WSP Indicator Analysis for the Section of the Bulkley TSA Situated Within the Babine River Watershed:

Riparian Disturbance

Interior Watershed Assessment Protocol (IWAP) Watersheds

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May 2023

Note to reader:

These Wild Salmon Policy (WSP) habitat indicator assessment reports are intended as a coarse filter approach to identify watersheds that are potentially at risk of exceeding thresholds for the four WSP habitat indicators (Road Density, Stream Crossing Density, Total Land Cover Alteration, and Riparian Disturbance). These reports present the results of GIS-based (Tier 1) methods for assessing the status of a particular freshwater aquatic habitat pressure indicator and determining the watershed indicator "risk" status by comparing the measured values to indicator benchmarks. Pressure indicators are identified by Canada's WSP as proactive measures of identifying potential impacts to salmon habitat within a watershed. Additional information on the WSP is available at https://www.pac.dfo-mpo.gc.ca/fm-gp/salmon-saumon/wsp-pss/ip-pmo/ip-smm-pmo-eng.html#assessment.

The analysis presented in this report was carried out using standardized provincial datasets and did not integrate field-based (Tier 2) information or industry datasets. The results are presented for informational purposes and are not intended to replace operational watershed assessments.

Acknowledgements

We would like to thank Sarah Railton, Greg Knox, and Julia Hill Sorochan for their contributions and feedback, and to Mary Robinson, Glen Buhr, Craig Mount, and Simon Norris for providing input datasets and supporting information.

WSP Indicator Analysis for the Section of the Bulkley TSA Situated Within the Babine River Watershed

Pressure Indicator: Riparian Disturbance

Assessment Units: IWAP Assessment Watersheds

Description of Pressure Indicator

Riparian disturbance is used to describe streamside changes which may affect stream shade and water temperature, wood and organic matter inputs, bank stability, and other riparian processes, and is considered an important pressure indicator by the Wild Salmon Policy Habitat Working Group (Stalberg et al., 2009). Riparian disturbance is defined as the percentage of the riparian zone (30 m buffer around all water bodies) that has been altered by land use activities (Porter et al., 2014; Stalberg et al., 2009). Riparian disturbance is related to total land cover alteration and road development.

Study Area

The Babine River Watershed is situated in the interior of northwest BC and covers an area of 3,895 km^2. The Babine River connects Babine Lake to the southeast with the Skeena River to the west and is an important salmon migration corridor. The Babine River Watershed falls within the Kispiox and the Bulkley Timber Supply Areas.

This report presents results for Bulkley Timber Supply Area (TSA) Interior Watershed Assessment Protocol (IWAP) watersheds situated within the Babine River Watershed by group name. The study area extent is shown in Figure 1. IWAP watersheds are primarily fourth order historical assessment watersheds delineated by the Bulkley TSA Watershed Assessment Panel in 1999 as reporting units for watershed assessment and monitoring projects (G. Buhr, personal communication, May 2023). Reporting watershed assessment results by IWAP watershed allows for continuity and comparison with historical results. A reference map showing the study area and IWAP watersheds with the Bulkley TSA and Babine River Watershed boundaries is included as Appendix A.

Figure 1: The study area is indicated in red. The grey polygon indicates the outline of the Skeena River watershed and the brown polygon shows the Bulkley TSA extent.

Methodology

Data layers used to perform the spatial analysis include:

- Bulkley Strategic Road Inventory (BC Ministry of Forests, 2022a)
- BC Timber Sales (BCTS) Aggregated Road Layer (BCTS, 2022)
- Digital Road Atlas (BC Ministry of Land, Water & Resource Stewardship [MLWRS], 2022a)
- Forest Tenure Road Section Lines (BC Ministry of Forests, 2022b)
- Harvested Areas of BC (Consolidated Cutblocks) (BC Ministry of Forests, 2022c)
- Vegetation Resources Inventory (VRI) (BC Ministry of Forests, 2022d)
- BC Transmission Lines (BC MLWRS, 2022b)
- TANTALIS – Crown Tenures (BC MLWRS, 2022c)
- Railway Track Line (BC MLWRS, 2022d)
- Fire Perimeters - Historical (BC MLWRS, 2022e)
- TANTALIS - Surveyed Right-of-way Parcels (BC MLWRS, 2022f)
- TANTALIS - Crown Land Right-of-way Parcels (BC MLWRS, 2022g)
- Oil and Gas Commission Pipeline Segment Permits (BC Oil and Gas Commission, 2022)
- Permitted Mine Areas - Major Mine (BC Ministry of Energy, Mines and Low Carbon Innovation, 2022)
- Baseline Thematic Mapping (BTM) (BC MFLNRORD, 2019a)
- Freshwater Atlas (FWA) Lakes (BC MFLNRORD, 2019b)
- FWA Atlas Manmade Waterbodies (BC MFLNRORD, 2019c)
- FWA Rivers (BC MFLNRORD, 2019d)
- Fish Habitat and Road Crossings Model (BC Ministry of Environment and Climate Change Strategy [MECCS], 2022)
- Bulkley TSA "Interior Watershed Assessment Procedure" (IWAP) Watersheds (Bulkley TSA Watershed Assessment Panel, 1999)
- FADM – Timber Supply Area (TSA) (BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development, 2021)

The input dataset versions are the same as those for the 2022 Babine River Watershed riparian disturbance indicator analysis which used FWA assessment watersheds as assessment units (Eclipse Geomatics Ltd., 2022).

Riparian Area Identification

Riparian areas within the study area were calculated using the methodology developed by the Pacific Salmon Foundation ([PSF], 2020):

- A buffer of 30 m (60 m corridor width) was applied to all features in the fish habitat and road crossings model (BC MECCS, 2019) classified as stream/river, ditch or canal. Ditch and canal features (if present) were inspected visually to confirm intersection with the stream network. Isolated ditch and canal features were removed if present.
- Features within the fish habitat and road crossings model with a FWA stream network feature code of WA24111170 (construction line – flow inferred) were visually inspected for intersection with the stream network. Isolated stream segments were removed from the dataset if present. Interconnected lake and wetland features were identified through intersection with the inspected fish habitat and road crossings model, and the selected lakes and wetlands were merged into one layer. The resultant layer was buffered by 30 m, the areas covered by lakes and wetlands were removed, and island or donut features were also removed.
- River polygons were buffered by 30 m, the areas covered by river features were removed, and buffer features around islands or donuts were also removed.
- The stream, lake/wetland, and river riparian layers were merged, overlaid with the assessment unit boundaries, and dissolved to produce the total riparian area within each assessment unit.

Disturbance Characterization

For the purposes of this study, anthropogenic alterations to the land base were calculated as well as natural disturbance from wildfires. Principal sources of human disturbance identified within the study area include forest harvesting (cutblocks) and resource road development.

Linear Disturbance Characterization

The Bulkley Strategic Road Inventory (BSRI) data layer was developed by BC MFLNRORD Skeena-Stikine District staff using information sourced from provincial TRIM base mapping, the Digital Road Atlas (DRA), Forest Tenure Road Section Lines (FTEN), and major licensee digital road files within the Bulkley TSA. The dataset was refined using best available orthophoto and satellite imagery and non-existent roads were removed (e.g. phantom duplicate or parallel road sections and planned roads that were never constructed) while deactivated roads were left in the data set (G. Buhr, personal communication, October 15, 2020).

The BCTS road layer is a combined road layer originally created in 2014 by combining the DRA and FTEN datasets with BCTS road information. It has been updated yearly by BCTS using ortho imagery to identify and remove overlapping features, creating a more accurate roads layer. The BCTS roads layer was partially updated in 2022, with the Bulkley TSA updated in 2021, the Morice TSA updated in 2022, and the Lakes TSA last updated in 2020 (M. Robinson, personal communication, Nov. 1, 2022). The BSRI data layer was used for the Bulkley TSA due to its more recent update date.

An updated roads layer was developed for the purposes of this analysis by adding new (post-update) road segments from the DRA and FTEN data layers that do not appear in the BSRI or BCTS layers as well as all DRA and FTEN roads within the study area but outside of the extents of the road inventory and BCTS datasets. These additional segments were extracted from the 2022 DRA and FTEN datasets by applying a buffer of 30 m to the road inventory and BCTS datasets and selecting DRA and FTEN roads outside of this buffer added since the respective update dates of each TSA extent. Overlapping roads within the DRA and FTEN subsets were removed by applying a 30 m buffer to the DRA subset and selecting FTEN roads outside of the buffer. The extracted DRA and FTEN roads were then merged with the BSRI and BCTS data layers to produce the input roads dataset.

Calculated road, railway, and transmission line right-of-way buffer widths were applied to the respective disturbance layers as set out below, where buffer width refers to the total width of each right-of-way:

Description	Modelled Buffer Width (m)
Trail	0
Overgrown Road	5
Unimproved Road	10
Resource Road	15
Main Resource Road	20
Local Road	25
Highways Road	50
Railway	15
Transmission Line	30

The BSRI roads layer is published with modelled buffer width as attributes in the datasets according to the characterization above. Modelled buffer widths were derived for BCTS, DRA, and FTEN road features with characterization estimated based on available attributes for each dataset. Refer to Appendix B for details on the method applied.

Land cover alteration along pipeline rights-of-way and other utility corridors was estimated from the TANTALIS – Crown Tenures dataset selected for utility and transportation with a tenure stage of “tenure” (i.e. active tenures), from the TANTALIS - Surveyed Right-of-way Parcels, the TANTALIS - Crown Land Rights of way with a tenure stage of “tenure”, and the Oil and Gas Commission Pipeline Segment Permits with a construction description of “constructed” and a buffer width of 18m. The utility category does not include the Prince Rupert Gas Transmission Project, which has been permitted but to our knowledge not constructed.

Forestry Disturbance Characterization

The Consolidated Cutblocks layer was used to identify disturbance from forest harvesting within the last 60 years (i.e. harvested since 1961). This is consistent with the approach used by the Pacific Salmon Foundation (2020).

Other Anthropogenic Disturbance Characterization

Additional sources of land cover alteration were estimated from the TANTALIS – Crown Tenures dataset selected for agriculture, industrial, commercial, quarrying, residential, and community tenure purposes with a tenure stage of "tenure" (i.e. active tenures).

Urban and developed areas were identified using the BTM filtered for a land use of "Urban", and the VRI filtered for land classifications of "urban" and "airport".

Areas disturbed by agriculture or rural residential use were identified using the BTM dataset filtered for land uses of "Agricultural" and "Residential Agricultural Mixtures", and the VRI dataset filtered for non-productive descriptors of "clearing" and "hayfield".

Mine footprints were estimated from the Permitted Mine Areas - Major Mine layer, the BTM filtered for a land use of "Mining", and the VRI filtered for land classifications of "mine spoils", "gravel pit", "open pit mining", and "tailings".

For the purposes of this analysis, 'other' disturbance includes disturbance from settlements, agriculture, industrial and commercial areas, mines, pipelines, transmission lines, and railways.

Natural Disturbance Characterization

The Fire Perimeters layer was used to estimate fire disturbance within the last 25 years (i.e. fires post 1997), consistent with the approach used by the Pacific Salmon Foundation (2020).

Riparian Disturbance Calculation

In order to report estimated total disturbed areas by disturbance type without overlaps, a hierarchy based on predicted degree of disturbance was applied: overlapping 'other' disturbances (railways, transmission lines, mines, settlements, and tenures) were removed from harvested areas, 'other' disturbances and harvested areas were removed from road areas, and 'other' disturbances, harvested areas, and road areas were removed from fire disturbance areas.

Riparian disturbance was calculated by merging all the disturbance layers into a total disturbance layer which was divided by the riparian area within each assessment unit using IWAP watersheds as assessment units. Figure 2 shows the location and types of land cover alteration with respect to the assessment units.

This analysis follows the methodology set out by the Pacific Salmon Foundation (2020) for Total Land Cover Alteration with the following adaptions:

- Substitution of the updated BSRI and BCTS roads layers for the DRA and FTEN datasets as they are considered to be the more accurate road layer for the study area; and
- Application of the buffer widths provided by G. Buhr as they were considered more accurate for roads and more conservative for rail and transmission line disturbance.

Salmon Habitat Characterization

The streams layer from the Fish Habitat and Road Crossings Model developed by Mount et al. (2011) and revised by Norris (2022) was used to identify and characterize riparian habitat available to salmon. The model uses input data extracted from the BC Geographic Data Warehouse including the FWA Stream Network and Known Fish Observations among others. Output from the fish habitat model classifies fish habitat as accessible by specific species of fish based on stream gradient and absence of natural fish passage barriers such as waterfalls (Norris, 2022). For the purposes of this assessment, fish habitat was defined as habitat accessible by salmon species (up to a 15% grade) and is reported as "Accessible Salmon Habitat" and "Non-accessible Habitat". This is a change from previous assessments (Eclipse Geomatics Ltd., 2021) where salmon habitat was reported as "Observed", "Inferred" and "Non-habitat". This change was made due to reporting modification in the Fish Habitat and Road Crossings Model which no longer allows for the same type of characterization of stream habitat.

Riparian zones for streams and rivers were identified through the application of a 30 m buffer to stream/river features in the Fish Habitat and Road Crossings Model and to river polygons, for which fish presence attributes were extrapolated through intersection with the Fish Habitat and Road Crossings Model. The areas covered by river polygon features and buffer features around islands or donuts were removed. Stream riparian area was calculated and summed for each assessment unit by fish habitat.

Stream riparian area and fish habitat characterization is provided for context only and is not used to assess or qualify riparian habitat disturbance in this analysis.

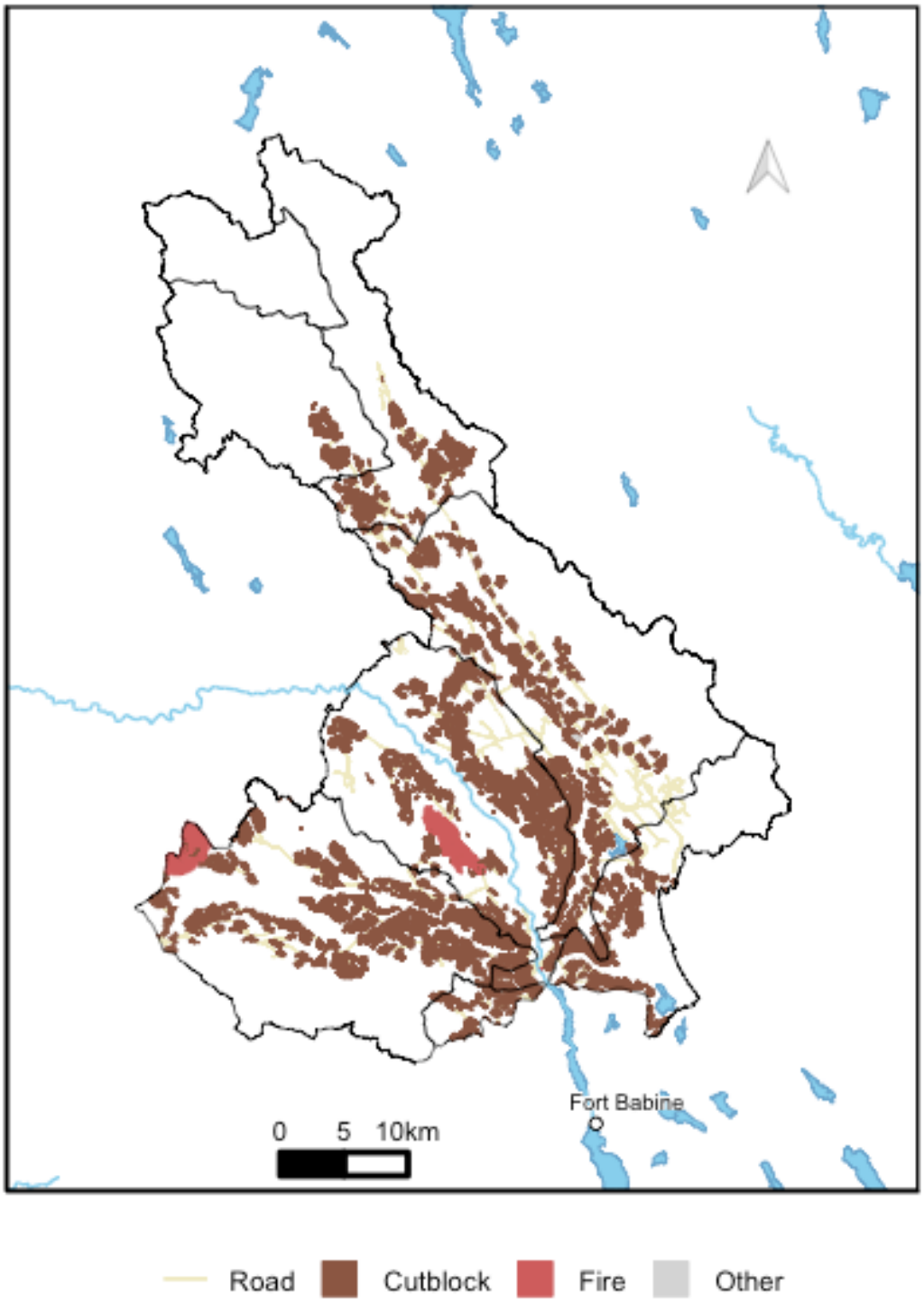

Figure 2: Assessment units and disturbance type located in the study area, including roads; forest harvesting; wildfire; and agricultural, industrial, utility, transportation, commercial, quarrying, residential and community land tenures, railways, powerlines, and settlements, shown collectively as other disturbance.

Risk Thresholds

Categorical risk thresholds applied were generated by the Pacific Salmon Foundation based on recommendations from the Wild Salmon Policy Habitat Working Group (Porter et al., 2014; Stalberg et al., 2009) and are tabulated below:

Threshold Rating	Percent of Riparian Area Disturbed (%)
Low	< 5%
Moderate	≥ 5% and < 15%
High	≥ 15%

Results of Analysis

A summary of the results of the riparian disturbance analysis with categorical risk thresholds for each assessment unit are shown as Figure 3. Detailed results for each assessment unit are tabulated in Appendix C, and the distribution of the assessment results are shown as a series of figures in Appendix D. Riparian habitat characterization for each assessment unit is included as Appendix E.

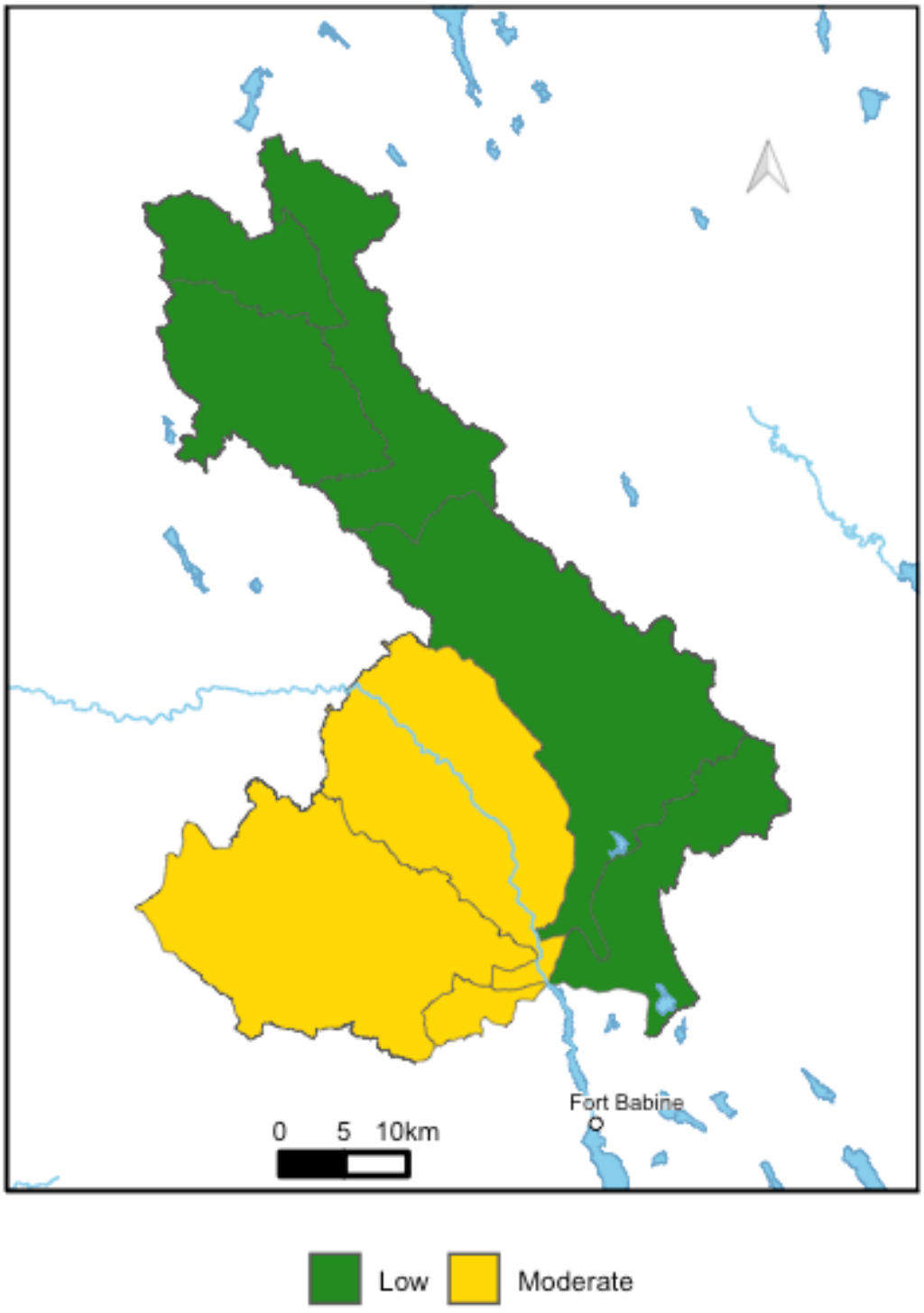

Figure 3: Riparian disturbance for each boundary in the study area is shown on a study area map. The results are colourized by risk threshold (low risk < 5% disturbed, moderate risk ≥ 5% and < 15% disturbed, and high risk > 15% disturbed).

Riparian disturbance was calculated for a total of eight IWAP watersheds. Values ranged from 0% to a maximum of 14.21% (Appendix B and Appendix C). Three assessment units had riparian disturbance values above the moderate risk threshold, and are associated with forestry activities, wildfires, and road development in the southern portion of the study area (Figure 2, Figure 3).

Summary

Riparian habitat was characterized and riparian disturbance from forestry activities, roads, utility and railway corridors, and settlements was calculated for eight IWAP watersheds within the Bulkley TSA and Babine River Watershed using datasets sourced from the Province of BC. Risk categories derived by the Pacific Salmon Foundation based on recommendations from the Wild Salmon Policy Habitat Working Group were used to assess risk to freshwater habitat from riparian disturbance.

Results of the analysis indicated riparian disturbance ranged from 0% to 14.21% of riparian area disturbed, with IWAP watersheds at moderate from riparian disturbance-related impacts to fish habitat situated in the southern portion of the study area.

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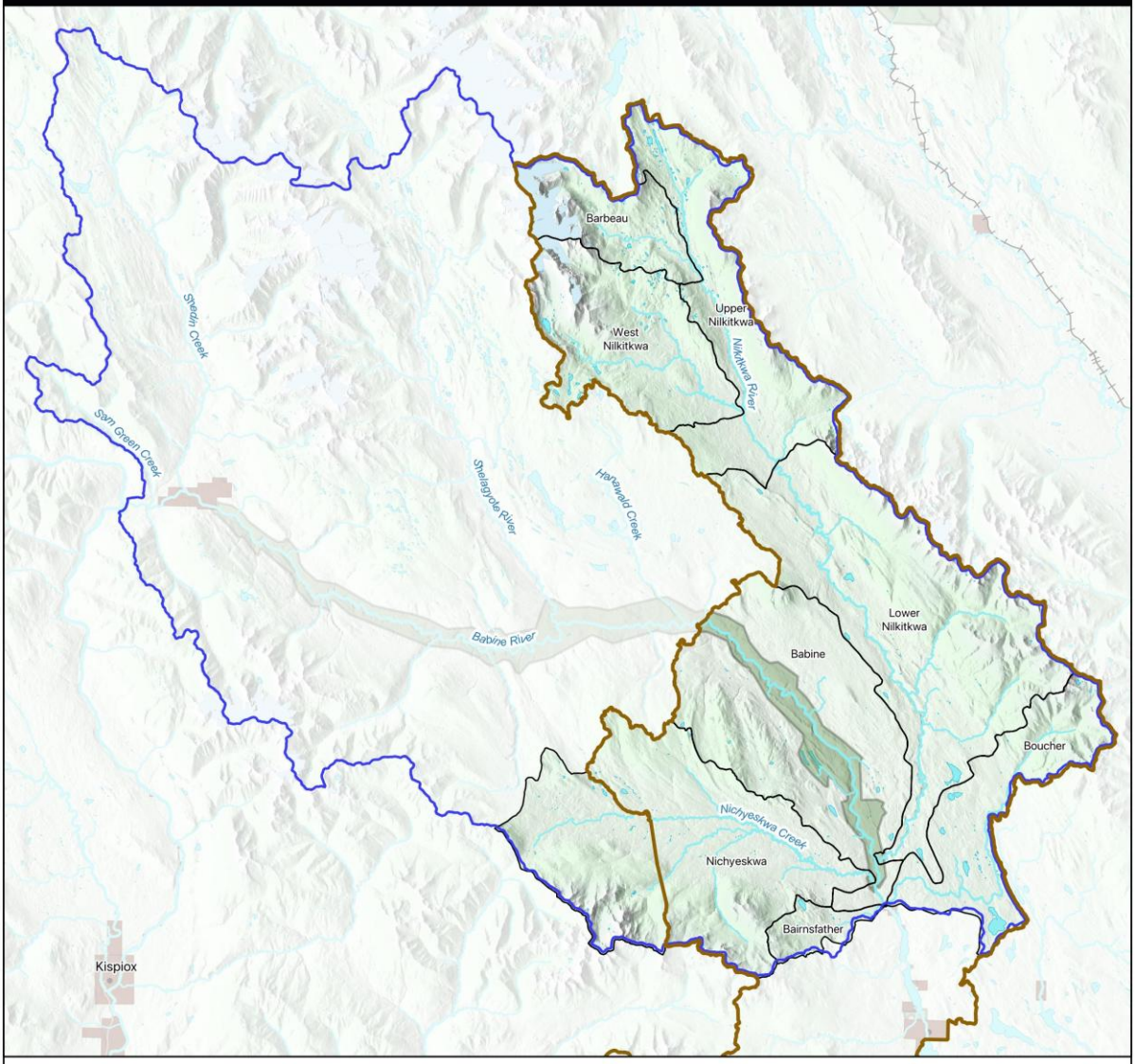
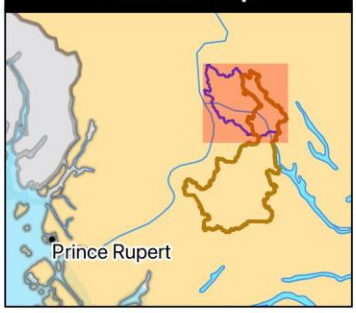
Appendix A: Reference Map

Babine River Watershed Reference Map



Location Map



Legend

- Babine River IWAP Watershed
- Bulkley Timber Supply Area
- Babine River Watershed
- Reserve
- Park

0 10 20 km

Prepared for SkeenaWild by Eclipse Geomatics Ltd., May 2023.

Appendix B: Modelled Road Buffer Width Methodology

Description	Modelled Buffer Width (m)	FTEN Attributes	DRA Attributes	BCTS Attributes
Trail	0	-	ROAD_CLASS = trail, driveway or proposed	LICRDCLASS = TRAIL and BUF_DIST = 5
Overgrown Road	5	-	RDSURFACE = overgrown or seasonal	-
Unimproved Road	10	-	ROAD_CLASS = resource or unclassified, RDSURFACE ≠ paved or overgrown, AND NUMLANES = 1	LICRDCLASS ≠ TRAIL and BUF_DIST = 4 or 5
Resource Road	15	FIL_TP_DSC = Road Permit	ROAD_CLASS = resource, recreation or unclassified, RDSURFACE ≠ rough, paved, overgrown or seasonal, AND NUMLANES = 2	BUF_DIST = 8, 9 or 10
Main Resource Road	20	FIL_TP_DSC = Forest Service Road	ROAD_CLASS = resource or unclassified, AND RDSURFACE = rough, AND NUMLANES = 2	BUF_DIST = 14 or 15 and LICRDCLASS ≠ HWY
MOT/Local Road	25	-	ROAD_CLASS = local, arterial, service, or strata, OR RDSURFACE = paved, AND ROAD_CLASS ≠ trail or highway	BUF_DIST = 20
Highways	50	-	ROAD_CLASS = highway	BUF_DIST = 15 or 30 and LICRDCLASS = HWY

Notes:

FIL_TP_DSC = file type description

RDSURFACE = road surface

NUMLANE = number of lanes

STLG = short-term low-grade

LTAW = long-term all-weather

LICRDCLASS = license road class;

BUF_DIST = buffer distance

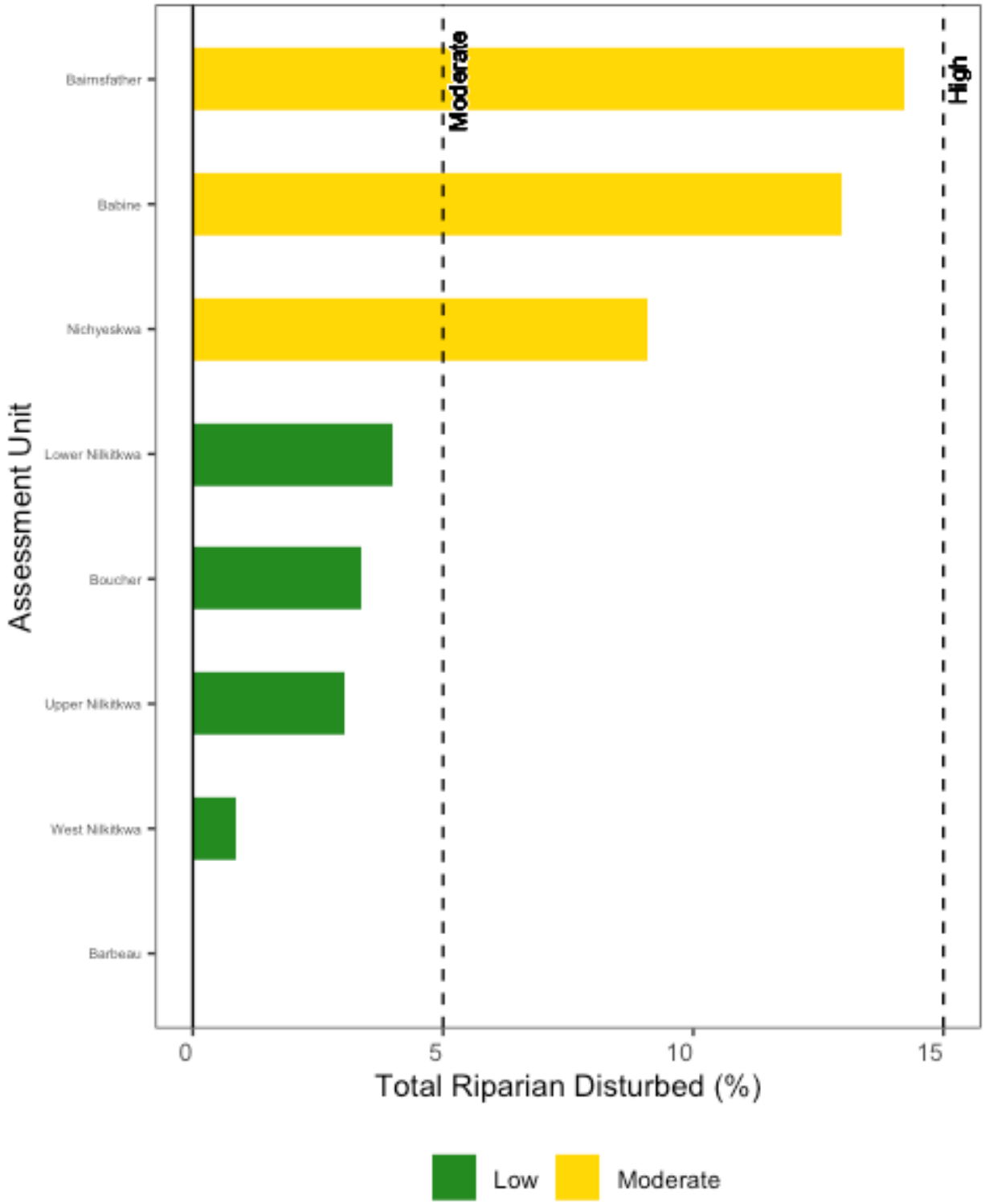
Appendix C: Results Table

Assessment Unit	Total Riparian (km^2)	Disturbed Riparian (km^2)				Total Riparian Disturbed (km^2)	Percent Disturbed (%)	Risk
		Roads	Harvested (Post 1961)	Other	Fire Disturbance (Post 1996)			
Babine	33.20	0.16	3.06	0.00	1.10	4.31	12.99	Moderate
Bairnsfather	3.40	0.01	0.48	0.00	0.00	0.48	14.21	Moderate
Barbeau	11.83	0.00	0.00	0.00	0.00	0.00	0.00	Low
Boucher	17.11	0.03	0.55	0.00	0.00	0.58	3.38	Low
Lower Nilkitkwa	49.21	0.15	1.80	0.01	0.00	1.96	3.99	Low
Nichyeskwa	45.50	0.10	3.02	0.00	1.01	4.13	9.08	Moderate
Upper Nilkitkwa	26.56	0.04	0.77	0.00	0.00	0.81	3.03	Low
West Nilkitkwa	23.61	0.01	0.20	0.00	0.00	0.21	0.87	Low

Note: Values were rounded to two decimal places following risk characterization.

Appendix D: Results Distribution

Results are colourized by risk threshold (low risk < 5%, moderate risk ≥ 5% and < 15%, high risk ≥ 15%).



Appendix E: Riparian Habitat Characterization

Assessment Unit	Total Area (km^2)	Riparian Area by Type (km^2)		Total Stream Riparian (km^2)	Stream Riparian as % of Total Area
		Accessible Salmon Habitat	Non-accessible Habitat		
Babine	300.37	13.72	17.18	30.90	10.29
Bairnsfather	26.23	1.50	1.68	3.19	12.15
Barbeau	85.83	3.77	7.17	10.95	12.75
Boucher	142.18	8.40	6.71	15.11	10.63
Lower Nilkitkwa	376.37	19.32	26.25	45.58	12.11
Nichyeskwa	358.43	23.95	18.74	42.69	11.91
Upper Nilkitkwa	189.67	11.41	13.78	25.19	13.28
West Nilkitkwa	169.97	6.85	14.11	20.96	12.33