# Williams & Sockeye Creeks Pilot

## Watershed Status Evaluation Report

FREP *WSEP Note # 2, September 2021*

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**KEY MESSAGE: The effects of pre & post 1995 forest harvesting, along with other human disturbance, resulted in an "impaired" watershed function rating. Opportunities exist to improve the watershed's condition through coordinated watershed management, promoting recovery and improving operational practices. The watershed would benefit from a "fisheries sensitive watershed" designation.**

## 1. INTRODUCTION & BACKGROUND

Williams and Sockeye Creeks (also referred to as 'sub-basins' or 'study area') form the largest watershed flowing directly into the Lakelse Lake, and at 226.8 km$^2$, account for over a third of the larger Lakelse watershed's area. The Lakelse watershed, known as *Lax gyels* by the local First Nations (meaning "place of mussels"), is within the territories of the Tsimshian peoples. Lakelse Lake is a uniquely northern warm-water lake and the watershed has the highest historic per area fish production on the Skeena River supporting Aboriginal, recreational, and commercial fisheries (Gottesfeld and Rabnett 2008). Situated in the middle Coast Mountain Range, the Lakelse is a tributary to the Skeena River (Figure 3). Williams Creek is the larger of the two study area sub-basins, and due to gradient where about two-thirds of the upper reaches are confined in steep mountain valleys, there is efficient sediment transport capability accounting for its large alluvial fan. Fish are found throughout the study area and the lower third of the sub-basins host the highest species richness including: sockeye and coho salmon; steelhead and cutthroat trout; as well as a variety of other species. The sub-basin's high fish values make it a good candidate for a Fisheries Sensitive Watershed (FSW) designation under *Forest and Range Practices Act* (FRPA). The first documented broad-scale forest harvesting took place in the late 1940s, but some logging likely occurred after the 1900's when railway construction and establishment of local settler communities occurred. In addition to residential development in the Jackpine Flats area (occupying a portion of an alluvial fan), major linear corridors (highway, power transmission, and gas pipeline) and forestry remain the primary development activities influencing the condition of the study area.

This report provides the results from the first of several pilot applications of the Watershed Status Evaluation Protocol (WSEP) developed to help understand the status (i.e. 'potential-risk' and 'condition') of a watershed with significant fish values such as recognized under an FSW designation (see Appendix 6.3 for regulatory context). True to the nature of a pilot, much was learned (Pickard et al., *in progress*) and

***Figure 1. Williams Ck. Mainstem; while not part of a sample reach, this example depicts recent wind damage in Riparian Reserve Zone adjacent to clear cut forest harvesting.***

correspondingly, not all aspects of the WSEP were successfully completed as originally conceived. However, using data collected for the study area, this report provides important baseline information, initial finds and summarizes status information about the fish habitat in the watershed and, as warranted, offers generalized recommendations aimed at conserving and improving the condition of fish habitat. As such, this report is intended to convey WSEP results to land managers, decision makers, First Nations, and the public to help improve natural resource management practices and fish habitat conditions.

In this report section 1 provides a general overview of the watershed, including summary statistics and risk ratings for key habitat pressure indicators. Sections 2–4 outline key riparian, fish passage, and sediment delivery monitoring results. Section 5 contains a discussion of the watershed's status in 2011, including generalized management recommendations. Sections 6 and 7 contain references, data sources and additional analysis to help interested readers access supplementary information related to the watershed and this report.

The ***Watershed Status Evaluation Protocol*** (WSEP) is a science-based watershed monitoring tool that ties together landscape level GIS assessment with a series of existing on-the-ground sampling protocols. The WSEP is focused on legal "fisheries sensitive watersheds" and can also be used to monitor other watersheds with fish values.

***The FREP Mission:*** Collect and communicate the best available natural resource monitoring information to inform decision making, improve resource management outcomes and provide evidence of government's commitment to environmental sustainability.

# 1. WATERSHED OVERVIEW

## 1.1 WATERSHED OVERVIEW & SYNTHESIS

Figure 2 provides an analysis of remotely sensed habitat risk indicators (Porter et al. 2013) using available data for the watershed in 2011 (see Section 6.2). Most indicators (5 of 8) show moderate (yellow) to high (red) potential risk ratings, and of the high-risk indicators all are associated with potential riparian impacts (Figure 2). Vegetation Resource Inventory (VRI) data often underestimate the extent of forest harvesting (Porter et al. 2015) and field observations along with 2011 aerial imagery review indicate a substantial portion of the watershed as harvested (Figure 3). These results reflect the progression of forest harvesting and human disturbance over time where easily accessible lower-elevation areas, and where fish values are typically highest, were exploited first followed by rising rates of utilization in areas of increasing elevation.

## 1.2 TIER II WATERSHED SYNTHESIS

Table 1 represents a synthesis of Tier II field data showing watershed-scale evaluation of condition. For this assessment only riparian data was used in the analysis (the fish passage and fine sediment delivery components are discussed further in sections 3 and 4). A green outcome in Table 1 would indicate a riparian condition within an acceptable range of variability (RAV), a tan outcome indicates a marginal exceedance of RAV, and a red outcome indicates that a high benchmark has been reached or exceeded, and thus the component condition is considered "impaired" (Pickard et al. 2014). Given that each component and subcomponent is independently important to watershed-level condition of fish habitat, one or more red (and tan) scores is sufficient to support a closer look at the watershed for specific causal factors and remedies.

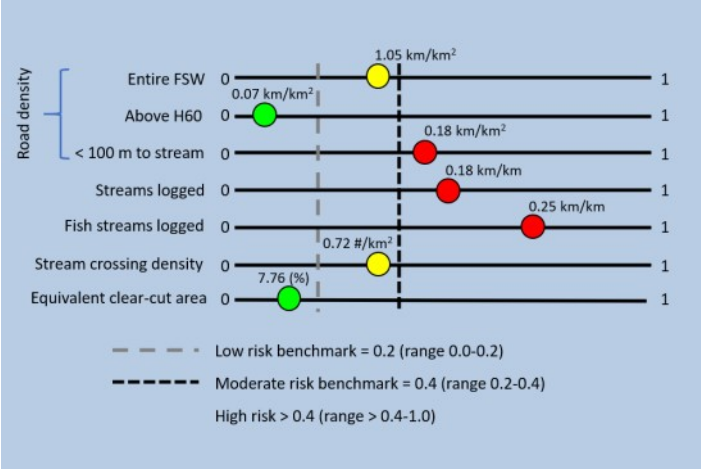


**Figure 2. Tier I remotely sensed (GIS) indicators of potential risk.**

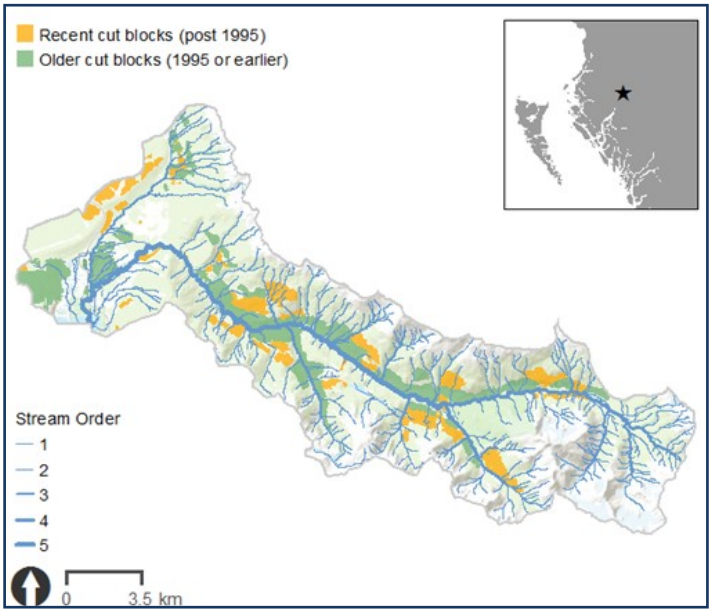


**Figure 3. 'Documented' forest harvest activity in the watershed to 2011. When comparing documented harvest area with aerial imagery from the same time period it was noted that actual harvest area was underrepresented.**

| *Steam Category* | *Riparian* | *Fish Passage* | *Water Quality* |
|---|---|---|---|
| Non-fish | ? | N/A | N/A |
| 1st & 2nd Order | ✖ | N/A | N/A |
| ≥ 3rd Order | ✖ | N/A | N/A |

**Table 1. Tier II riparian and fish passage data synthesis.**

# 2. RIPARIAN MONITORING

## 2.1 RIPARIAN SURVEY

Figure 4 shows the locations of 52 randomly selected riparian monitoring sites. Sampling was undertaken 2011 starting in the lower non-snowbound portions of the watershed in the spring, and then the remaining portions of the study area were sampled in the fall. Field data collection followed a WSEP-adapted (Pickard et al. 2014) FREP Riparian Management Evaluation Protocol (Tripp et al. 2009), which uses 15 distinct questions to assess the relative health, or "functioning condition" of a stream and its riparian habitat. Sites were selected using a stratified random design (Pickard et al. 2014). The results depicted in Table 2 show outcomes and riparian functioning condition ratings across sample sites within different habitat categories (strata). Riparian monitoring results (Table A1) are analyzed to understand causal factors (Tripp 2020).

## 2.2 KEY RIPARIAN SURVEY RESULTS

Of the 52 sites evaluated 40% (21) were at high risk or not properly functioning (Table 2). 25 sites were dropped in the field because they were: unsafe (4), a non-classified drainage (10), wetlands (6), or overlapped with another site (5). Many stream reaches surveyed showed the adjacent, and upstream effects of forest harvesting (Figure 5). Impacts have resulted in unstable substrate accumulations, channel widening, and atypical wood composition and distribution throughout stream channels. Compounding these factors, many harvested riparian areas were too young with wood too small to be fully functional. Furthermore, they often lack the forest age and structure necessary to supply functional large woody debris (LWD) or the complex shrub and understory layers that stabilize stream banks and provide habitat complexity, and do not represent natural conditions (Figure 6). In some situations, these conditions were exacerbated where old logging (pre-1995) and subsequent second-growth harvesting occurred (e.g., on FRPA class S4, S5, and S6 streams). In these examples, residual LWD was degraded and new sources of functional LWD were removed with the second-harvest, leaving streams deplete of both old and new LWD sources. Causal factor analysis (Tripp 2020) showed half (52%) of all factors affecting stream condition were related to human activity (see Table A1). Legacy impacts of pre-1995 logging, particularly to the stream edge, caused more impacts than post-1995 logging. Pre-1995 logging impacts were primarily on large fish-bearing streams while post-1995 impacts were mostly due to windthrow. Excessive debris torrenting (Figure 5) and sediment buildups (Figure 6) were prevalent, but upstream cause was often unknown. Natural factors including beavers, floods, naturally high background sediment levels and mass wasting were also important, accounting for 26% of all impacts.

| STRATA | PF | | | FR | | FHR | | NPF | | | n |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NFH | 4 | 6 | 3 | 2 | 1 | 3 | | 2 | | | 21 |
| FH 1&2 | | | 1 | 2 | 4 | 3 | 4 | 2 | | 1 | 17 |
| FH ≥3 | | 3 | 1 | 3 | 1 | 2 | 2 | 1 | 1 | | 14 |
| # No answers | 0 | | 2 | | 4 | | 6 | | | 9 | |

**Table 2. Distribution of riparian survey sample results. Each number in the table represents the number of surveys (sites) receiving a corresponding # "no" answers (x axis) by strata (y axis). Colored columns represent functional condition categories. Study area outcomes are shown in Table 4. (Condition abbreviations: PC = Properly functioning; FR = functioning but at risk; FHR = functioning condition but at high risk; and NRF = not properly functioning.)**

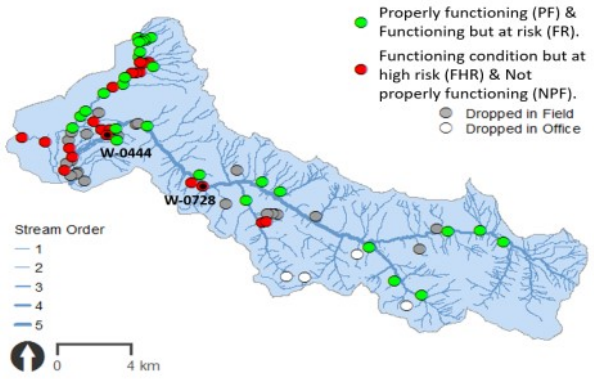


**Figure 4. Riparian survey locations in the watershed, showing functioning condition ratings.**

**Figure 5. Site W-0728, modeled as a non-fish-bearing stream, this is an example of upstream mass wasting imported to the survey site filling the channel and reach with coarse sediment and fallen trees (Functioning but at high risk).**

**Figure 6. Site W-0444, a highly impacted section of the Williams Creek alluvial fan (Not Properly Functioning). Harvested in the 1950s, this site represents an impacted area with high historic fish habitat values (Anon. 1946 and 1953; DFO 1954; McKinnon et al. 1954). Impacts include extensive aggradation, channel and bank instability, and LWD deficits. Sediment delivery from upstream locations is compounding degraded condition and prolonging recovery.**

**Key Riparian Findings—Riparian and stream channel condition impaired due to legacy effects of pre-1995 harvesting; at least half of all impacts caused by human activities.**

**Management Opportunities— To promote recovery, future operational activities should retain functional riparian areas on all streams, and where feasible, consider restoration of impacted stream channels and riparian areas throughout the study area.**

# 3. FISH PASSAGE MONITORING

## 3.1 FISH PASSAGE SURVEY

Figure 7 shows the locations of nine fish passage monitoring sites in the study area. Field data collection followed the Ministry of Environment's protocol "Field Assessment for Fish Passage Determination of Closed Bottom Structures" (MOE 2011) to assess fish passage at stream crossings. To determine the likelihood that a structure at a stream crossing provides safe passage this protocol uses a cumulative scoring approach, involving a suite of indicators (culvert length, slope, embedment, stream width ratio, outlet drop, etc.). Sample sites were completed by the riparian crew at the nearest road crossing a fish-stream closest to each randomly selected riparian site. Observed (i.e., confirmed) and modeled fish distribution were used to identify stream crossing sample sites along streams with fish habitat (BCMOE [2011] and Mount et al. 2011).

## 3.2 FISH PASSAGE SURVEY RESULTS

The intent of the above sample design was to increase sampling efficiency by using the same crew to apply all components of the Watershed Status Evaluation Protocol within reasonable proximity of the randomly selected riparian sample site. In practice, the approach reduced the efficiency of the crews and the sample achieved was too small to apply a watershed-level fish passage condition rating (Pickard et al. *in progress*). Of the nine sites sampled, barriers were observed at 71% of the 1st and 2nd order stream crossings and at 67% of all the stream crossings assessed. One 4th order bridge crossing was sampled, and it was passible. Several significant barriers were identified along non-industrial public roads (e.g. Figure 8a and 8b).

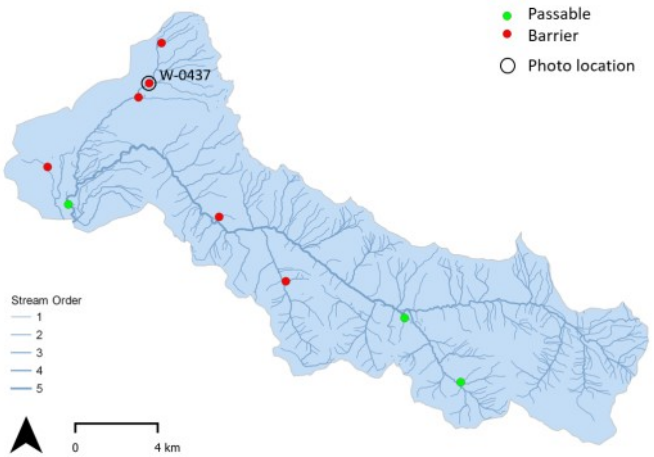


**Figure 7. Fish passage survey locations throughout the sub-basins, showing passage ratings**

**Key Fish Passage Finding – Of the small number of fish passage sites assessed a noteworthy number, both along public and industrial roads, were determined to be barriers.**

**Management Opportunities —The study area (including adjacent sub-basins in The Lakelse watershed) should be considered for a fish passage census to identify and remediate problematic fish passage locations.**

**Figure 8a. Site W-0437, located along a public road (Old Lakelse Lake Road), and a 3rd order stream with beaver/debris guard was assessed to be a significant fish barrier. Issues included: undersized culvert restricting channel, velocity barrier, and outlet and inlet drops.**

**Figure 8b. This site, located along a public road (Old Lakelse Lake Road) and ~ 100 meters from site W-0437, is also a 3rd order stream with beaver/debris guards. Although not assessed, it is another example of problematic beaver guarding impeding or blocking fish access.**

# 4. FINE SEDIMENT DELIVERY MONITORING

## 4.1 FINE SEDIMENT SURVEY

Figure 9 shows twenty-five sites where fine sediment surveys were completed. Field data collection followed FREP's "Water Quality Effectiveness Evaluation Protocol" (Carson et al. 2009). Like the Fish Passage assessments (see Section 3), site selection was tied to randomly selected riparian sample sites.

## 4.2 FINE SEDIMENT SURVEY RESULTS

As with the Fish Passage component, the sample design used for assessment of fine sediment delivery was insufficient to attribute a watershed-level fine sediment condition rating (Pickard et al. *in preparation*). However, of the 25 sites assessed, multiple and individually significant concerns with road design, construction and maintenance were observed including: numerous washed out and undersized culverts; lack of sediment controls while working in and around a stream; insufficient use of water bars and cross-ditches resulting in accumulated run-off, erosion and sediment delivery to streams; and inadequate road maintenance/deactivation practices (Figure 10 & 11). Of all the sites surveyed, 28% exceeded $\geq 5 m^3$ annual fine sediment delivery, placing these sites in the highest of the two high fine-sediment delivery categories.

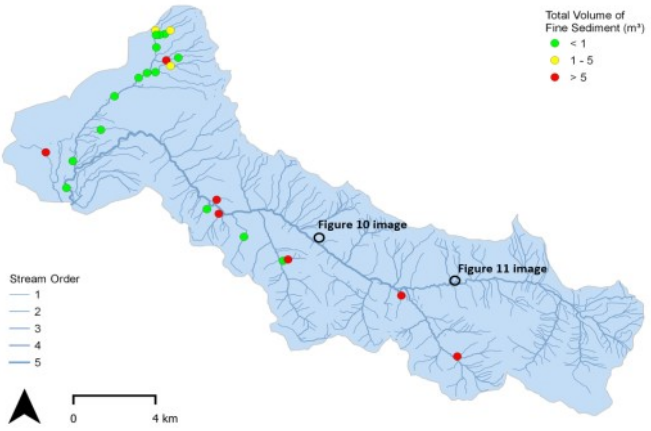


**Figure 9. Fine sediment survey locations within the sub-basins showing volume of fine sediment inputs at each site.**

**Key Sediment Delivery Finding – Of the small number of the fine sediment delivery sites assessed a significant number (10 of 25) were determined to be sources of high or very high sediment concentrations.**

**Management Opportunities — The watershed should be re assessed using the latest WSEP-FREP fine-sediment sampling methods and, where necessary, remediation measures implemented minimize sediment generation and delivery to streams.**

**Figure 10. Recently constructed spur with active hauling. Site had poor water management and high road-related sediment generation, which was compounded by over-steepened cutslopes.**

**Figure 11. One of several washouts observed in upper Williams Cr. directly above mainstem fish habitat**

# 5. WILLIAMS & SOCKEYE WATERSHED STATUS — SUMMARY

## 5.1 WATERSHED STATUS & RECOMMENDATIONS

**RIPARIAN— Riparian and stream channel conditions are impaired; recommend watershed and site-level measures that increase riparian protection and promote recovery.**

**FISH PASSAGE – Several significant barriers to fish passage were observed (e.g., Sockeye Ck sub-basin). Remediate these as necessary to improve fish access/aquatic network connectivity and conduct an updated WSEP census of fish-stream crossings throughout the sub-basin.**

**SEDIMENT DELIVERY – Significant sources of sedimentation were observed. A new WSEP Fine Sediment survey is recommended. Measures to improve road maintenance and construction practices resulting in sediment generation should be implemented.**

**FSW – Designate the sub-basins as a "fisheries sensitive watershed".**

Application of the WSEP to the Williams & Sockeye Creek study area showed that various benchmarks set as an indication of satisfactory condition (see Pickard et al. 2014) were not met. Outcomes for Tier I risk indicators (Figure 2) highlight elevated levels of human disturbance and associated residual risk to high value fish habitat. The results of Tier II are similar. Observations made for both the water quality and fish passage monitoring components indicate a reasonable basis for concern. While neither sample design nor size was adequate to determine watershed-level condition ratings for these two components, impacts determined during site assessments indicate both components require (i) site-level remediations, and (ii) application of the updated WSEP assessment to the study area. Analysis of riparian condition resulted in an overall rating for the sub-basins as 'impaired' (Table 4). Causal factor analysis of riparian data (Tripp 2020) indicated the single largest human cause of impact was pre-1995 logging (25%), and cumulative disturbances associated with human activities (e.g., pre-1995 logging, post-1995 logging, roads and utility corridors) accounted for half (52%) of all impacts to streams in the sub-basins (Table A1). Additionally, at least some of the 22% of unknown upstream causal factors are likely attributed to human activity, potentially increasing further cumulative human disturbances. The high proportion attributed to natural causal factors (26%, or as high as 48% if all unknow upstream causal factors are assumed to be natural) underscores the study area's inherent sensitivity to disturbance. The proportion of human disturbance resulting in impaired conditions in a watershed with inherent sensitivity underlines the importance of careful planning and management actions to improve fish habitat conditions. Special management is required to enable coordinated planning and management of activities throughout the watershed to prevent future development compounding existing impacts (i.e. allowing recovery of natural watershed processes, and in due coarse, important fish habitats). A watershed plan should emphasize managing: unstable terrain; current/future road locations, construction, use and maintenance practices; and the rate and location of forest harvesting (Milne 2014). Emphasis on accelerating the long-term recovery of riparian function along disturbed streams is recommended (e.g. riparian restoration within suitable areas), as well as retaining riparian buffers on all class S4, S5, and S6 streams (Tschaplinski 2010; Tschaplinski and Tripp 2017). Given the findings from this evaluation, the sub-basins high fish values and geomorphic sensitivities (Milne 2014), a fisheries sensitive watershed designation under FRPA and OGAA is warranted.

*Riparian Survey Results – Watershed Score*

| | Y/N (%) | Outcome |
|---|---|---|
| **Non-fish Habitat (n=21)** | | |
| are < 10% of sites NPF? | Y (5%) | ✓ |
| are <25% of sites FHR or NPF? | Y (24%) | |
| are >80% of sites PFC or FR | N (76%) | |
| **Fish Habitat 1st & 2nd order (n=17)** | | |
| are < 5% of sites NPF? | N (18%) | ✗ |
| are <20% of sites FHR or NPF? | N (53%) | |
| are >85% of sites PFC or FR | N (47%) | |
| **Fish Habitat ≥ 3rd order (n=14)** | | |
| are 0% of sites NPF? | N (14%) | ✗ |
| are <15% of sites FHR or NPF? | N (43%) | |
| are >90% of sites PFC or FR | N (58%) | |

**Table 4. Survey results by habitat category. Following categories described in the WSEP (Pickard etal. 2014), a green outcome indicates the condition of a sub-component is within an acceptable range of variability (ARV), a tan outcome indicates the condition marginally exceeds ARV and is of moderate concern, and a red outcome indicates that the outcome exceeds the ARV and is of high concern. See table 2 for distribution of "no" answers by stratum.**

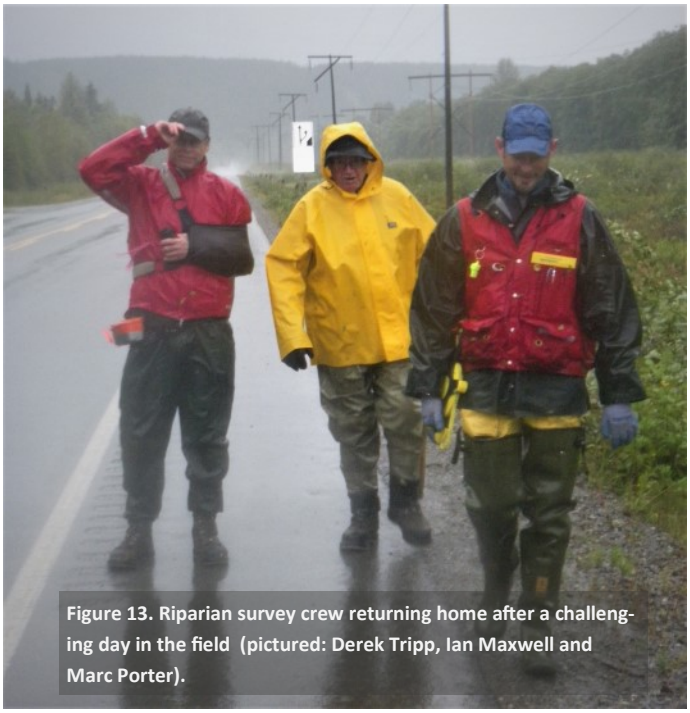

**Figure 13. Riparian survey crew returning home after a challenging day in the field (pictured: Derek Tripp, Ian Maxwell and Marc Porter).**

# 6. REFERENCES AND DATA SOURCES

## 6.1 REFERENCES


Anon. 1946. Spawning Stream Surveys – Lakelse. (*Williams Ck. field notes.*) Department of Fisheries and Oceans Canada.

Anon. 1953. The Sockeye Run to Williams Creek (*Report*). Department of Fisheries and Oceans Canada.

B.C. Ministry of Environment. 2011. Field assessment for fish passage determination of closed bottomed structures. 4th ed. https://www.for.gov.bc.ca/ftp/hcp/external/!publish/web/fia/Field-Assessment-for-Determining-Fish-Passage-Status-of-CBS.pdf

B.C. Ministry of Environment. (2011). PSCIS assessments (stream crossing) [online database]. https://catalogue.data.gov.bc.ca/dataset/pscis-assessments

Carson, B., D. Maloney, S Chatwin, M. Carver, and P. Beaudry. 2009. Protocol for evaluating the potential impact of forestry and range use on water quality (Water Quality Routine Effectiveness Evaluation). Version 1.0. Forest and Range Evaluation Program.

DFO. 1954. (*Archival Williams Ck stream reach spawning maps.*) Department of Fisheries and Oceans Canada.

Gottesfeld, A. and Rabnett, K. 2008. Skeena River Fish and Their Habitat. OSU Press.

McKinnon, Opseth, LeBrasseur and Humphreys. 1954. (*Archival field notes.*) Department of Fisheries and Oceans Canada.

Milne, M. 2014. Lakelse River Watershed – Review of Existing Information. M.J. Milne & Associates Ltd. http://a100.gov.bc.ca/pub/acat/public/viewReport.do?reportId=50402

Mount, C., S. Norris, R. Thompson, and D. Tesch. 2011. GIS modelling of fish habitat and road crossings for the prioritization of culvert assessment and remediation. Streamline. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/land-based-investment/fish-passage/habitat_modelling.pdf

Pickard, D., M. Porter, L. Reese-Hansen, R. Thompson, D. Tripp, B. Carson, P. Tschaplinski, T. Larden, and S. Casley. 2014. Fish values: watershed status evaluation (Working Draft). Version 1.0. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/140402_wse_protocol_april_02_14.pdf.

Pickard, D., D. Tripp, L. Reese-Hansen, R. Thompson, B. Carson, M. Porter, P. Tschaplinski, and D. Morgan. (*In progress*). Evaluating condition – Tier 2 fish-habitat values monitoring (Version 2.0); Watershed Status Evaluation Protocol (WSEP). Forest and Range Evaluation Program & Fish and Aquatic Habitat Branch.

Pickard, D., and L. Reese-Hansen. (*In progress)*. (Lessons learned from pilot applications of the Watershed Status Evaluation Protocol). Forest and Range Evaluation Program.

Porter, M., S. Casley, D. Pickard, E. Snead, and K. Wieckowski. 2013. Tier 1 watershed-level fish values monitoring protocol. Version 3.2. ESSA.

Porter, M., L. Reese-Hansen, R. Smith, S. Casley, D. Pickard, R. Thompson, D. Tripp, Z. Jumean, P. Tschaplinski, and S. Lees. (*In press*). Evaluating risk – Tier 1 fish-habitat values monitoring (Version 4.0); Watershed Status Evaluation Protocol (WSEP). Forest and Range Evaluation Program & Fish and Aquatic Habitat Branch.

Reese-Hansen, L., S. Sulyma, K. Rezansoff, and M. Phillpotts. 2017. Fisheries Sensitive Watershed Default Objectives and Designation Procedure. http://www.env.gov.bc.ca/wld/documents/fsw/171231_FSW%20Default%20Objectives%20Designation%20Procedure.pdf

Tripp, D.B. 2020. An Analysis of the Causal Factors Responsible for the No Answers On the 2011 Williams-Sockeye Creek Watershed Riparian Assessments. Tripp and Associates Consulting Ltd. http://a100.gov.bc.ca/pub/acat/public/viewReport.do?reportId=58699

Tripp, D.B., P.J. Tschaplinski, S.A. Bird, and D.L. Hogan. 2009. Protocol for evaluating the condition of streams and riparian management areas (Riparian Management Routine Effectiveness Evaluation). https://www.for.gov.bc.ca/ftp/hfp/external/!publish/frep/indicators/Indicators-Riparian-Protocol-2009.pdf

Tschaplinski, P.J. 2010. State of stream channels, fish habitats, and their adjacent riparian areas: resource stewardship monitoring to evaluate the effectiveness of riparian management, 2005–2008. https://www.for.gov.bc.ca/ftp/hfp/external/!publish/FREP/reports/FREP_Report_27.pdf.

Tschaplinski, P. and D. Tripp. 2017. Post-Harvest condition of stream channels, fish habitats, and adjacent riparian areas: resource stewardship monitoring to evaluate the effectiveness of riparian management 2005-2014. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/extension-notes/frep_extension_note_39.pdf


## 6.2 TIER I AND TIER II DATA SOURCES

| | Indicators (Data source) | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|---|
| GIS derived indicators | | | | | | | |
| Tier I | Watershed road density | ✓ | | | | | |
| | Road density above H60 | ✓ | | ✓ | ✓ | | |
| | Road density < 100m from stream | ✓ | | | | | |
| | Streams logged | | ✓ | | ✓ | | |
| | Fish streams logged | | ✓ | | | ✓ | |
| | Stream crossing density | ✓ | | | ✓ | | |
| | ECA | | ✓ | | | | |
| Field data | | | | | | | |
| Tier II | Riparian | | | | ✓ | ✓ | ✓ |
| | Fish passage | | | | | ✓ | ✓ |
| | Sediment delivery | | | | | | ✓ |

Data sources: (1) Digital Roads Atlas & Forest Tenures roads (2) Consolidated cutblocks (cut within last 100 years); (3) Digital Elevation Model; (4) Freshwater Stream Atlas stream network (5) Ministry of Environment fish habitat distribution model, (Version 2011) and (6) Field data (L. Reese-Hansen); For detailed information on data sources used for Tier 1 indicators, please refer to WSEP Tier 1 protocol (Porter et al. 2013).


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### MORE INFORMATION


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### CITATION


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# 6. REFERENCES AND DATA SOURCES CONT.

## 6.3 CONTEXT

In British Columbia, regulations under statutes such as the *Forest and Range Practices Act* (FRPA), *Oil and Gas Activities Act* (OGAA), and the *Land Act* can be used to augment standard regulatory requirements emphasising additional conservation requirements in the management of watersheds with fish and fish habitat values. For example, under the FRPA and OGAA, the provincial government can legally designate an area as a *fisheries sensitive watershed* (FSW) if it has significant fish values and sensitivity to disturbance (Reese-Hansen et al. 2017) As part of the designation, and consistent with the watershed's values and sensitivities, land use management objectives are established to protect fish habitat in the FSW by requiring that affected operators prevent (cumulative) impacts to fish habitat arising from their activities. Assessing watershed status is critical to conserving fish habitat and other associated values, and for continually improving both ecological condition and management practices within these watersheds.

Working with a range of partners, the provincial government developed the "Watershed Status Evaluation Protocol" (WSEP). It is used to collect monitoring data to help understand the pressures and conditions in watersheds with important fish values. The WSEP employs assessment methods that are repeatable and rapidly deployable, thereby cost-effectively improving our understanding of a watershed's status and relationships among watershed components (Pickard et al. 2020 and Porter et al. 2020). The protocol uses a two-tiered approach where: Tier I brings together the best available spatial information to assess the level of potential risk associated with disturbance; and Tier II applies existing field-based protocols via a spatially randomized sample-design to understand a watershed's fish habitat condition. Pre and post-1995 disturbance is often refer to as "old" or "new logging" (e.g., Tripp 2020). The WSEP distinguishes between old (e.g. pre 1995) and new impacts (post 1995 — the year when regulatory requirements were strengthened requiring forest management operations to better protect fish habitat). Field surveys undertaken in the Williams-Sockeye sub-basins represent the first of a series of WSEP pilots used to establish and refine the application of WSEP methods.

The FREP WSEP methods used in this assessment are aligned with government's Cumulative Effects Framework (CEF) assessment of Aquatic Ecosystems. While the CEF is an analysis of all watersheds across the province (using predefined standardized "assessment units"), the WSEP is a targeted analysis (i.e., targets FSWs, or watersheds with fish values of interest) of both risk (Tier I) and condition (Tier II). Together these are used to understand the status of a watershed, including the influence of cumulative disturbances (natural and human) on fish habitat. WSEP Tier II analysis can also be used to inform the condition of CEF assessment units.

# 7. APPENDIX

## CAUSAL FACTOR ANALYSIS OF RIPARIAN SURVEYS

***Table A1**. The average number of "No" answers caused by different categories of factors on riparian assessment of random sites stratified by stream class in the Williams-Sockeye Creek watershed. Numbers in brackets are the % of the total number of "No" answers for each category. Old and new logging refers to pre and post 1995 harvesting . (Adapted from Tripp 2020.)*

| Categories of Factors Causing "No" Answers | ≥3 Order Fish Streams (n=14) | 1-2 Order Fish Streams (n=17) | Non-Fish Streams (n=21) | All Sites (n=52) | Predominant Causal Factors for Category[1] |
|---|---|---|---|---|---|
| Old logging (<1995) | 1.1 (27%) | 1.0 (21%) | 0.7 (30%) | 0.9 (25%) | Clear cutting to/over stream edge (19%) |
| New logging (≥ 1995) | 0.0 (0%) | 0.9 (17%) | 0.6 (24%) | 0.5 (14%) | Wind throw (11%) |
| Roads[2] | 0.2 (5%) | 0.6 (11%) | 0.4 (17%) | 0.4 (11%) | Erosion on exposed surfaces (7%) |
| Powerline & gas line utility corridors[2] | 0.2 (5%) | 0.0 (0%) | 0.0 (0%) | 0.1 (2%) | -- |
| Natural events, conditions | 1.3 (32%) | 1.3 (27%) | 0.4 (18%) | 1.0 (26%) | Beavers (7%), high background sediment (4%), floods (4%), mass wasting (4%), unknown (4%) |
| Unknown upstream factors | 1.2 (30%) | 1.2 (23%) | 0.3 (11%) | 0.8 (22%) | Mass wasting (High sediment buildups or torrents, similar unknown cause) (11%) |
| All | 3.9 (100%) | 4.9 (100%) | 2.4 (100%) | 3.6 (100%) | |

[1] Relative importance of predominant causal (sub) factors to the overall number of "No" answers by category. Specific sub-factors refer to factors partly or wholly responsible for achieving at least 3% or more of "No" answers.

[2] Areas with low to no recovery potential.