the Nechako Environment and Water Stewardship Society (NEWSS) to initiate a watershed health assessment in the Stoney Creek watershed. NEWSS contracted Avison Management Services to complete this task.

2 Introduction

The gazetted name for this stream is Stony Creek (Watershed Code 180-271000); however it is locally known as Stoney Creek. The Stoney Creek watershed is >56,000 ha watershed that lies within the sub-boreal spruce biogeoclimatic zone. White spruce and subalpine fir are the dominant upland climax tree species. Lodgepole pine and trembling aspen are common seral species, with paper birch occasionally a pioneer species at disturbed sites. Douglas fir are common at dry, nutrient-rich sites. Black spruce are common in the wet, swampy areas. Extensive wetlands (sedge marshes, shrub fens, treed fens, and moss bogs) occur in poorly drained postglacial depressions. Black cottonwood are common along the shores of streams.
Soils in the Stoney Creek watershed were derived from glaciofluvial processes, and are dominated by sandy to gravely textures (moderate to well drained). Luvisolic, Podzolic and Brunisolic soils are common on morainal deposits. Poorly drained organic soils are associated with damp depressional areas.

Total precipitation averages 26.5 cm annually, with 75% of the rainfall occurring between the beginning of May and the end of October.

Elevation in the watershed ranges from ~730 m (above sea level) at the surface of Nulki and Tachick Lakes to ~1340 m at Corkscrew Creek's headwaters in the Nulki Hills. Although the southernmost edge of the watershed has steep gradients (hilly to mountainous), most of the watershed is flat or gently sloping.

In addition to Rainbow trout, the Stoney Creek watershed hosts a list of diverse fish species, including mountain whitefish, burbot, northern pike minnow, peamouth chub, lake chub, redside shiner, longnose sucker, largescale sucker and prickly sculpin. Historical accounts also suggest that Coho Salmon spawned in the lower reaches of Stoney Creek, and that juvenile Chinook salmon and Nechako White Sturgeon have used these reaches for rearing habitat during a portion of their life history (W. Salewski 2014, pers. comm., March 31)

According to a 2002 report by Irvine and McIntosh, one important tributary to this system is Corkscrew Creek, which is the principle stream used by rainbow trout for spawning and rearing purposes. This 60 km monoculture network of streams is created by a two metre waterfall located two km from its confluence with Nulki Lake. Only rainbow trout are able to negotiate these falls and gain access to the extensive habitat above. Approximately 35-50% of the watershed has been cleared by agricultural and forest industries since the 1950's. There were major developments in the headwaters prior to implementation of the Forest Practices Code. A network of logging roads, culverts, bridge crossings and timber staging areas exists within the watershed. As much of the Corkscrew Creek mainstem and tributary riparian zone forest (~35 km) has been harvested, recruitment sources for large woody debris (LWD) have been removed in this drainage area. Subsequent loss of instream LWD and pool habitat has been detrimental to juvenile rearing habitat.

Stoney Creek flows out of Nulki Lake, roughly 20 km south of Vanderhoof. The creek flows through the Saik'uz First Nation Reservation, north toward the Nechako River. There is a series of natural falls on Stoney Creek that cascade over the steep valley wall of the Nechako River valley. Below the falls, Stoney Creek flows through agricultural, forested and residential landscapes. The lower roughly 5km of Stoney Creeks flows within the municipal boundary of the District of Vanderhoof. The riparian zone is heavily altered along much of its length within the municipal boundary.

Stoney Creek is situated on the south bank of the Nechako River just upstream of Riverside Park in the community of Vanderhoof. Stoney Creek was once a thriving rainbow trout and Chinook salmon creek. A historical account is from 30 years ago, indicated juvenile Nechako white sturgeon were caught as bi-catch of the salmon fishery in the creek (W. Salewski 2014, pers. comm., March 31). Stoney Creek is also an important traditional area for Saik'uz First Nation.

3 Assessment Objectives

The purpose of this project is a preliminary exercise to assess the general health of the Stoney Creek Watershed. Due to funding constraints this project primarily used a desktop GIS based approach rather than utilizing a more logistically intensive field assessment. Three indicators were analyzed in this approach, 1) Identification of known and potential natural fish passage issues, 2) Identification of potential anthropogenic fish passage issues, and 3) Riparian Health, including identification of known and potential areas of erosion and sources of sediment in the watershed.

In addition to a watershed health report, sites will be identified and prioritized that are in need of restoration. The intent is of this project is to lay the groundwork for future field assessments and the development of restoration prescriptions for high priority sites, while fostering relationships and working with landowners, First Nations, and local governments to carry out restoration projects and secure perpetual funding to restore the Stoney Creek watershed to a healthy system.

4 Watershed Health Assessment Methods

4.1 Potential Fish Barriers

Local knowledge and desktop based GIS analysis was also conducted to identify both permanent and temporary barriers in the Stoney Creek Watershed. Some of the identified potential culvert crossings were also assessed.

4.1.1 Permanent and Temporary Barriers

For the purposes of this assessment, permanent barriers refer to gradient barriers typically >20% and >1.5m high (i.e. Waterfalls and Cascades). Temporary potential barriers included beaver dams, debris jams and culverts. Barriers were identified in several ways, 1) documentation of local knowledge regarding barriers, 2) the Freshwater Atlas - Obstructions metadata, 4) the Provincial Obstacles to Fish Passage metadata, and 4) visual analysis of recent (2012) orthophotos.

4.1.2 Crossing Identification for Future Assessment

As part of an overall watershed assessment, we used local knowledge, GIS analysis, and orthophoto interpretation to identify road, culvert, and livestock stream crossings. These crossings were cataloged and used in a pre-freeze up culvert assessment of a few crossings, and will be used to help guide efforts in future assessments.

4.1.3 Assessed Crossings

Some of culverts identified on public land or right of ways were assessed for Fish Passage prior to freeze up. Identified stream crossing were assessed using the guidelines from the BC Ministry of Environment's "Field Assessment for Determining Fish Passage Status of Closed Bottom Structures", document. Additional culverts that could not be assessed due to obtaining access permission or other timing constraints are identified in the results section for future assessment and prescription work.

4.2 Riparian Health

Riparian health was evaluated using GIS Desktop analysis. Sections of stream were broken down by a provincial Property Identification Number (PID), and unique polygons encompassing the riparian buffer were created for every parcel of land within the Agricultural Land Reserve (ALR) on both the sight and left bank. Both sides of the stream were assessed separately as land management practices can vary drastically along separate banks of the same section of stream. Each polygon was given a unique identifier for assessment purposes as there were literally hundreds of polygons and not every land parcel had a PID number. Outside the ALR on Crown Land, a riparian buffer polygon was created for each bank and section of stream similar to the ALR with the exception that manmade features such as roads were used divide sections of stream.

Each section of stream ≥ a 3rd order stream in the watershed was evaluated based on 1) a measurement of the minimum and the average riparian buffer width, 2) a systematic visual qualitative assessment of riparian vegetation structure and condition, 3) a systematic visual qualitative assessment of upland vegetation structure and condition with attention given to areas of prevalent erosion and sources of sediment.

Known areas of erosion and sources of sediment were identified using local knowledge of these sites. Potential areas of erosion and sources of sediment were evaluated using GIS Desktop analysis. Potential erosion sites and sources of sediment, were classified as areas, of mass wasting, severe instream bank cutting, old blown out beaver dams, areas of bare earth adjacent to the stream with no or minimal riparian buffer (i.e. construction sites, unfettered livestock access areas, instream livestock watering sites, adjacent newly tilled fields, adjacent roads, road crossings, logged areas with little or no riparian buffers, skid trails next to or through the stream, and landings adjacent to the stream).

The vegetation structure and condition assessment attributes can be found on the Stoney Creek - Riparian Health Index in appendix 11.

5 Results

5.1 Potential Fish Barriers

5.1.1 Permanent Barriers

Only three (3) permanent barriers were identified using local knowledge, the Freshwater Atlas - Obstructions metadata, the Provincial Obstacles to Fish Passage metadata, and visual analysis of recent (2012) orthophotos (Table 1). An overview map of these obstructions can be viewed in Appendix 3.

Table 1. Identified permanent barriers in the Stoney Creek watershed.

Source	Obstruction Type	Zone	Easting	Northing
Freshwater Atlas - Stream Obstructions/FISS	Rapids	10U	1122759	1000451
FISS	Falls	10U	1118425	989016
FISS	Falls	10U	1118275	978538

5.1.2 Temporary Barriers

Only six (6) non-culvert temporary barriers were identified using local knowledge, the Freshwater Atlas - Obstructions metadata, the Provincial Obstacles to Fish Passage metadata, and visual analysis of recent 2012 orthophotos (Table 2). Identification and assessment of potential culvert barriers are discussed in the crossing identification and assessed culverts sections. An overview map of these obstructions can be viewed in Appendix 3.

Table 2. Identified Temporary barriers in the Stoney Creek watershed.

Source	Obstruction Type	Zone	Easting	Northing
Freshwater Atlas - Stream Obstructions	Sinkhole	10U	1110786	998005
Freshwater Atlas - Stream Obstructions	Beaver Dam	10U	1115621	983168
Freshwater Atlas - Stream Obstructions	Sinkhole	10U	1109969	997793
FISS	BEAVER DAM	10U	1128309	1003299
FISS	BEAVER DAM	10U	1115079	995248
FISS	BEAVER DAM	10U	1122715	989737

5.1.3 Crossing Identification for Future Assessment

A total of 49 sites were identified in this assessment (Table 3). The majority of these sites are believed to be closed bottom culverts, some crossing sights do however appear to be livestock

watering and crossing locations, or through stream vehicular crossings. Future site assessments with help determine the status of these sites. An overview map of these crossings can be viewed in Appendix 2.

Table 3. Identified crossings in the Stoney Creek watershed assessment area.

Id	Zone	Easting	Northing
1	10U	433423	5986349
2	10U	432720	5985658
3	10U	432632	5985437
4	10U	431146	5985221
5	10U	429033	5985502
6	10U	427596	5984990
7	10U	426445	5983777
8	10U	427938	5980414
9	10U	427350	5977720
10	10U	421288	5972702
11	10U	420946	5971629
12	10U	420433	5973090
13	10U	420166	5973591
14	10U	420036	5974205
15	10U	419739	5974148
16	10U	418723	5973519
17	10U	433077	5985806
18	10U	415362	5978160
19	10U	415273	5977859
20	10U	413454	5977971
21	10U	417111	5969350
22	10U	415339	5968547
23	10U	415175	5967857
24	10U	417735	5971911
25	10U	416779	5971478

Id	Zone	Easting	Northing
26	10U	419363	5973456
27	10U	416815	5973559
28	10U	416808	5973117
29	10U	411482	5970718
30	10U	408545	5965442
31	10U	422166	5969799
32	10U	418734	5966428
33	10U	415329	5962389
34	10U	426081	5972608
35	10U	426866	5985529
36	10U	426643	5985673
37	10U	424188	5985601
38	10U	427369	5985172
39	10U	425677	5985858
40	10U	424872	5985929
41	10U	424500	5985704
42	10U	423518	5985360
43	10U	420258	5983636
44	10U	417969	5984020
45	10U	421668	5972992
46	10U	426011	5972671
47	10U	421283	5972696
48	10U	421480	5972783
49	10U	412411	5962486
50	10U	423728	5966028

5.1.4 Assessed Crossings

We were able to assess 9 of the 49 crossings prior to freeze up. Of these 9 crossings, 6 were culverts and were assessed using the guidelines from the BC Ministry of Environment's "Field Assessment for Determining Fish Passage Status of Closed Bottom Structures". Of the six culverts assessed, 4 were considered to be barriers to fish passage, and 2 culverts were assessed to be potential barriers to fish passage. Detailed assessment results and photographs can be found in appendices 5-10.

Table 4. Results from selected assessed culverts in the Stoney Creek Watershed.

Assessment Date	UTM	Road Name	Creek Name	Tenure	Final Score	Barrier Result
05-Nov-13	10U.432720.5985658	CN Rail Crossing	Stoney Creek	CN	29	Barrier
05-Nov-13	10U.432631.5985436	Hwy 16	Stoney Creek	MOT	24	Barrier
05-Nov-13	10U.431145.5985220	NA	Stoney Creek	Private	21	Barrier
05-Nov-13	10U.427937.5980414	Kenny Dam	Stoney Creek	MOT	19	Potential
05-Nov-13	10U.420432.5973089	Edwards	Tributary of Stoney Creek	MOT	18	Potential
05-Nov-13	10U.420166.5973591	Edwards	Stoney Creek	MOT	21	Barrier

5.2 Riparian Health

We analyzed 353 riparian buffers in the Stoney Creek watershed. Out of the 353 analyzed riparian buffers, 73 riparian buffers were identified as adequate. This means that out of a total of 20 possible points used in the analysis, these sites only scored between 9 and 11 total points. These are riparian buffers that are functioning, but functionality may be enhanced by improving management practices (e.g. fencing riparian buffers, keeping stockyards away from streamside's, etc…).

Seventy seven (77) riparian buffers were identified as problematic meaning that out of a total of 20 possible points used in the analysis, these sites only scored between 5 and 8 total points. These are riparian buffers that are in need of improved management practices, and are likely to need some restoration projects to restore functionality (Table 5).

Another 10 riparian buffers were identified as unhealthy this means that out of a total of 20 possible points used in the analysis, these sites scored less than 5 points. These are riparian buffers that have a high probability of needing restoration work and improved management practices to restore functionality (Table 6).

The remaining 193 riparian buffers were considered to be either healthy or ideal meaning that that out of a total of 20 possible points used in the analysis, these sites scored between 12 and 20 total points. These are sites that appear to be functioning well and have little if any need for improvement.

Table 5. List of Problematic Riparian Buffers in the Stoney Creek Watershed.

ID	PID	Zone	Easting	Northing	Metres of Bank	Bank Side	Minimum Buffer	Average Buffer	Final Point Total	Riparian Health Index Rank Ideal (16-20), Healthy (12-15), Adequate (9-11), Problematic (5-8), Unhealthy (<5)
2	012978043	10U	433336	5986192	98	L	8	15.5	8	Problematic
3	006013546	10U	433349	5986117	80	L	7	15.5	8	Problematic
4	009049550	10U	433324	5986040	47	L	7	15.5	8	Problematic
5	009040595	10U	433304	5985996	50	L	8	15.5	8	Problematic
6	005623464	10U	433278	5985947	58	L	10	15.5	8	Problematic
7	023502240	10U	433221	5985882	118	L	8	15.5	8	Problematic
8	023633301	10U	433150	5985832	77	L	12	15.5	8	Problematic
9	012476234	10U	433113	5985801	38	L	14	15.5	8	Problematic
13	293315172	10U	432684	5985662	60	B	10	0	5	Problematic
14	293315172	10U	432770	5985655	60	B	10	0	5	Problematic
15	011200774	10U	432615	5985536	210	R	16	33.8	8	Problematic
16	005030439	10U	432690	5985560	210	L	24	43.1	8	Problematic
29	010077731	10U	429356	5985519	115	R	5	10.8	7	Problematic
30	Not Owned	10U	429285	5985582	31	R	6	11.6	7	Problematic
82	011699361	10U	418975	5976946	676	Lake (T)	12	15.3	8	Problematic
104A	15228360	10U	427386	5978052	975	R	0	10.6	8	Problematic
106	15228360	10U	427148	5977322	988	R	0	12.8	8	Problematic
179	015659704	10U	426918	5973068	885	Lake (N.)	9	14	6	Problematic
180	005894603	10U	426353	5973146	24	Lake (N.)	12	13.2	8	Problematic
181	015659691	10U	427498	5973031	491	Lake (N.)	5	19.75	7	Problematic
183	PIN SID: 15	10U	427836	5973176	568	Lake (N.)	5	20	7	Problematic
189	013440802	10U	428252	5974384	481	Lake (N.)	10	12	7	Problematic
191	015732088	10U	427946	5974529	1306	Lake (N.)	0	22	7	Problematic
192	011644401	10U	421560	5972902	653	R	0	56.8	8	Problematic
192A	011644401	10U	421336	5972760	273	R	0	12	7	Problematic
193	011644401	10U	421521	5972814	554	L	4	15.4	7	Problematic
195	011644117	10U	421332	5972717	32	L	0	5	5	Problematic
195A	011644117	10U	421534	5972161	236	L	0	11	7	Problematic
202	008900311	10U	415148	5977766	198	R	0	6	5	Problematic
203	008900311	10U	415161	5977738	198	L	0	6	5	Problematic
205	013668137	10U	414705	5977497	728	L	0	15	5	Problematic
206	015754201	10U	414105	5977456	856	R	0	7.5	5	Problematic
207	015754201	10U	414089	5977448	856	L	0	6	5	Problematic
208	005019630	10U	413005	5977250	1409	R	81	264.6	8	Problematic
209	005019630	10U	413083	5977024	1409	L	6	63.8	8	Problematic
211	008899983	10U	415388	5978123	111	R	0	0	6	Problematic
212	008899983	10U	415383	5978099	104	L	0	0	6	Problematic

213	008900311	10U	414860	5978260	754	R	0	0	5	Problematic
214	008900311	10U	414894	5978198	754	L	0	55.3	8	Problematic
219	005019621	10U	413315	5978103	881	R	0	14.3	8	Problematic
220	005019621	10U	413285	5978062	881	L	0	13.3	6	Problematic
222	005019613	10U	412426	5978148	890	L	1	12.8	6	Problematic
232	011644435	10U	420060	5973636	120	R	2	2	5	Problematic
233	011644435	10U	420099	5973573	120	L	2	2	5	Problematic
234	011644486	10U	419915	5973587	184	R	2	2	5	Problematic
235	011644486	10U	419979	5973570	184	L	2	2	5	Problematic
236	015730051	10U	419570	5973479	764	R	0	10.5	6	Problematic
237	015730051	10U	419501	5973453	764	L	0	31.2	8	Problematic
238	015655148	10U	418675	5973525	845	R	0	11	6	Problematic
284	013920235	10U	411603	5978109	850	R	6	36.8	7	Problematic
285	013920235	10U	411701	5977995	850	L	6	22.7	6	Problematic
286	011655372	10U	410837	5978406	940	Both	3	13.3	5	Problematic
287	009875140	10U	427222	5985346	1145	L	0	14	5	Problematic
288	009875140	10U	427183	5985303	1145	R	0	14	5	Problematic
289	004616375	10U	426770	5985630	213	R	0	0	5	Problematic
290	004616375	10U	426771	5985597	213	L	0	0	5	Problematic
291	011952245	10U	426340	5985854	947	R	7	14.2	8	Problematic
292	011952245	10U	426300	5985823	947	L	5	12.2	8	Problematic
295	015668363	10U	424840	5985880	559	R	0	7.8	8	Problematic
296	015668363	10U	424865	5985838	559	L	0	4.2	7	Problematic
297	008154678	10U	424459	5985729	468	R	0	0	5	Problematic
298	008154678	10U	424426	5985682	468	L	0	0	5	Problematic
302	004861469	10U	423989	5985511	251	L	25	28	7	Problematic
303	015736709	10U	423651	5985444	448	R	0	19	7	Problematic
305	026586533	10U	423025	5985482	917	R	0	7	8	Problematic
306	026586533	10U	422843	5985303	1491	Both	0	3	7	Problematic
307	026586533	10U	423076	5985166	1388	L	0	2	7	Problematic
308	011253282	10U	422181	5985671	840	R	0	1	5	Problematic
309	011253282	10U	422258	5985621	840	L	0	1	5	Problematic
310	015717151	10U	421769	5985612	15	R	1	1	5	Problematic
311	004192401	10U	421586	5985502	440	Both	0	1	5	Problematic
312	015684041	10U	422093	5984487	1089	R	0	13.2	8	Problematic
313	015684041	10U	422177	5984499	1089	L	0	11.1	8	Problematic
315	015688135	10U	421648	5984082	358	L	7	15	5	Problematic
317	015613224	10U	420856	5983738	1607	L	2	29.3	6	Problematic
327	010939962	10U	418029	5983027	652	L	17	38.8	7	Problematic
328	015320731	10U	417830	5982730	60	L	60	60	8	Problematic

Table 6. List of Unhealthy Riparian Buffers in the Stoney Creek Watershed.

ID	PID	Zone	Easting	Northing	Metres of Bank	Bank Side	Minimum Buffer	Average Buffer	Final Point Total	Riparian Health Index Rank Ideal (16-20), Healthy (12-15), Adequate (9-11), Problematic (5-8), Unhealthy (<5)
38	009875140	10U	427824	5985206	2172	R	2	0	4	Unhealthy
39	009875140	10U	427905	5984897	2325	L	100	0	4	Unhealthy
200C	008899983	10U	415241	5977849	84	R	0	0	4	Unhealthy
201B	008899983	10U	415241	5977821	66	L	0	0	4	Unhealthy
211A	008899983	10U	415300	5978223	152	R	0	0	3	Unhealthy
212A	008899983	10U	415298	5978205	152	L	0	0	3	Unhealthy
215	015754201	10U	414194	5977589	168	R	0	0	4	Unhealthy
216	015754201	10U	414167	5977589	168	L	0	0	4	Unhealthy
217	015668258	10U	413988	5977982	1001	R	0	0	4	Unhealthy
218	015668258	10U	414033	5977974	1001	L	0	0	4	Unhealthy

One initial site assessment and prescription was completed near the confluence of Stoney Creek and the Nechako River. Many years ago, old cars, airplane parts, scrap metal, and concrete slabs were dumped at this site, it believed this was done to help prevent erosion and stabilize the bank (site 1, Table 3). A detailed description of the assessment can be found in Appendix 4.

6 Discussion and Recommendations

We identified 3 permanent natural obstacles to fish passage which may prevent upstream mobility of some or all species of fish in the watershed (Table 1). We also identified 49 crossings which are potential barriers and we were able to access nine of these crossings. We recommend that future work include assessing the remaining crossings to determine if a fish passage barrier exists, or if these sites are contributing to excessive sediment entering the stream.

The riparian health assessment revealed that 160 of 353 assessed riparian buffers could benefit from improved farming and livestock management practices. Of these 160 riparian buffers, 87 could not only benefit from improved management practices, but may need restoration efforts to help return these riparian buffers to a healthy functioning state.

It is important to note that this riparian assessment was an initial desktop review designed to identify potentially problematic riparian areas that may be contributing to, sediment loading through anthropogenic erosion processes, nutrient loading and eutrophication from farming and ranching practices, and increases in stream temperature from excessive vegetation removal in the Stoney Creek Watershed. With this initial assessment we have identified riparian buffer areas that have are likely contributing to a number of issues in the watershed. We recommend future field assessments are completed to verify riparian conditions and identify specific problems and potential solutions in these areas. Relationships with individual landowners should be developed and project prescriptions initiated and developed to restore riparian buffers to a functioning healthy state.

Due to budget constraints, we confined most of our riparian buffer health assessment to ≥3rd order stream. Although we were not able to assess most of the streams <3rd order, initial visual analysis of orthophotos in the agricultural belt suggests that much of the riparian buffers of these stream have be degraded or eliminated altogether through agricultural practices. Additional funding could allow analysis of these <3rd order streams and provide identification of many more problematic areas in the watershed, however based on the extensive degradation that has occurred in many of these lower order streams where often entire sections of streams have been cleared and are in agricultural production, perhaps funding and effort should be focussed on improving streams and riparian buffers that have some semblance of functionality remaining.

NEWSS is currently working with FLNRO staff begin the calculation of the Equivalent Clearcut Area (ECA). The ECA is an indicator used to measure the relative loss and recovery of hydrologic function for a forest canopy (BC Ministry of Forests 1999). Lewis and Huggard (2010) explained that the forest canopy plays a critical role in intercepting precipitation, and affecting

evapotranspiration, snow accumulation, and snowmelt. Loss of forest canopy through natural and anthropogenic disturbances can affect the amount and rate of precipitation that reaches the forest floor and influences the quantity and timing of water runoff. ECA is linked to these key hydrologic processes and can be used to forecast potential increased spring peak flow generation (BC Ministry of Forests 1999).The calculation of the ECA should be made a priority and the work completed as this is a key component of an overall watershed health assessment.

From this preliminary assessment, it appears that outside the agricultural land reserve area, riparian buffers are largely intact and functioning, although improvement could be made on range tenures to reduce livestock access to riparian areas to reduce riparian degradation, increased erosion potential resulting in sedimentation, and excessive nutrient loading to a watershed that has experienced eutrophication from historical agricultural practices. The Agricultural areas of this watershed have a very mixed report in terms of riparian buffer condition and functionality. Some areas are healthy or ideal while others are severely degraded and are in need of a combination of changed management practices and restoration projects to reverse the damage. Overall this preliminary assessment suggests that the health of the watershed in the agriculturally dominated areas is problematic and unless agricultural management practices are improved, the lentic systems within this watershed will continue to experience increased eutrophication, riparian buffer will continue to degraded resulting reduce riparian function in the system, and stream health will continue to decline.

7 Next Steps

The following is a list of recommended next steps for the Stoney Creek Watershed. Most of these steps require additional funding to complete.

High Priority

1) Start developing relationships with landowners, initiate and develop prescriptions for restoration projects in riparian buffers, suggest improved management practices in and around streams, and begin carrying out restoration projects in identified riparian buffers and streams.
2) Assess the remaining identified crossings to determine if a fish passage barrier exists, or determine if these sites are contributing to excessive sediments entering the stream if these sites are livestock or vehicular crossings. Develop prescriptions to improve, restore, or replace crossings/culverts and begin carrying out project work at these sites.

Additional Recommendations

1) Calculate the ECA for the Stoney Creek watershed.
2) Analyze existing data and map out the aquifer in the Stoney Creek watershed.
3) Assess the riparian health of the <3rd order streams and identify additional potential restoration projects.
4) Collect water temperature, water quality, and hydrological data, in the Stoney Creek watershed. Analyze and compare this data to historic information from previous studies to determine any changes or trends in these metrics.
5) Conduct macrophyte, phytoplankton, zooplankton sampling in Nulki and Tachick Lakes and compare this data to previous studies to determine if any major changes or trends have developed.
6) Conduct fish (species abundance and composition) and fish habitat (spawning, rearing, and overwintering) assessments; compare this data to previous studies to determine if major changes or trends have developed.
7) Conduct stream invertebrate (species abundance and composition) assessments; compare this data to previous studies to determine if major changes or trends have developed.
8) Complete a comprehensive assessment of the overall health of the Stoney Creek watershed using the information from this report, and the recommendations outlined in items 1-7 above.

8 References

B.C. Ministry of Environment. 2011. Field Assessment for Fish Passage Determination of Closed Bottomed Structures. 4th Edition.

British Columbia Ministry of Forests. 1999. Watershed assessment procedure guidebook. 2nd edition, Version 2.1. Forest Practices Code of British Columbia, Victoria, BC.

British Columbia Ministry of Forests. 1996. Community Watershed Guidebook.

Brooks, K.N., P.F. Folliott, H.M. Gregersen, and L.F. Debano. 1997. Hydrology and the management of watersheds. 2nd edition. Iowa State University Press, Ames, Iowa.

Irvine C. and McIntosh S. March 2002. The Nulki-Tachick Watershed Restoration Project: 1995-2000 Summary. Prepared for Forest Renewal BC and the BC Ministry of Environment Lands and Parks. Prince George BC.

Lewis D. and Huggard D. Spring 2010. A Model to Quantify Effects of Mountain Pine Beetle on Equivalent Clearcut Area. Streamline Watershed Management Bulletin Vol. 13/No. 2

9 Metadata Links

Digital Road Atlas (DRA) –
https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=45674&recordSet=ISO19115

Forest Tenure Road Segment Lines (FTEN Roads) –
https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=51944&recordSet=ISO19115

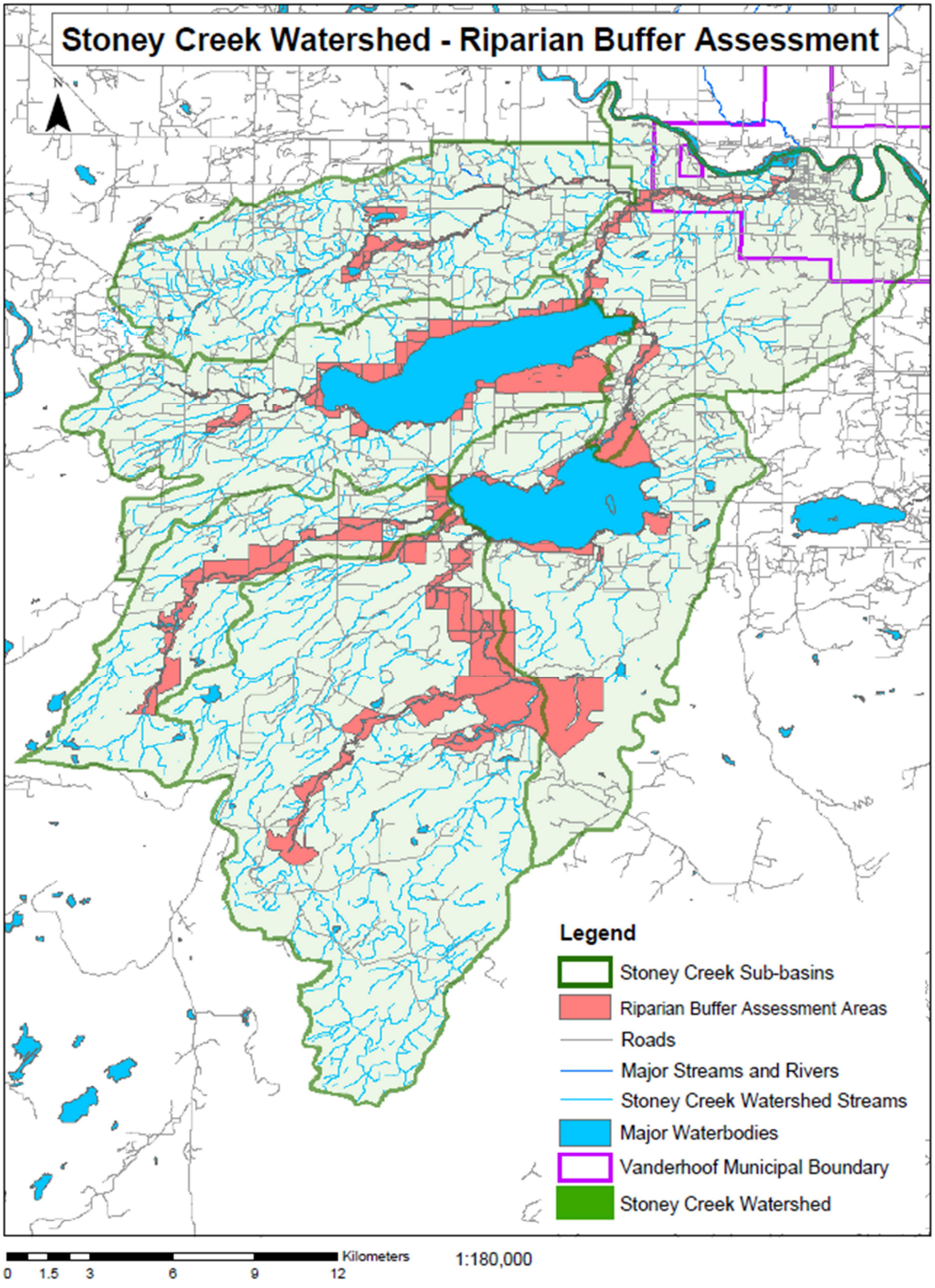
Freshwater Atlas: Obstructions –
https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?from=search&edit=true&showall=showall&recordSet=ISO19115&recordUID=50645

Freshwater Atlas: Stream Network –
https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=50648&recordSet=ISO19115

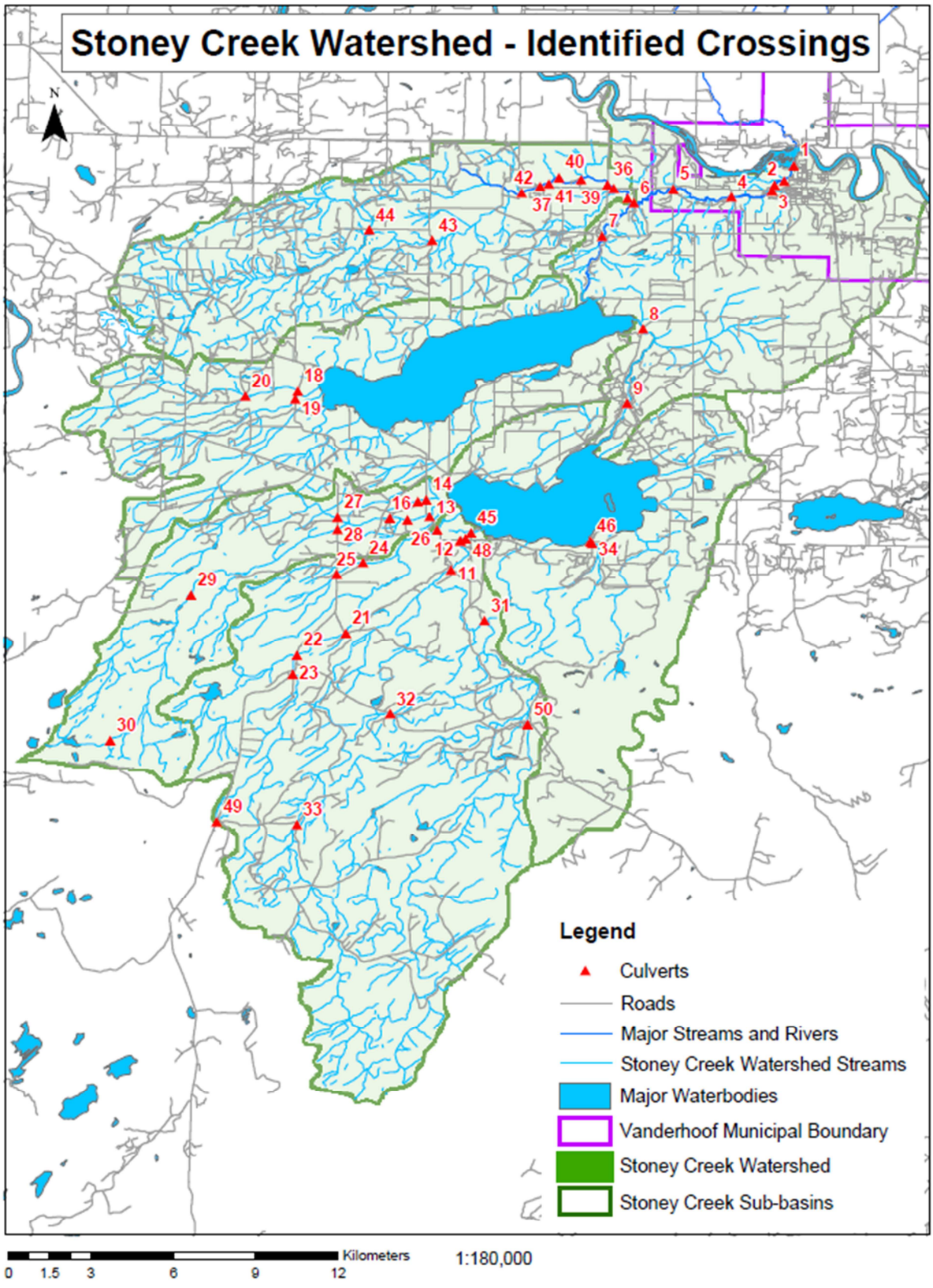
Provincial Obstacles to Fish Passage –
https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?from=search&edit=true&showall=showall&recordSet=ISO19115&recordUID=50219

10 Appendices

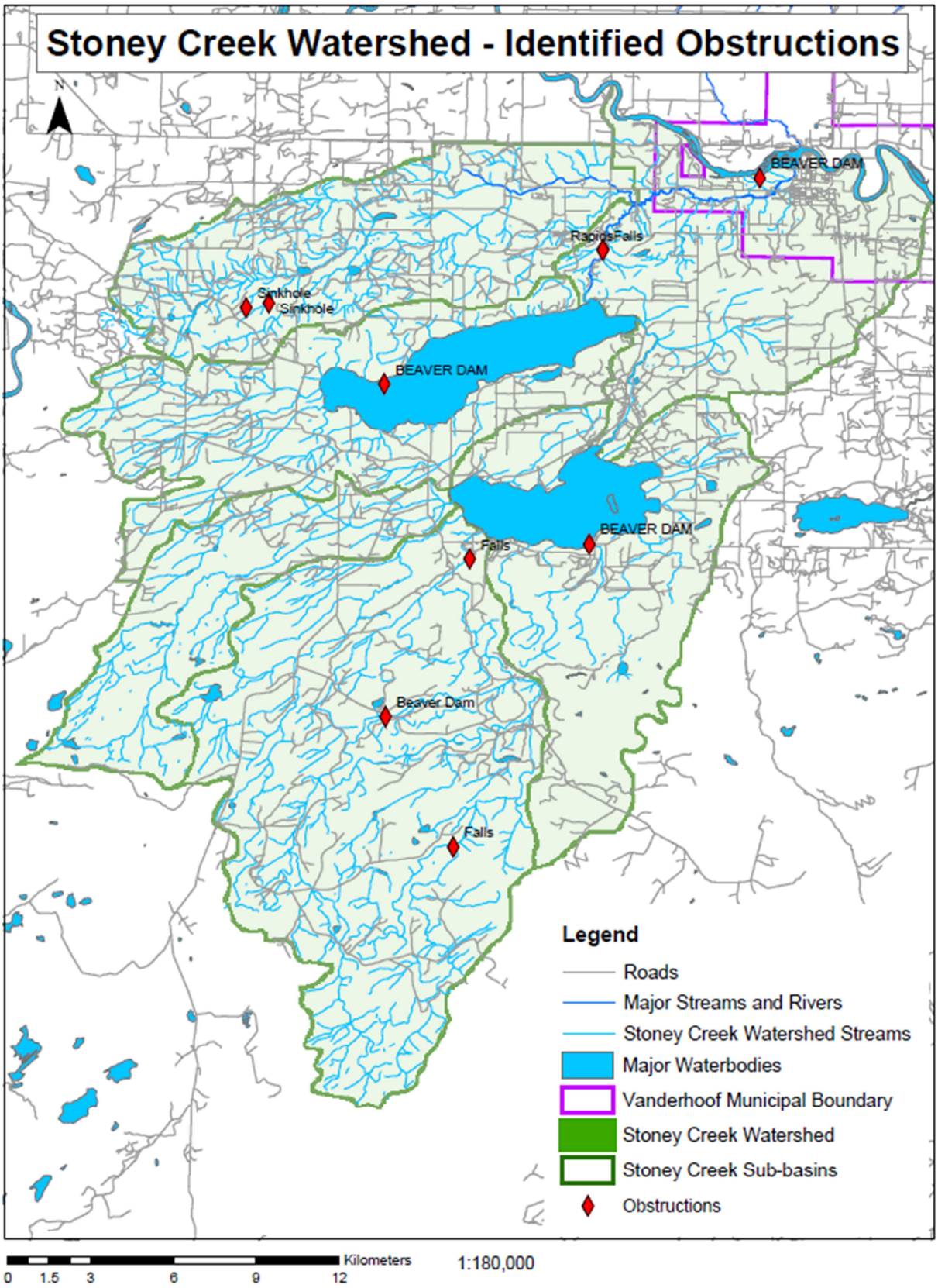
Appendix 1: Overview Map of the Stoney Creek Watershed Assessment Area



Appendix 2: Overview Map of Identified Crossings in the Stoney Creek Watershed.



Appendix 3: Overview Map of Identified Obstructions in the Stoney Creek Watershed.



Appendix 4: Initial Assessment and Prescription for a Stream Bank Clean-up and Erosion Prevention (Site 1).

Nechako Watershed

Initial Assessment and Prescription for a Stream Bank Clean-up and Erosion Prevention Site:

Location

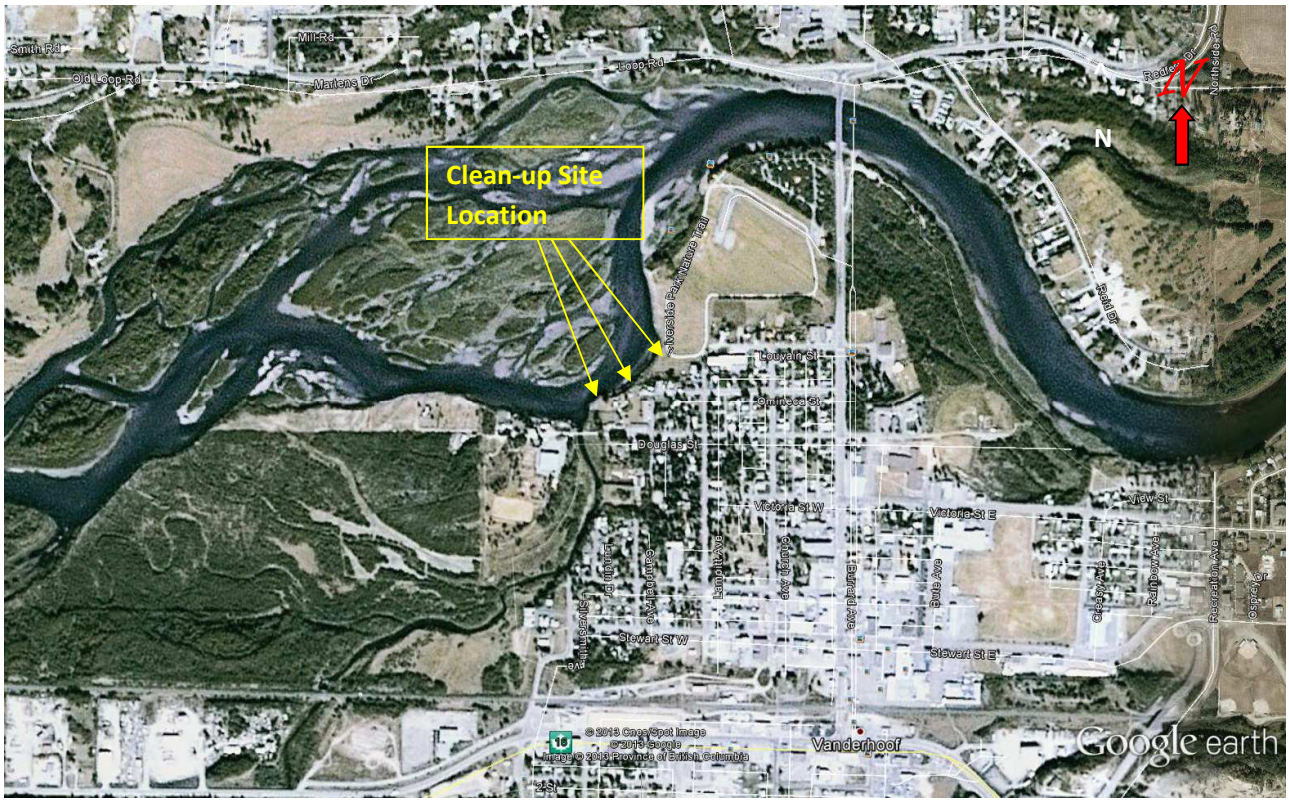
Legal Description of Property: NA

Property PID: NA

Location Description: This site is on the South bank of the Nechako River downstream of the confluence of Stoney Creek, and just upstream of Riverside Park in Vanderhoof.

Site GPS Location: 10U 432720 5985658

Map:



Site Description and Issues

Background: Old cars, airplane parts, scrap metal, and concrete have been dumped at this site many years ago to help prevent erosion and stabilize the bank.

Qualitative Assessment:

It is currently unknown who is responsible for these actions. What is known is that this site is in need of attention and remediation efforts should be considered. The old cars, scrap metal, concrete, garbage and debris should ideally be cleaned up and removed from the river if this can be done with minimal disturbance to the river substrate and bank, and with minimal sediment suspension instream. The old cars, airplane parts, scrap metal, and concrete have had some functionality in reducing erosion and providing bank stability and should be replaced with approved acid free rip-rap to prevent erosion and provide bank stabilization.

Initial Prescription

There are at several options for clean-up of this sight that could be explored, some of which will be expensive and some cost prohibitive.

1) Risks outweigh the benefits; leave the old cars, scrap metal, and concrete in place as they currently are?
2) At low water in late fall late (October) remove the old cars, scrap metal, concrete, garbage and debris using an amphibious excavator instream. Following the clean-up, rip-rap would then be placed for erosion prevention and bank stabilization.
3) At low water in late fall late (October) use a small 200 series excavator to remove the old cars, scrap metal, concrete, garbage and debris, while building a narrow riprap pad out and along the bank which will keep the excavator out of the river and bank soils while clean-up commences. The rip-rap will then be placed and contoured for bank stabilization.
4) Using a barge, float a small series excavator on river to remove the old cars, scrap metal, concrete, garbage and debris. Following the clean-up, rip-rap would then be placed for erosion prevention and bank stabilization.

Pictures:

Photo 1: Stoney Creek/Nechako River Confluence

Photo 2: Downstream of Stoney Creek/Nechako Confluence

Photo 3: Concrete and metal scrap along bank

Photo 4: View of clean-up site downstream

Photo 5: Metal scrap along bank

Photo 6: More metal scrap along bank

Photo 7: Aircraft wing along bang

Photo 8: Looking downstream at abandoned cars

Photo 9: Close-up of abandoned cars

Photo 10: Looking upstream at scrap metal

Photo 11: Garbage and debris in the water

Photo 12: More metal scraps in river

Appendix 5: Initial Site Assessment - Culvert Crossing (Site 2)

Stoney Creek Watershed

Initial Assessment and Prescription for Project 2: CN Rail Crossing

Location

Legal Description of Property: NA

Property PID: NA

Location Description: Culvert crossing at Stoney Creek North and West of Fountain Tire in Vanderhoof, BC.

Site GPS Location: 10U 432720 5985658

Map:

Site Description and Issues

Background: A Canadian National Rail (CN) crossing exists across Stoney Creek at this site. The site is located on just North and West of Fountain Tire in Vanderhoof. There are three culverts at this crossing.

Qualitative Assessment:

There are three round closed bottom culverts at this site. It appears, that these culverts were placed so that during freshet when high water velocities are coming out the culvert outlets, water is forced into the Northwest bank causing the bank to erode. All three culverts have a partial blockage inside the culverts caused by beavers. These blockages are causing the stream to be backed up upstream for several hundred meters. Even without these blockages, it appears the culverts inlets are raised to high, and water would be still be backed up upstream although at a lower water level. The lowest of the three culverts has a 15 cm outlet drop, and the other two culverts are higher and are likely fish impediments at low water and during spring freshet before the Nechako River water levels have risen. Fish passage may be possible when the Nechako River flows are high enough to back water up and slow velocities through the culverts however under normal and freshet conditions these culverts are likely barriers to fish. These culverts were assessed as barriers and are in definite need of replacement.

Location and Overview information

Assessment Date	Crossing ID	Crew	UTM	Road Name	Creek Name	Tenure
Nov 5, 2013	8	OA/CC	10U.432720.5985658	CN Rail Crossing	Stoney Creek	CN

Field Observations and Assessment Measurements

Crossing Type	Crossing Subtype	Diameter or Span (m)	Length or Width (meters)	Continuous Embeddedment? Yes/No	Average Depth Embededdment (meters)
CBS	RC	2.18	23.40	No	0

Resemble Channel? Yes / No	Backwatered? Yes / No	Percentage Backwatered	Fill Depth (meters)	Outlet Drop (meters)	Outlet Pool Depth (0.01m)	Inlet Drop? Yes / No	Culvert Slope (%)
No	No	0.00	4.10	0.15	0.94	No	2.00

Stream Information

Downstream Channel Width (m)	Stream Slope %	Beaver Activity? Yes / No	Fish Observed? Yes / No	Valley Fill	Habitat Value
17.02	1	Yes	Yes	Deep Fill	Medium

Scoring Data

Stream Width Ratio	Culvert Length Score	Embed Score	Outlet Drop Score	Culvert Slope Score	Stream Width Ratio Score	Final Score	Barrier Result
7.81	3	10	5	5	6	29	Barrier

Recommendations

Crossing Fix	Recommended Diameter or Span (meters)	Assessment Comment
Open Bottom Structure	25	Three culverts, all the same size. Beavers have dammed inside of the culvert. Water is backed up above the culverts

Initial Prescription

There are several options for this site.

1) Take out the culverts during low flow and replace them with a bridge.
2) Replace these culverts with a large diameter open bottom arch culvert that will handle freshet flows and will not impede fish passage.
3) Additionally, the Northwest bank downstream of the culvert needs to be armoured to prevent further erosion. This could be accomplished with a combination of rip-rap, rock-toe and tree revetments, root wad deflectors, or other options.

Pictures:

Picture 1: Culvert Inlet

Picture 2: Culvert Outlet

Picture 3: Upstream View

Picture 4: Downstream View

Picture 5: Culvert Barrel

Picture 6: Down Stream Bank Erosion

Appendix 6: Initial Site Assessment - Culvert Crossing (Site 3)

Stoney Creek Watershed

Initial Assessment and Prescription: Culvert Crossing (Highway 16)

Location

Legal Description of Property: Unknown

Property PID: NA

Location Description: Culvert crossing at Stoney Creek just past Fountain Tire heading west in Vanderhoof.

Site GPS Location: 10U 432631 5985436

Map:

Site Description and Issues

Background: A BC Ministry of Transportation (MOT) crossing exists across Stoney Creek at this site. The site is located on Highway 16 just west of Fountain Tire. There are two culverts at this crossing.

Qualitative Assessment:

There are two oval closed bottom culverts at this site. There was no evidence of washouts occurring in past years; indications are that the two culverts have been able to handle the flows thus far. Three CN Rail culverts downstream of this site are causing water to be backed up beyond these culverts. Currently these culverts are well under water, and without replacement of the CN culverts, it is difficult to ascertain what these stream flow would look like if stream flow were at normal levels. These culverts were assessed and scored as barriers. Although these culverts appear to allow fish passage in their currently backwatered state, they should eventually be replaced. Although water velocities at the time of the assessment would not likely be an obstacle to fish, seasonally high flows (i.e. freshet) may create a temporary obstacle to fish. In the interim looking at bio-engineering options to improve fish passage should be explored.

Location and Overview information

Assessment Date	Crossing ID	Crew	UTM	Road Name	Creek Name	Tenure
Nov 11, 2013	9	OA/CC	10U.432631.5985436	Hwy 16	Stoney Creek	MOT

Field Observations and Assessment Measurements

Crossing Type	Crossing Subtype	Diameter or Span (m)	Length or Width (meters)	Continuous Embeddedment? Yes/No	Average Depth Embededdment (meters)
CBS	OC	2.7	23.10	No	0.00

Resemble Channel? Yes / No	Backwatered? Yes / No	Percentage Backwatered	Fill Depth (meters)	Outlet Drop (meters)	Outlet Pool Depth (0.01m)	Inlet Drop? Yes / No	Culvert Slope (%)
No	Yes	100.00	2.30	0	0.02	No	1.00

Stream Information

Downstream Channel Width (m)	Stream Slope %	Beaver Activity? Yes / No	Fish Observed? Yes / No	Valley Fill	Habitat Value
18.30	1	Yes	Yes	Deep Fill	Medium

Scoring Data

Stream Width Ratio	Culvert Length Score	Embed Score	Outlet Drop Score	Culvert Slope Score	Stream Width Ratio Score	Final Score	Barrier Result
6.78	3	10	0	5	6	24	Barrier

Recommendations

Crossing Fix	Recommended Diameter or Span (meters)	Assessment Comment
Open Bottom Structure	25	Two culverts, same size.

Initial Prescription

There are at least two options for this site.

1) Take out the culverts during low flow and replace them with a bridge.
2) Replace these culverts with a large diameter open bottom arch culvert that will handle freshet flows and will not impede fish passage.
3) Look at bio-engineering options: increase substrate depth and roughness inside the culvert, place rock baffles to reduce velocities, and create step pools downstream of culvert outlet if needed.
4) Look at additional bio-engineering options upstream and downstream of the culvert that will help channelize and return the stream to a natural functioning state. This may be achieved by placing LWD, rock weirs, and rock-toe and brush revetments.

Pictures:

Picture 1: Culvert Inlet

Picture 2: Culvert Outlet

Picture 3: Upstream View

Picture 4: Downstream View

Picture 5: Culvert Barrel

Appendix 7: Initial Site Assessment - Culvert Crossing (Site 4)

Stoney Creek Watershed

Initial Site Assessment: Culvert Crossing (Site 4)

Location

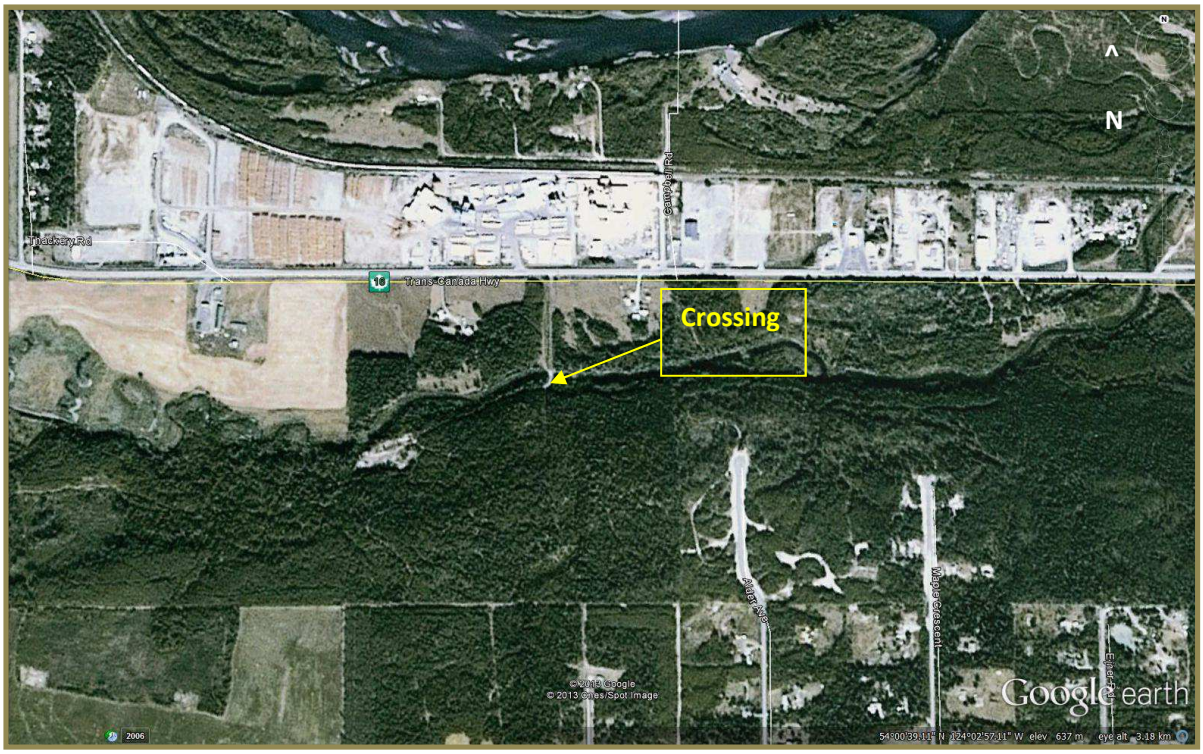
Legal Description of Property:

Property PID:

Location Description: The site is accessed between the Walter Wigmore property to the east, and the BID construction Property to the West. Ponderosa owns the property on the south side of the creek, and this road is the only access to this property.

Site GPS Location: 10U 431140 5985223

Map:



Site Description and Issues

Background:

An illegal crossing exists across Stoney Creek at this site. The site is accessed between the Walter Wigmore property to the east, and the BID construction Property to the West. Ponderosa owns the property on the south side of the creek, and this road is the only access to this property. The crossing was put in during the early 1980's by L&M Lumber in search of a Rock Quarry.

Qualitative Assessment:

There are three culverts at this crossing. It appears that the water slows at it approaches the culverts which has caused sediment to fall out of suspension above the crossing, the substrate above the culvert appears to be silty fines and relatively deep causing the water to be shallow (30-40 cm) above the culverts. At the time of the site visit, the water was high enough to be flowing through all three culverts and did not appear to be impeding fish passage; however observers from the previous year's reconnaissance fly over reported that the creek was virtually dry downstream of the culverts, and it appeared the sediment upstream of the culverts had formed a low flow dam which kept the creek watered upstream of the culverts. There was no evidence of washouts occurring in past years, so the three culverts have been able to handle the flow thus far. There is log debris washed from upstream that is providing a partial blockage to the two southern most culverts. These culverts are likely large enough to handle high flow, but did score as a barrier to fish passage in the culvert fish passage assessment.

Location and Overview information

Assessment Date	Crossing ID	Crew	UTM	Road Name	Creek Name	Tenure
Nov 11, 2013	10	OA/CC	10U.431145.5985220	NA	Stoney Creek	Private

Field Observations and Assessment Measurements

Crossing Type	Crossing Subtype	Diameter or Span (m)	Length or Width (meters)	Continuous Embeddedment? Yes/No	Average Depth Embededdment (meters)
CBS	RC	1.87	12.30	No	0.00

Resemble Channel? Yes / No	Backwatered ? Yes / No	Percentage Backwatered	Fill Depth (meters)	Outlet Drop (meters)	Outlet Pool Depth (0.01m)	Inlet Drop? Yes / No	Culvert Slope (%)
No	No	0.00	0.88	0	1.17	No	1.00

Stream Information

Downstream Channel Width (m)	Stream Slope %	Beaver Activity? Yes / No	Fish Observed? Yes / No	Valley Fill	Habitat Value
19.76	1	Yes	Yes	Deep Fill	Medium

Bankfull Width (m)	Wetted Width (m)	Upstream Depth (cm)	Downstream Depth (cm)
26	18	40-50	50-60

Scoring Data

Stream Width Ratio	Culvert Length Score	Embed Score	Outlet Drop Score	Culvert Slope Score	Stream Width Ratio Score	Final Score	Barrier Result
10.57	0	10	0	5	6	21	Barrier

Recommendations

Crossing Fix	Recommended Diameter or Span (meters)	Assessment Comment
Removal	0	Three culverts, all same size.

Initial Prescription

There are at least three options for this site.

1) This is the preferred option, is to let the stream return to a natural state by taking out the culverts during low flow and do not replace them with anything.
2) Take out the culverts during low flow and replace them with a bridge. Although this is also an acceptable option, it would be a very expensive endeavour which may preclude this option.
3) Replace this culvert with a large diameter open bottom arch culvert that will handle freshet flows and will not impede fish passage. Although this is also an acceptable option, it would also be an expensive endeavour.

Summer Pictures:

Picture 1: Culvert Inlet *(Looking North East*)

Picture 2: Culvert Outlet (Looking South West)

Picture 3: Upstream View (Looking West)

Picture 4: Downstream View (Looking East)

Picture 5: View of road over culverts (Looking South)

Picture 6: View inside middle culverts (West)

Fall Pictures:

Picture 1: Culvert Inlet *(Looking North East*)

Picture 2: Culvert Outlet (Looking South West)

Picture 3: Upstream View (Looking West)

Picture 4: Downstream View (Looking East)

Picture 5: View of road over culverts (Looking South)

Picture 6: View inside middle culverts (West)

Early Winter Pictures:

Picture 1: Culvert Inlet

Picture 2: Culverts Barrel

Picture 3: Upstream View (Looking West)

Picture 4: Downstream View (Looking East)

Appendix 8: Initial Site Assessment - Culvert Crossing (Site 8)

Stoney Creek Watershed

Initial Assessment and Prescription: Culvert Crossing (Highway 16)

Location

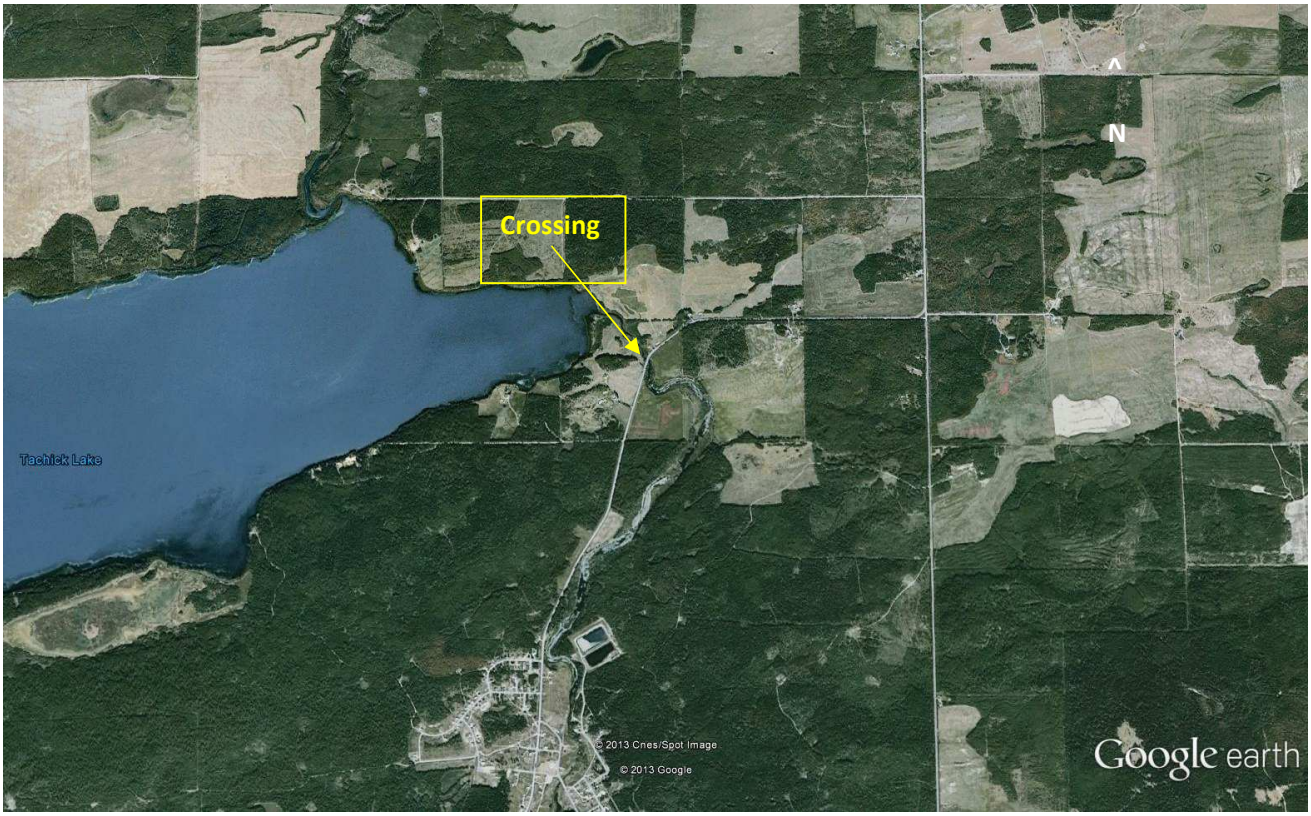
Legal Description of Property: NA

Property PID: NA

Location Description: Culvert crossing Site 8 at Stoney Creek just before flowing into Tachick Lake

Site GPS Location: 10U 427937 5980414

Map:



Site Description and Issues

Background: A BC Ministry of Transportation (MOT) crossing exists across Stoney Creek at this site. The site is located on Kenny Dam Road. There is one culvert at this crossing.

Qualitative Assessment:

There is a large oval closed bottom culvert at this site. The culvert is large, but still undersized for this stream. There was no evidence of washouts occurring, or severe erosion in past years. There is a lot of fresh beaver activity up and down stream of the culvert. Although water velocities at the time of the assessment would not likely be an obstacle to fish, seasonally high flows (i.e. freshet) may create a temporary obstacle to fish. This culvert scores as a potential barrier and although not a high priority, should eventually be replaced. In the interim looking at bio-engineering options to improve fish passage should be explored.

Location and Overview information

Assessment Date	Crossing ID	Crew	UTM	Road Name	Creek Name	Tenure
Nov 11, 2013	14	OA/CC	10U.427937.5980414	Kenny Dam	Stoney Creek	MOT

Field Observations and Assessment Measurements

Crossing Type	Crossing Subtype	Diameter or Span (m)	Length or Width (meters)	Continuous Embeddedment? Yes/No	Average Depth Embededdment (meters)
CBS	OC	4.30	21.50	Yes	0.08

Resemble Channel? Yes / No	Backwatered ? Yes / No	Percentage Backwatered	Fill Depth (meters)	Outlet Drop (meters)	Outlet Pool Depth (0.01m)	Inlet Drop? Yes / No	Culvert Slope (%)
No	Yes	100.00	2.40	0	0.18	No	1.00

Stream Information

Downstream Channel Width (m)	Stream Slope %	Beaver Activity? Yes / No	Fish Observed? Yes / No	Valley Fill	Habitat Value
15.60	1	Yes	No	Deep Fill	Medium

Scoring Data

Stream Width Ratio	Culvert Length Score	Embed Score	Outlet Drop Score	Culvert Slope Score	Stream Width Ratio Score	Final Score	Barrier Result
3.63	3	5	0	5	6	19	Potential

Recommendations

Crossing Fix	Recommended Diameter or Span (meters)	Assessment Comment
Open Bottom Structure	25	Lots of beaver activity, Beaver dam upstream of culvert, and broken dam downstream.

Initial Prescription

There are at least three options for this site.

1) Take out the culvert during low flow and replace it with a bridge.
2) Replace this culvert with a large diameter open bottom arch culvert that will handle freshet flows and will not impede fish passage.
3) Look at bio-engineering options: increase substrate depth and roughness inside the culvert, place rock baffles to reduce velocities, and create step pools downstream of culvert outlet if needed.

Pictures:

Picture 1: Culvert Inlet

Picture 2: Culvert Outlet

Picture 3: Upstream View

Picture 4: Downstream View

Picture 5: Culvert Barrel

Picture 6: In stream cattle watering site

Appendix 9: Initial Site Assessment - Culvert Crossing (Site 11)

Stoney Creek Watershed

Initial Assessment and Prescription: Culvert Crossing Site 11 (Edwards Rd)

Location

Legal Description of Property: NA

Property PID: NA

Location Description: Culvert crossing on Edwards Rd

Site GPS Location: 10U 420432 5973089

Map:

Site Description and Issues

Background: A BC Ministry of Transportation (MOT) crossing exists across this tributary of Stoney Creek at this site. The site is located on Edwards Road. There is one culvert at this crossing.

Qualitative Assessment:

There is a closed bottom culvert at this site. The stream width ratio for this culvert indicates it may be adequate for this stream, but some of the other assessment attributes (culvert length, embeddedness, and slope) make this culvert a potential barrier to fish. There was no evidence of washouts occurring, or severe erosion in past years. There is some evidence of beaver activity up and down stream of the culvert and a metal grate has been placed on the upstream side of the culvert to presumably limit beaver activity at this site. While the grate does not appear to restrict small fish passage based on mesh size, it could potentially be a barrier to large fish and if not regularly maintained could back up sufficient debris to become a passage issue for all fish and could cause erosion around the culvert, or culvert failure issues in the future. This culvert scores as a potential barrier and is a candidate for replacement.

Location and Overview information

Assessment Date	Crossing ID	Crew	UTM	Road Name	Creek Name	Tenure
Nov 5, 2013	18	OA/CC	10U.420432.5973089	Edwards	Tributary of Stoney Creek	MOT

Field Observations and Assessment Measurements

Crossing Type	Crossing Subtype	Diameter or Span (m)	Length or Width (meters)	Continuous Embeddedment? Yes/No	Average Depth Embededdment (meters)
CBS	RC	2.40	24.50	No	0.00

Resemble Channel? Yes / No	Backwatered? Yes / No	Percentage Backwatered	Fill Depth (meters)	Outlet Drop (meters)	Outlet Pool Depth (0.01m)	Inlet Drop? Yes / No	Culvert Slope (%)
No	Yes	100.00	1.40	0	0.40	No	1.00

Stream Information

Downstream Channel Width (m)	Stream Slope %	Beaver Activity? Yes / No	Fish Observed? Yes / No	Valley Fill	Habitat Value
1.80	1	Yes	No	Deep Fill	Medium

Scoring Data

Stream Width Ratio	Culvert Length Score	Embed Score	Outlet Drop Score	Culvert Slope Score	Stream Width Ratio Score	Final Score	Barrier Result
0.75	3	10	0	5	0	18	Potential

Recommendations

Crossing Fix	Recommended Diameter or Span (meters)	Assessment Comment
Open Bottom Structure	25	One Culvert

Initial Prescription

There are at least two options for this site.

1) Take out the culvert during low flow and replace it with a bridge.
2) Replace this culvert with a large diameter open bottom arch culvert that will handle freshet flows and will not impede fish passage.

Pictures:

Picture 1: Culvert Inlet

Picture 2: Culvert Outlet

Picture 3: Upstream View

Picture 4: Downstream View

Picture 5: Culvert Barrel

Appendix 10: Initial Site Assessment - Culvert Crossing (Site 12)

Stoney Creek Watershed

Initial Assessment and Prescription: Culvert Crossing Site 12 (Edwards Rd)

Location

Legal Description of Property: NA

Property PID: NA

Location Description: Culvert crossing on Edwards Rd

Site GPS Location: 10U 420166 5973591

Map:

Site Description and Issues

Background: A BC Ministry of Transportation (MOT) crossing exists across this tributary of Stoney Creek at this site. The site is located on Edwards Road. There are two culverts at this crossing.

Qualitative Assessment:

There are two closed bottom culverts at this site, one main culvert, and a smaller overflow culvert. The stream width ratio for this culvert indicates it is inadequate for this stream. In addition, some of the other assessment attributes (culvert length, embeddedness, and slope) make this culvert score as a barrier to fish. There was no evidence of washouts occurring, or severe erosion in past years. There is little evidence of beaver activity near the culvert. This culvert scores as a barrier and should be replaced.

Location and Overview information

Assessment Date	Crossing ID	Crew	UTM	Road Name	Creek Name	Tenure
Nov 5, 2013	19	OA/CC	10U.420166.5973591	Edwards	Stoney Creek	MOT

Field Observations and Assessment Measurements

Crossing Type	Crossing Subtype	Diameter or Span (m)	Length or Width (meters)	Continuous Embeddedment? Yes/No	Average Depth Embededdment (meters)
CBS	RC	1.83	20.20	No	0.00

Resemble Channel? Yes / No	Backwatered? Yes / No	Percentage Backwatered	Fill Depth (meters)	Outlet Drop (meters)	Outlet Pool Depth (0.01m)	Inlet Drop? Yes / No	Culvert Slope (%)
No	Yes	50.00	1.56	0	0.16	No	1.00

Stream Information

Downstream Channel Width (m)	Stream Slope %	Beaver Activity? Yes / No	Fish Observed? Yes / No	Valley Fill	Habitat Value
2.20	2	No	No	Deep Fill	Medium

Scoring Data

Stream Width Ratio	Culvert Length Score	Embed Score	Outlet Drop Score	Culvert Slope Score	Stream Width Ratio Score	Final Score	Barrier Result
1.20	3	10	0	5	3	21	Barrier

Recommendations

Crossing Fix	Recommended Diameter or Span (meters)	Assessment Comment
Open Bottom Structure	25	2 Culverts, one smaller than the other.

Initial Prescription

There are at least two options for this site.

1) Take out theses culverts during low flow and replace them with a bridge.
2) Replace these culverts with a large diameter open bottom arch culvert that will handle freshet flows and will not impede fish passage.

Pictures:

Picture 1: Culvert Inlet

Picture 2: Culvert Outlet

Picture 3: Upstream View

Picture 4: Downstream View

Picture 5: Culvert Barrel

Picture 6: Culvert Outlet with Both Culverts

Appendix 11: Stoney Creek Watershed Assessment - Riparian Health Assessment Criteria

Stoney Creek - Riparian Health Index

ID	PID	Zone	Easting	Northing	Owner	Metres of Bank	Bank Side	Minimum	Average Buffer		Riparian Buffer ≤ 5m	Riparian Buffer (6 - 15m)	Riparian Buffer (16 - 29m)	Riparian Buffer (30-59m)	Riparian Buffer (≥ 60m)		Total		Bare Ground/Very Heavily Grazed/Recent Industrial Development or Construct	Unfettered Livestock Access/Heavily Grazed/Few Riparian Shrubs Present	Limited Livestock Access/Lightly Grazed/Some Natural Riparian Vegetation & S	Natural Riparian Vegetation Mostly Natural and Intact/Few Disturbance Indicat	Natural Riparian Vegetation Intact/No Disturbance Indicators		Total
											Riparian Buffer Width								Riparian Vegetation Structure and Condition						
											Inadequate	Problematic	Adequate	Healthy	Ideal		Total		Very Poor	Poor	Moderate	Good	Excellent		
											1	2	3	4	5				1	2	3	4	5		

Bare Ground/Recent Industrial Development or Construction	Unfenced Riparian/Heavily Grazed Pasture/Areas of Exposed Soils	Industrial Buildings, Paved Paved or Gravel Parking, Little Vegetation	Fenced Riparian/Heavily Grazed Pasture/Few Areas of Exposed Soils	Unfenced Riparian/Lightly Grazed Pasture/Moderate Vegetation Height	Urban Setting, Abundant Cut Grasses, Some Schrubs and Trees	Annually Tilled Seed,Oil, or Grain Crop	Fenced Riparian/Lightly Grazed Pasture/Moderate Vegetation Height	No Till Seed, Oil, or Grain Crop	Perennial Hay Crop	Recently Logged Cutblock		Ungrazed Grassland/Few Shrub and Trees	Shrub, Grass, Forb Complex/Few Trees	Newly Planted Forest 1 - 9 years	New Forest 10 - 25 years	Young Forest 26 - 59 years	Mature Forest 60 - 119 years	Old Growth Forest > 120 years					Riparian Health Index Rank
Upland Vegetation Structure and Condition																					Final	Ideal (16-20), Healthy (12-15), Adequate (9-11), Problematic (5-8), Unhealthy (<5)
Very Poor	Very Poor	Very Poor	Poor	Poor	Poor/Mod	Poor/Mod	Moderate	Moderate	Moderate	Moderate		Moderate	Mod Good	Mod Good	Good	eally Good	Great	Excellent		Total		
1	1	1	2	2	3	3	4	4	4	5		5	6	6	7	8	9	10				Point Total