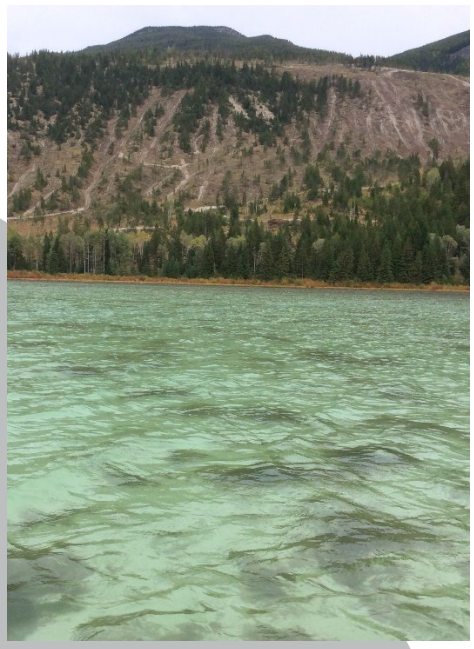
Whitetail Lake Foreshore Integrated Management Planning – 2021

Wood Project# VE52823-2020B



Prepared for:

Living Lakes Canada
Nelson, BC

31 March 2021

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Executive Summary

Whitetail Lake is located in the East Kootenays, approximately 28 km northwest of Canal Flats, BC. The lake has a surface area of approximately 1.66 km^2 with approximately 10 km of shoreline. The lake is moderately productive and has a large littoral area covering approximately 77% of its basin. There is a BC Recreation Site on the west side of the lake and all other properties around the lake are privately held. Whitetail Lake experiences significant recreational fishing pressure from anglers targeting trophy-sized Rainbow Trout (*Oncorhynchus mykiss*) and Eastern Brook Trout (*Salvelinus fontinalis*).

Foreshore Inventory Management Planning (FIMP) is a three staged process. Foreshore Inventory and Mapping (FIM) is a standard technique that uses GIS, GPS and field observation to identify and document the land uses (e.g., residential and industrial development, etc.), shoreline modifications (e.g., docks, and retaining walls), and biophysical attributes (e.g., wetlands, riparian vegetation, and substrate) along a lake shoreline. Shoreline biophysical attribute data collected during the FIM survey, fish and wildlife sampling results and information from other data and literature sources are used to create a Foreshore Habitat Sensitivity Index (FHSI) which ranks the habitat value or environmental sensitivity of a shoreline segment. Foreshore Development Guidelines (FDG) are used to guide development and restoration activities within each shoreline segment according to its FHSI Ecological Rank. A FIM survey was conducted on Whitetail Lake on 21 and 22 September 2020. Wildlife surveys were conducted during the FIM but fish sampling was not included because extensive data is already available for the lake. Data collected during the FIM was analyzed to compare shoreline areas of Whitetail Lake, an FHSI was developed and used to determine the FHSI Ecological Rank of each shoreline area and results were incorporated into the Whitetail Lake FDG.

Overall, the FIM survey observed that most of the entire 9,915 m mapped Whitetail Lake shoreline was in natural condition (8,186 m; 83%) while the remainder was disturbed (1,729 m; 17%). This resulted in most of the lake shoreline being classified as having a low level of impact with remaining areas having either medium (2,951 m; 30%) or no (2,227 m; 23%) level of impact. The primary land use observed was rural (6,414 m; 65%) with remaining area used for forestry (3,501 m; 35%). Gravel was the most prevalent shore type (6,411 m; 65%), followed by wetland (3,504 m; 35%). Aquatic vegetation was observed along 1,834 m (19%) of the shoreline and consisted primarily of emergent vegetation. Foreshore substrates consisted primarily of gravel and cobble with lesser amounts of marl, sand, boulder, fines, organics and mud. Most of the lake's littoral area was wide (>50 m) and littoral substrates were predominantly marl. Nearshore riparian vegetation was relatively continuous along the lake and was dominated by coniferous, mature forests or shrubs where wetlands were observed. Patchy riparian vegetation resulting from land clearing within upland areas was observed along 4,797 m (48%) of the lake shoreline. Lineal shoreline modifications were observed along 2,792 m (28%) of Whitetail Lake, the most common being roadways (2,719 m; 28%) with small areas of substrate modification (73 m; <1%) also observed. Other shoreline modifications included docks (n=36), sheds (n=3), boat launches (n=2), fences (n=2), a boat lift, a dock groyne, a mooring buoy, a retaining wall, a staircase and a swim dock. Wildlife surveys recorded five bird species, and numerous wildlife trails. Based on background information, two fish species, Rainbow Trout and Eastern Brook Trout, are currently found in Whitetail Lake.

The FHSI developed for Whitetail Lake included FIM (biophysical and shoreline modifications) and non-FIM (fisheries and wildlife) criteria. Most of the shoreline of Whitetail Lake was ranked as Moderate (64.5%) ecological value followed by High (18.4%) and Very High (16.9%) ecological value. None of the Whitetail Lake shoreline ranked as Low or Very Low ecological value. High and Very High Ecological Rankings were located at the north, northwest and south shorelines of Whitetail Lake where little/no disturbance was observed and high value habitat attributes included wetlands, stream mouths, aquatic vegetation, large woody debris and abundant riparian vegetation. The west and east shorelines of Whitetail Lake received a

Moderate Ecological Rank because some disturbance and shoreline modifications including docks and boat launches were observed, though important habitat attributes were also documented. Zones of Sensitivity, important habitats for species or general ecosystem function, included wetlands and tributary confluences which were included as polygons on FIMP mapping products. Two wetland areas in the south end of the lake were identified as potential conservation zones.

The Whitetail Lake FDG provides development and planning guidelines that are aimed at protecting ecologically sensitive areas. Guidance is provided for landowners, regulators and other stakeholder on the permitting and review process for shoreline development and the FDG also identify areas where development should be avoided.

First Nations Traditional Ecological Knowledge (TEK) was not available for Whitetail Lake during the FIMP process and was therefore not incorporated into the FHSI or FDG. It is recommended that TEK be incorporated into the Whitetail Lake FIMP process if it becomes available in the future. In addition, an Unpiloted Aerial Vehicle (UAV) survey is recommended to visually document the entire shoreline of Whitetail Lake. The UAV survey could not be conducted in 2020 due to wildfires within the vicinity of Whitetail Lake that restricted its use.

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List of Acronyms and Abbreviations

DFO	Fisheries and Oceans Canada
CDC	Conservation Data Center
FIDQ	Fisheries Inventory Data Query
FDG	Foreshore Development Guidelines
FHSI	Foreshore Habitat Sensitivity Index
FIM	Foreshore Inventory and Mapping
FIMP	Foreshore Integrated Management Planning
GIS	Geographic Information Systems
GPS	Geographic Positioning Systems
HWM	High Water Mark
LiDAR	Light Detection and Ranging
LLC	Living Lakes Canada
LWD	Large Woody Debris
MFLNRORD	BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development
OCP	Official Community Plan
RDEK	Regional District of East Kootenay
SARA	Species-At-Risk-Act
SHIM	Sensitive Habitat Inventory and Mapping
SMG	Shoreline Management Guidelines (now referred to as FDG)
TRIM	Terrain Resource Information Management
UTM	Universal Transverse Mercator
WSC	Water Survey of Canada
ZOS	Zones of Sensitivity

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Living Lakes Canada

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Heather Leschied B.E.S. (Hons), Program Manager

Bruce Mac Donald B.Sc., B.Ed., Program Director

Living Lakes Canada is a non-profit society that facilitates collaboration in education, monitoring, restoration and policy development initiatives for the long-term protection of Canada's lakes, rivers, wetlands and watersheds. Our mandate is to help Canadians understand, adapt and mitigate the impacts of climate change to water quality and quantity, biodiversity and healthy human communities through grassroots water stewardship activities. Living Lakes Canada bridges the gap between science and action to foster and normalize citizen- based water stewardship.

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1.0 Introduction

Whitetail Lake is located at an elevation of 1,100 m approximately 28 km northwest of Canal Flats and is located within the Kootenay Dry Mild Interior Douglas-fir (IDFdm2) biogeoclimatic sub zone. There is a small BC Recreation Site on the west side of the lake (Figure 1). The lake has a surface area of approximately 1.66 km^2 with approximately 10 km of shoreline and a maximum and mean depth of 19.2 m and 9.8 m, respectively (MWLAP 2004, 2005). The lake is moderately productive and has a large littoral area covering approximately 77% of its basin (Cena 2012). Whitetail Lake is managed predominantly to emphasize its fisheries resources. The lake has been stocked with Rainbow Trout (*Oncorhynchus mykiss*) since 1958, with non-native Eastern Brook Trout (*Salvelinus fontinalis*) introduced in 1967 (MWLAP 2004, 2005). The lake was chemically treated with rotenone in 1970 to remove native Mountain Whitefish (*Prosopium williamsoni*) and Longnose Dace (*Rhinichthys cataractae*) but this did not eradicate non-native Eastern Brook Trout (MWLAP 2004, 2005). Since then, the lake has been managed to promote a trophy-sized Rainbow Trout fishery. The lake continues to be stocked with Rainbow Trout, which are inventoried and studied regularly. Similarly, water quality is monitored by the provincial government (MWLAP 2004, 2005).

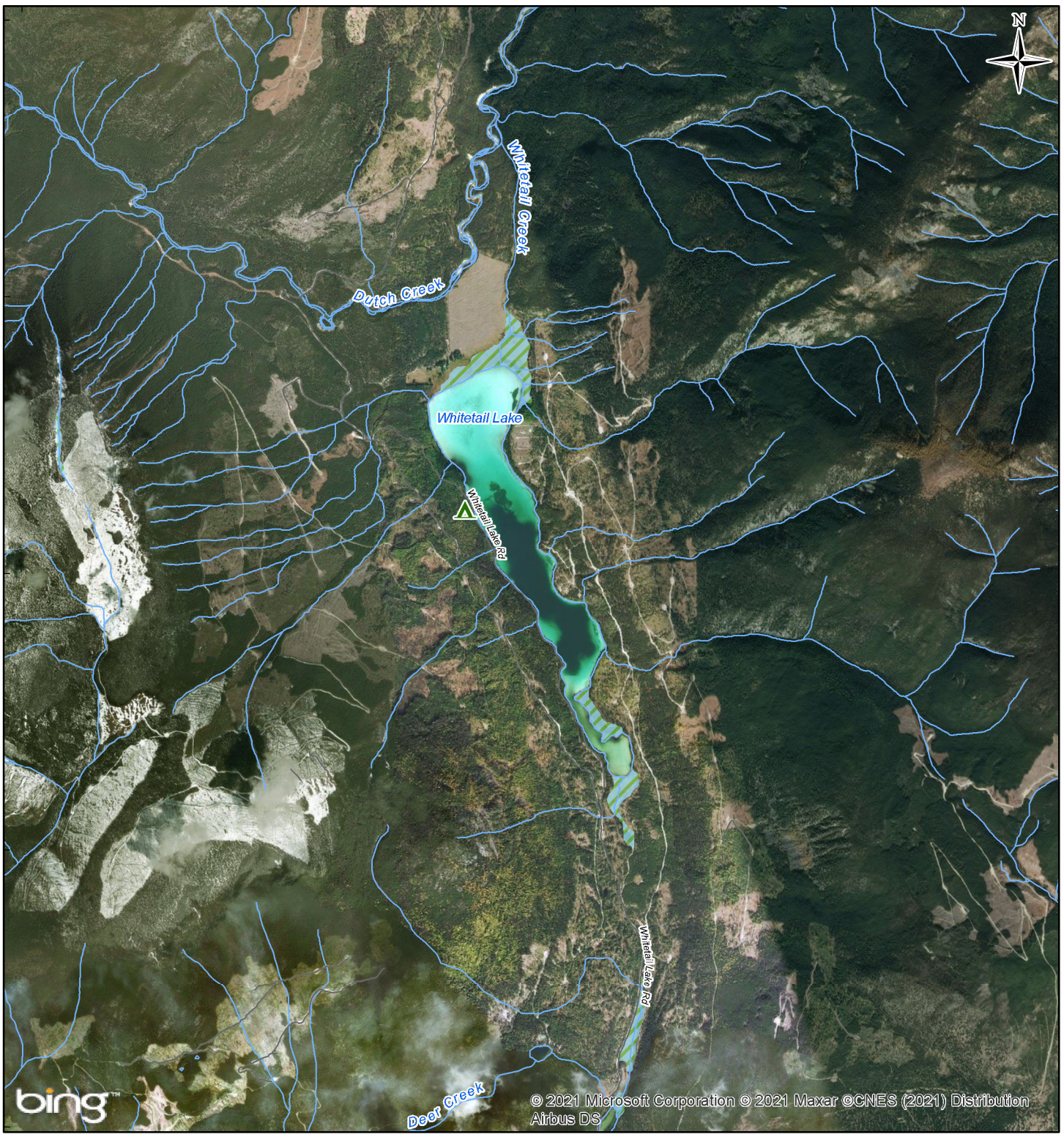
Whitetail Lake experiences high recreational fishing pressure with approximately 10,000 angler hours per year reported. As mentioned, anglers tend to target the trophy-sized Rainbow Trout and Eastern Brook Trout the lake (MWLAP 2005). An angler survey in the mid-2000's found the number of angler hours had nearly doubled from what was reported in the early 1990's (MWLAP 2005). The land surrounding the lake is under private ownership (BC LTSA 2020) and land use is dominated by forestry with some public and commercial recreation. More recently, logging has occurred on the east side of the lake and this area is under consideration for subdivision development that has the potential to impact foreshore habitat and increase the already high level of recreational pressure on the lake.

Living Lakes Canada contracted Wood Environment & Infrastructure Solutions (Wood) to complete a Foreshore Integrated Management Planning (FIMP) program on Whitetail Lake. FIMP was initially developed from the Sensitive Habitat Inventory and Mapping (SHIM) procedure (2001), updated into Foreshore Inventory and Mapping (FIM) (2005 and 2009), and more recently, redesigned as FIMP (2020). Recently, standardized methodologies and guidelines were redeveloped for the three main FIMP components including FIM, Foreshore Habitat Suitability Index (FHSI) and the Foreshore Development Guide (FDG) (Schleppe et al. 2020). The following summarizes the outcomes of each step of the process:

1. Foreshore Inventory and Mapping (FIM) – is a process that uses GIS, GPS and field observation to inventory and describe the land uses (e.g., residential and industrial development, etc.), shoreline modifications (e.g., docks, retaining walls, etc.), and biophysical attributes (e.g., wetlands, riparian vegetation, substrate, etc.) along the lake or reservoir shoreline. Information collected can be incorporated into a variety of land use planning documents including Official Community Plans, Shoreline Management Plans and Land and Resource Management Plans.
2. Foreshore Habitat Sensitivity Index (FHSI) – is generated using the FIM data to determine the relative habitat value of a shoreline segment. The FHSI uses data collected during the FIM survey, additional field reviews (e.g., fish and wildlife surveys) and data from other sources to identify zones of sensitivity and develop an index that ranks the sensitivity of each shoreline segment. The index that is developed is specific to the waterbody of interest and compares the ecological sensitivity of different shoreline areas within that waterbody.

3. Foreshore Development Guide (FDG) – is prepared to identify the shoreline vulnerability, based on the output of the FHSI analysis described above. The FDG is intended to provide background information to land managers, homeowners, developers and stakeholders when land use changes or activities are proposed that could alter the shoreline thereby affecting fish and wildlife habitat. The guidelines include the vulnerability ratings for all shoreline areas, an activity risk table and a decision-making flow chart for proposed works along the shoreline.

The following includes all completed phases for Whitetail Lake FIMP, which includes reporting on the FIM survey, generation of the FHSI and completion of the FDG.



Legend

- Whitetail Recreation Site
- Road
- Watercourse
- Waterbody
- Wetland

0 0.5 1
Kilometers

References:
DataBC Data Distribution Service
Open Government License
(http://www.data.gov.bc.ca/)
Geogratis/Geobase
Open Government License - Canada
(http://data.gc.ca/eng/about-datagcca)

CLIENT: LivingLakes				
PROJECT: Whitetail Lake FIMP				
TITLE: Whitetail Lake Overview Map				
DATE: March 18, 2021	SCALE: 1:50,000	**Figure 1**		
GIS FILE: 02-01-006_whitetail_lake_overview.mxd				
COORDINATE SYSTEM: NAD 1983 UTM Zone 11N	JOB No: VE52823	ANALYST: PK	QA/QC: CL	

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2.0 Methods

Methods presented herein provide a summary of all three phases of FIMP pertaining to Whitetail Lake, a lake that has not previously been surveyed. FIMP methods are outlined in Schleppe et al. (2020), unless otherwise specified below.

2.1 Foreshore Inventory and Mapping (FIM)

2.1.1 Pre-Field Assessment

Background information was compiled and baseline field maps prepared during the pre-field assessment to help guide field data collection activities and ensure all required information was collected.

GIS map file layers including Regional District of East Kootenay (RDEK) legal boundaries/jurisdiction/ cadastral/zoning land uses, provincial data layers (e.g., TRIM), and Conservation Data Centre (CDC). BC Species and Ecosystems Explorer plants, animals and ecosystem mapping were obtained from online platforms. The most recent and complete set of orthophotos for Whitetail Lake were purchased from the BC Government Base Map Online Store (2009; Map Sheet #82K.030; 1:20,000; colour; pixel size of 0.5 m).

Baseline maps were prepared in ArcGIS initially using orthophoto imagery and the various GIS layers obtained. However, the 2009 orthophoto imagery was outdated as satellite imagery depicted additional land clearing. Therefore, satellite imagery was used instead of the orthophoto imagery; publish date for satellite imagery was not available. The high-water mark (HWM) was initially delineated using the Watershed Atlas 1:50,000 outline and then realigned using satellite imagery interpretation to within ±5 m. Whitetail Lake does not have an active or historical hydrometric data station maintained by Environment Canada and Climate change, so the HWM could not be determined using staff gauge measurements (MOE 2009 as cited in Schleppe et al. 2020). In addition, there was no publicly available LIDAR data to use for HWM determination (RDEK 2020).

Preliminary options for FIM segment breaks were evaluated by reviewing changes in shore type and property boundaries (Schleppe et al. 2020). However, actual segment breaks were confirmed during field surveys (Section 2.1.3).

A brief literature review was conducted to obtain any relevant studies for Whitetail Lake. This was done to ensure any necessary information required was collected during the FIM field surveys. Resources reviewed for fish, wildlife and ecological values included EcoCat: The Ecological Reports Catalogue, Conservation Data Centre (CDC) iMap, BC Species & Ecosystem Explorer and targeted searches using the Google search engine.

All digital datasets and mapping layers were loaded onto a tablet (e.g., iPad) prior to conducting the field portion of the FIM surveys (Section 2.1.2). A health and safety plan was prepared and reviewed with team members prior to conducting field surveys.

2.1.2 Field Data Collection Platform

The primary method for field data collection was a tablet (e.g., iPad) loaded with the *ArcGIS Collector*™ application. Collector for ArcGIS is a map-driven, mobile data collection application that allows for easy and accurate field data capture. This application uses the device's GPS location services to identify your position and data can be captured in both a connected and disconnected (i.e., without Wi-Fi/cellular data) environment. Collector for ArcGIS is fully integrated with the ArcGIS platform so it can be seamlessly incorporated with other ArcGIS apps to maximize efficiency in workflows. A fully functional data dictionary was completed and tested outside of this program.

Base maps developed during pre-field assessment (Section 2.1) were loaded into the ArcGIS Collector application. The Whitetail Lake data dictionary was also loaded onto the tablet for use in the ArcGIS Collector. This data dictionary included all segment line features as outlined in Schleppe et al. (2020; specifically Appendix B) which generates a layer within a file geodatabase that was then published and used by field assessors to populate. Other geometry type (e.g., point and polygon) feature layers were created for any additional data collection that was outside of the segment break data dictionary (e.g., photographs, aquatic vegetation polygons etc.). Photographs were directly embedded as a point location for each segment along with metadata including location (e.g., UTM), timestamp, segment number, photograph number and caption.

Field data were collected using the Whitetail Lake ArcGIS Collector data dictionary in a disconnected environment. Data was exported and backed up to a laptop, cloud-based storage and Wood's internal server daily. Data were also reviewed for completeness at this time.

Additional data collection tools available in the field included:

- Digital and hard copies of Excel spreadsheets with a copy of the updated data dictionary.
- Avenza Maps, an alternative application for georeferenced photo collection, was also loaded onto the tablet, with baseline maps imported.
- Hard copy print outs of base maps were available for field assessors to mark up polygons and other feature information. And,
- Waterproof field notebooks and hand counters were also available for field assessors to take additional notes and tally counts.

2.1.3 Field Surveys

The field survey was conducted over a 2-day period on 21 and 22 September 2020. Whitetail Lake was accessed via one of two boat launches (i.e., south end) at the Whitetail Lake BC Recreation Site. As outlined in Schleppe et al. (2020), the field survey was conducted by navigating a boat along the shoreline of the lake, slowly and within a safe distance from shore to minimize wave action and avoid nearshore hazards. A three-person field crew was stationed on the deck of the boat and each crew member was responsible for ensuring specific data fields were collected. The south basin of the lake was too shallow for boat navigation so the field crew surveyed this area by foot and made observations from western shoreline by walking along an abandoned road that reached to the southernmost tip of the lake. In total, approximately 85% of the lake was surveyed by boat and 15% was surveyed by foot.

Data collection was accomplished via tablet using the Whitetail Lake ArcGIS Collector data dictionary (Section 2.1.2). The survey began at a segment break close to the boat launch and proceeded along the shoreline in a clockwise direction (Appendix A). Due to the small size of Whitetail Lake and ability to review property boundaries within the ArcGIS Collector application in the field, georeferenced segment breaks were added to the dataset during the survey. Within each segment, all lake characteristics (i.e., data fields) outlined by Schleppe et al. (2020) were inventoried following standard methods. The only exceptions to these methods were as follows:

- Large woody debris (LWD) clusters for Whitetail Lake were defined as 5 or more pieces over 10 m linear length along the shoreline and they were not included in the overall LWD count. Note that LWD clusters are not specifically defined in Schleppe et al. (2020); and,
- % Overhanging Vegetation was classified under the first Vegetation Band and not again for the Aquatic Vegetation data section as this is erroneously repeated in Schleppe et al. (2020).

Digital and hard copies of Schleppe et al. (2020) were referenced in the field as needed to ensure proper interpretation of the data required. At least one photograph of each single-family residential lot, each shoreline modification, as well as representative photographs of each segment was taken. Aquatic vegetation and wetland polygons were mapped using the Whitetail Lake ArcGIS Collector data dictionary and/or directly outlined in permanent marker on hard copy baseline maps.

Videography and still image photography via an Unpiloted Aerial Vehicle (UAV) (drone) survey was scheduled to be conducted during the FIM survey, however, it was not possible to conduct the survey in 2020. Nearby wildfire activity (Doctor Creek fire) resulted in UAV use being prohibited within a five nautical mile radius of the fire which included the entire Whitetail Lake area. UAV use was prohibited until the fire was declared out in late fall at which time snowfall prevented access to Whitetail Lake.

2.1.3.1 Fish Survey

Fish surveys were not conducted as part of the FIM survey. Information on fish and other aquatic resources in Whitetail Lake was compiled during the background literature review. The conservation status of all fish species identified in the lake was reviewed against the federal (e.g., Species at Risk Act (SARA) and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)) and provincial (e.g., CDC) species listings (Government of Canada 2021, CDC 2021). That information was summarized and is presented in Section 3.1.6.

2.1.3.2 Wildlife Survey

A wildlife survey was conducted during the FIM survey to inventory habitat availability, nesting, roosting and/or denning sites for aquatic and terrestrial wildlife. Point counts were used to identify bird species following standard methods for the assessment of forest and grassland songbirds (RIC 1999). Preliminary maps generated from the FIM survey data were viewed on an iPad using the ArcGIS Collector application during the surveys and allowed the crew to geo-reference wildlife sightings and identify the associated shoreline segment. Observations were made along the foreshore and into the riparian band as far as was visible from the water. At times it was necessary to go ashore to verify observations made from the boat. Wildlife were documented via live observations or by the presence of scat, tracks, nests or other animal signs. The conservation status of all wildlife species identified in the lake was reviewed against the federal (e.g., SARA and COSEWIC) and provincial (e.g., CDC) species listings (Government of Canada 2021, CDC 2021). These observations are summarized in Section 3.1.7.

2.1.4 GIS and Data Analyses

Post-processing included extracting photos, converting data, adding and modifying feature layers (e.g. vegetation polygons hand-drawn on maps in the field), and shoreline segment mapping. Tributary stream mouth boundaries were delineated adjacent to previously known or suspected spawning/migration areas using a 50 m radius placed around each confluence. Wetland polygons were included from the BC Freshwater Atlas (1:50,000) and verified against the satellite imagery. One wetland that was observed in Segment 1 in the field that was not depicted in the BC Freshwater Atlas was digitized based on review of orthophoto and satellite imagery. The HWM was modified as required based on field data capture. While the littoral zone width for each segment was intended to be derived from the satellite imagery, it could not be determined because the littoral zone for most segments spanned across the entire width of the lake.

The dataset and maps were QA/QC'ed by field personnel after which data was exported into map templates displaying segment breaks and point and polygon features over satellite imagery including segment numbers and level of impact designation. Photographs were extracted from the geodatabase and embedded directly into the report to highlight key segments and features.

Segment summaries were created that included representative photographs and all inventory data collected during the FIM survey. The following shoreline characteristics were summarized and graphically displayed by evaluating the proportions of each category within a segment and summing each category for Whitetail Lake:

- Natural vs. disturbed shoreline;
- Shore type including the proportion of natural vs. disturbed shoreline within each shore type;
- Land use including the proportion of natural vs. disturbed shoreline within each land use type;
- Foreshore, littoral and riparian (i.e., vegetation bands) characteristics;
- Aquatic vegetation;
- Shoreline modifications; and,
- Level of impact.

Riparian characteristics were summarized qualitatively, where possible. Fish and wildlife observations/attributes were described based on background literature review and field observations.

All fish and wildlife-related datasets collected during the desktop review were exported digitally (e.g., shapefiles, file geodatabase, Excel) and provided to Living Lakes Canada as supporting documentation to this report.

2.2 Foreshore Habitat Sensitivity Index (FHSI)

A FHSI is a framework for assessing the relative aquatic and terrestrial habitat values along a lake's shoreline. The FHSI uses inventory information collected during the FIM survey, additional field surveys (e.g., fish and wildlife surveys), background literature reviews and/or data from other sources to develop a points-scale mathematical framework (i.e., index) that assigns positive values to important and sensitive habitat features and negative values to modifications (e.g., docks, boat launches, etc.) that have impaired habitat value. The FHSI is then applied to each shoreline segment delineated during the FIM, resulting in a collection of habitat segment scores. A numerical range is used to define each Ecological Rank (e.g., Very Low, Low, Medium, High, and Very High), allowing each segment to be labelled accordingly. Methods outlined by Schleppe et al. (2020) were followed during development and calibration of the Whitetail Lake FHSI, calculation of segment FHSI scoring and determination of FHSI Ecological Ranks. Additional details are also provided below.

2.2.1 Whitetail Lake FHSI Criteria

The FHSI developed for Whitetail Lake followed the example provided by Schleppe et al. (2020) and used both FIM and non-FIM criteria. Criteria included in the Whitetail Lake FHSI fell into four categories:

1. Biophysical,
2. Fisheries,
3. Wildlife, and,
4. Modifications.

Biophysical and modification criteria were characterized using data collected during the FIM survey (i.e, field data). Fisheries criteria used information compiled during background literature review, and wildlife criteria used information collected during the September 2020 wildlife survey and background literature review. Other non-FIM categories outlined in Schleppe et al. (2020) (e.g., herptile, waterfowl, ecosystem, rare or endangered species or ecosystems, and/or other criteria) were not included in the FHSI at this time as sufficient data did not exist to support the addition of these categories. The Whitetail Lake FHSI is provided in Table 1.

Methods for FHSI criteria weighting and calibration are provided in Section 2.2.2. Rationale for FIM criteria included in the Whitetail Lake FHSI is provided by Schleppe et al. (2020) and for non-FIM criteria (fisheries and wildlife) are provided below:

1. Fisheries Category
    a. Juvenile Rearing Habitat – The quality of juvenile rearing habitat in each shoreline segment was determined by reviewing the prevalence of individual habitat characteristics necessary for juvenile rearing, with a focus on juvenile salmonid rearing habitat. High quality juvenile rearing habitat occurred in areas with stream mouth or wetland shore types with abundant instream cover from aquatic vegetation and/or LWD, substrates that provide nutrients and interstitial space for cover, and are adjacent to tributaries potentially used for spawning. Juvenile rearing habitat was ranked as high, medium or low, relative to other shoreline segments, based on these variables. Other authors have used a juvenile rearing habitat index on lakes where detailed evaluation of juvenile habitat has not been conducted (e.g., Schleppe and Cormano (2016)). This index was not used for Whitetail Lake because many variables that weigh heavily within the index were similar between segments (e.g., littoral width and substrate) and authors felt reviewing the FIM dataset qualitatively was suitable for determining the relative value of juvenile rearing habitat between segments.
    b. Migration Corridor – Locations with creek or river mouths that may be utilized by native fish species for spawning are considered migration corridors. These corridors provide immigration routes for spawners and outmigration for juveniles following egg incubation, hatch and instream rearing. Tributaries in Segments 1 and 3 were identified as likely fish migration corridors in the FHSI (See Section 3.1.6).
    c. Staging Areas - Staging areas were identified based on the presence of tributaries where fish may stage in shoreline areas prior to spawning. All tributary mouths were considered as possible staging areas.
2. Wildlife Category
    a. Concentrated Wildlife Area – Areas where abundant wildlife trails and scat were observed in Riparian Band 1 during wildlife surveys in September 2020 and during orthophoto/ satellite imagery review were considered Concentrated Wildlife Areas in the FHSI. These areas provided abundant habitat for foraging, migration, breeding and other life history processes. Note that wildlife are likely to frequent shoreline and riparian areas throughout Whitetail Lake, not just those identified as Concentrated Wildlife Areas. Other wildlife features (e.g., lodges, nests, and dens) were not observed during the surveys nor were any species of conservation concern identified within the CDC iMap tool and therefore no other wildlife variables were included in the FHSI as this time.

Table 1: Foreshore Habitat Sensitivity Index for Whitetail Lake.

Category	Criteria	Percentage of FHSI	Percent Within Category	Calculation	Uses Weighted FIM Data	Value Categories
FIM	Shore Type	14.4	25	Proportion of Segment * Percentage of FHSI * Value Category	Yes	Stream Mouth = Wetland (1) > Gravel Beach = Rocky Shore (0.8) > Sand Beach = Cliff /Bluff (0.5), Other (0.3)
	Foreshore Substrate	11.5	20	Proportion of Segment * Percentage of FHSI * Value Category	Yes	Cobble (1) > Gravel (1) > Boulder = Organic = Mud = Marl (0.8), Fines = Sands (0.5) > Bedrock (0.3)
	Percentage Natural	8.6	15	Proportion of Segment Natural * Percentage of the FHSI	No	
	Aquatic Vegetation	4.6	8	Proportion of Segment with Aquatic Vegetation * Percentage of the FHSI	No	
	Overhanging Vegetation	2.9	5	Proportion of Segment with Overhanging Vegetation * Percentage of the FHSI	No	
	Large Woody Debris*	3.5	6	Percentage of the FHSI * Value Category	No	16 LWD/km (1) > 11 to 15 LWD/km (0.8) > 6 - 10 LWD/km (0.6) > 1 - 5 LWD/km (0.4) > 0
	Band 1	8.6	15	Vegetation Bandwidth Category * Vegetation Quality * Percentage of the FHSI	Yes	**Vegetation Bandwidth Category** 1 to 5 m (0.2) < 6 to 10 m (0.4) < 11 to 15 m (0.6) < 16 to 20 m (0.8) < 21 m (1)
	Band 2	3.5	6	Vegetation Bandwidth Category * Vegetation Quality * Percentage of the FHSI	Yes	**Vegetation Quality Category** Natural Wetland = Disturbed Wetland = Broadleaf = Shrubs (1) > Coniferous Forest = Mixed Forest (0.8) > Herbs/Grasses = Unvegetated (0.6) > Lawn = Landscaped = Row Crops (0.3) > Exposed Soil (0.05)
Category Subtotal		**57.5**	**100**			
Fisheries	Juvenile Rearing	10.0	50	High (Percentage of the FHSI), Moderate (0.5*Percentage of the FHSI), Low (0.1*Percentage of the FHSI)	No	
	Migration Corridor	5.0	25	Present (Percentage of the FHSI), Absent (0)	No	
	Staging Area	5.0	25	Present (Percentage of the FHSI), Absent (0)	No	
Category Subtotal		**20.0**	**100**			

Category	Criteria	Percentage of FHSI	Percent Within Category	Calculation	Uses Weighted FIM Data	Value Categories
Wildlife	Concentrated Wildlife Area	12.5	100	Present (Percentage of the FHSI), Absent (0)	No	
Category Subtotal		**12.5**	**100**			
Modifications	Retaining Wall	-2.5	25	Proportion of Segment with Retaining Walls * (Percentage of the FHSI) *-1	No	
	Docks	-2.0	20	Dock Density is categorized as High, Moderate, Low or None using segment data. High = Percentage of the FHSI, Moderate (0.75*Percentage of the FHSI), Low (0.5*Percentage of the FHSI), None (0*Percentage of FHSI) *-1	No	>0-5 docks/km (Low); >5-10 docks/km (Moderate); >10 docks/km (High)
	Groynes	-1.0	10	Groyne Density is categorized as High, Moderate, Low or None using segment data. High = Percentage of the FHSI, Moderate (0.75*Percentage of the FHSI), Low (0.5*Percentage of the FHSI), None (0*Percentage of FHSI) * -1	No	>0- 5 groynes/km (Low); >5-10 groynes/km (Moderate); >10 groynes/km (High)
	Boat Launch	-2.0	20	Boat Launch Density is categorized as High, Moderate, Low or None using segment data. High = Percentage of the FHSI, Moderate (0.75*Percentage of the FHSI), Low (0.5*Percentage of the FHSI), None (0*Percentage of FHSI) *-1	No	>0-1 boat launch/km (Low); >1-2 boat launches/km (Moderate); >2 boat launches/km (High)
	Marina	-2.5	25	Present (Percentage of the FHSI), Absent (0) *-1	No	
Category Subtotal		**10.0**	**100**			
Total		**100.0**				

Note – FIM, Fisheries and Wildlife criteria are calculated as positive values while modifications are negative when calculating segment scores.
* LWD for each segment is the total of littoral, foreshore and cluster counts. All clusters were given a standard value of 5 pieces of LWD for this evaluation.

2.2.2 FHSI Weighting and Calibration

Each FIM and non-FIM category were assigned an initial weighting following the standardized procedure outlined by Schleppe et al. (2020) whereby each category value was weighted equally initially, except for shoreline modifications. Next, the weights of categories were adjusted based on professional judgement regarding the expected biological influence of the criterion. At the same time, the influence of each criteria was determined by adjusting the Percent Within Category to reflect the influence of each criteria on foreshore habitat (Table 1; see rationale provided in Section 2.2.2.1). The FHSI score was then calculated by summing the score of all index criteria for each segment. Note that when Riparian Band 1 extended across the entire 50 m assessment zone and no Riparian Band 2 was observed, the values calculated for Band 2 used the vegetation characteristics observed in Band 1 (i.e. Band 1 data was used for both Band 1 and Band 2 calculations). Five versions of the FHSI were completed, each with different category and/or criteria weightings. Each version was scrutinized by the study team and that which best reflected the habitat values of Whitetail Lake was selected as the final version presented herein.

The FHSI segment scoring were then used to develop FHSI Ecological Ranks, a five-class ranking system, ranging from Very Low to Very High ecological value. This was done by reviewing the minimum, maximum, median and distribution of FHSI scores for the lake and creating appropriate boundaries for each ranking. Several iterations of the FHSI Ecological Rank breaks were assessed and resulting ranks reviewed to determine if the ranks were reflective of values along the shoreline. Iterations were reviewed, mapped (Section 2.2.4) and updated using procedures outlined by Schleppe et al. (2020).

The FHSI was calibrated by reviewing the influences of each of the different FIM and non-FIM FHSI categories and criteria and associated weightings to ensure that the index is appropriately scored. A working group of professionals, agencies, First Nations and other knowledgeable individuals such as local naturalists' volunteers who are familiar with the lake were provided the opportunity to review various versions of the FHSI criteria ranking and associated FHSI Ecological Ranks and use their opinions and understanding of the area to review, discuss, adjust and ultimately come to consensus on the final FHSI product. Three versions of the FHSI were selected to represent the most reflective of shoreline habitat value for review/calibration by the LLC Technical Committee, including the version selected by the study team. Feedback was received from one committee member and was used to finalize FHSI criteria, FHSI Ecological Rank breaks and segment rankings.

2.2.2.1 Ecological Rationale for FHSI Criteria Weighting

The following ecological rationale was used during the weighting and calibration process outlined in Section 2.2.2 to determine the final criteria weight (i.e., Percent within Category) presented in Table 1:

1. Biophysical (FIM):
    a. Shore Type – Shore type is related to many aspects of fish and wildlife habitat and inherent characteristics in each shore type (e.g., complexity, slope, substrate, etc.) can be an overarching determinant of habitat value. As a result, shore type received the highest weighting in the biophysical FIM category. Shore types with complexity that provides a variety of rearing, feeding and breeding habitats for both fish and wildlife (e.g., stream mouth, wetland, gravel beach and rocky shore) received higher value than less complex shore types (e.g., cliff/bluff and sand beach) (e.g., Kennedy and Mayer 2002; Rice et al. 2008).
    b. Foreshore Substrate – Substrates received a high weighting in the category because they provide important spawning and rearing habitat for fish. Cobble and gravel substrates received higher value than others because of their use as spawning and juvenile rearing habitat for salmonids Whitetail Lake (McPhail 2007).

c. Percent Natural – Percent natural was weighted high in the biophysical FIM category to capture the habitat value of intact ecosystems found in natural areas.

d. Aquatic Vegetation – Aquatic vegetation provides cover, food supply, primary production and filtration to aquatic ecosystems (Caskenette et al. 2020). The moderate weight assigned reflects the wider extent of this criterion than others with smaller range of influence (e.g., overhanging vegetation, LWD).

e. Overhanging Vegetation – Overhanging vegetation provides a source of nutrients to aquatic ecosystems, foraging areas for wildlife and can shade nearshore habitat (Caskenette et al. 2020). This criterion was weighted lowest of the biophysical FIM data because relative to other criteria, the influence is quite low due to the relatively small bandwidth overhanging vegetation occupies.

f. Large Woody Debris (LWD) – LWD provides instream cover for fish of all age classes and is an especially important habitat for rearing juvenile salmonids. The weighting of this criteria was relatively low because LWD was observed in similar densities throughout the lake.

g. Riparian Bands – Riparian Band 1 received a higher value than Riparian Band 2 because it inherently has more influence on foreshore habitat than riparian areas set back from the shoreline. Wider riparian areas received more value as did vegetation types that contribute to more to nutrient production than others (wetlands, broadleaf and shrubs) (Caskenette et al. 2020).

2. Fisheries (non-FIM): The juvenile rearing criterion was assigned a higher value than staging and juvenile rearing criteria because the area associated with this habitat is typically larger than that associated with migration corridors and staging areas. It was also rated higher than other fisheries criteria to reflect the risk of juvenile rearing habitat loss/alteration due to shoreline modification.

3. Wildlife (non-FIM): Concentrated wildlife habitat area was the only wildlife criterion included in the FHSI. Compared to other categories, Wildlife had less influence on the FHSI scoring (12%) because only one criterion is included in the index though the limited areas of concentrated wildlife habitat will still influence the output more than each fisheries criteria individually.

4. Modifications (FIM): Similar weights were given to all modification criteria. Groynes were weighted slightly lower because groyne density was low relative to docks and boat launches. Though there are currently no marinas in Whitetail Lake, the criterion was included in the FHSI in case marina development occurs in the future. Schleppe et al. (2020) provides detailed description of the impacts modifications can have on foreshore habitats.

2.2.3 Zones of Sensitivity

Zones of Sensitivity (ZOS) are specific areas identified as important habitats for either species or general ecosystem function. ZOS are a way of displaying sensitive habitat areas that may or may not have been included in the FHSI rank calculation, as point, line or polygon features graphically on maps. ZOS often include wetlands, creek mouths, native grasslands, wildlife habitat and corridors, gravel/cobble habitat, biologically productive areas and unimpacted/natural areas because of their value to fish and wildlife (Schleppe et al. 2020, Caskenette et al. 2020, NRC 2002). Whitetail Lake ZOS were determined during completion of the FHSI and displayed on GIS mapping products.

2.2.4 FHSI Mapping, Analysis and Reporting

Mapping is the best framework for viewing results of the FHSI. Mapping products initially developed during the FIM were updated to include the FHSI Ecological Rank of each segment using the prescriptive colour and mapping requirements as specified in Schleppe et al. (2020). ZOS were also added to the maps as polygons and a 10 m buffer was added to each polygon to account for unknowns in the mapping of the ZOS and protect the core ZOS from potential impacts from adjacent activities. The buffer size was kept relatively narrow due to inherent buffering already included in the ZOS polygons during digitization for tributary mouths and change in mapping scale for wetlands.

Standard analysis of FHSI Ecological Rank was completed as outlined in Schleppe et al. (2020). This included a summary of the total shoreline length and percentage of the total shoreline of each FHSI Ecological Rank with an additional summary of FHSI Ecological Rank by shore type and a plot of total length of natural and disturbed shoreline by rank (Schleppe et al. 2020).

Areas with unique, high value habitats were highlighted for designation as conservations zones. Potential conservation zones included areas with Very High FHSI Ecological Rank that also contain one or more ZOS.

2.3 First Nations Traditional Ecological Knowledge (TEK)

The FIMP framework acknowledges the benefit of including First Nation's Traditional Ecological Knowledge (TEK), where possible. TEK can be included as non-FIM criteria and/or as points, polygons or lines on FHSI mapping and GIS products (Schleppe et al. 2020). The Whitetail Lake FIMP program was initially developed to include the direct involvement of Shuswap Indian Band (SIB) members during the FIM field survey as well as in the review of FHSI criteria and the FDG document. However, due to capacity issues that arose in August 2020, SIB member participation was rescinded prior to conducting the FIM field survey. Additional contact occurred with SIB band members in early November 2020, which resulted in the execution of the *Shuswap Indian Band Traditional Knowledge Data-Sharing Agreement* (20 November 2020). SIB is currently in the process of assessing the level of effort and costs associated with the compilation of SIB TEK data and/or GIS mapped polygons for inclusion in the Whitetail Lake FIMP. However, TEK data was not available at the time of writing. Consequently, it has not been included into the FHSI or into any mapping products.

Members from the Ktuxana Nation Council (KNC) were not available to provide support during the Whitetail Lake FIMP due to COVID-19 restrictions (i.e., field survey participation was not allowed; K. Andreashuk, Stewardship and Protection KNC, personal communication, May 2020). Additional correspondence with KNC members was attempted several times during late 2020 and early 2021 regarding KNC TEK incorporation, but no response was received from any of the personnel contacted.

2.4 Foreshore Development Guide (FDG)

The FDG provides development planning guidelines, aimed at protecting sensitive fish and wildlife species and their habitats identified through the previous FIM and FHSI analyses. The template FDG provided by Schleppe et al. (2020) was populated with Whitetail Lake specific information including the FHSI Ecological Rank of each shoreline segment and ZOS. This information was also provided on FDG mapping products which were a streamlined version of the FHSI maps revised to only include FHSI Ecological Rank and ZOS using predetermined colour coding (Schleppe et al. 2020).

3.0 Results

3.1 FIM

Biophysical characteristics of Whitetail Lake are summarized below. Segment maps are provided in Appendix A and segment summaries, including all FIM data collected during the survey as well as representative photographs, are provided in Appendix B.

3.1.1 Natural vs. Disturbed Shoreline

FIM was completed along 9,915 m of the Whitetail Lake shoreline, which was divided into 6 segments ranging in length from 340 to 3,120 m. The total length of shoreline classified as disturbed was 1,573 m (16%), with the remaining 8,342 m (84%) classified as natural (Figure 2).

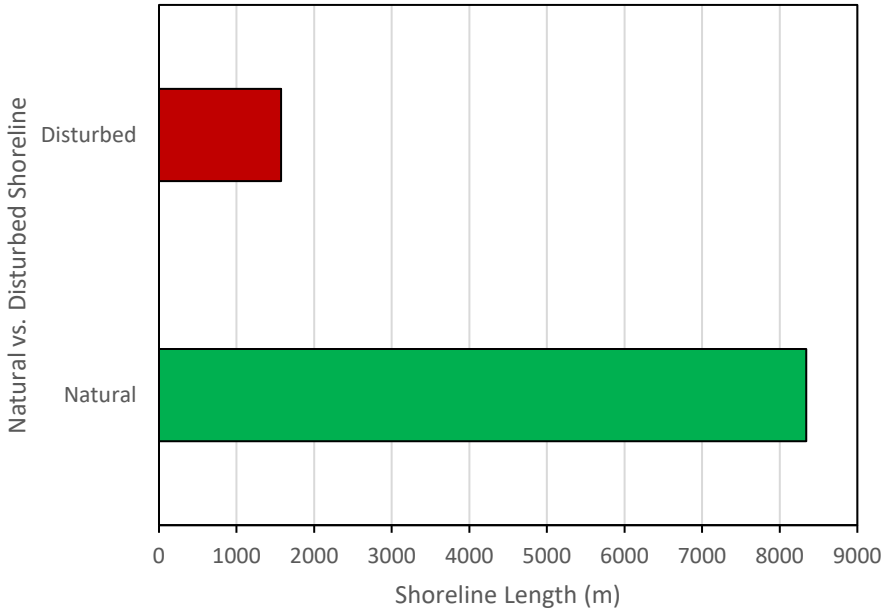

Figure 2: Total shoreline length (m) classified as disturbed versus natural for Whitetail Lake.

3.1.2 Shore Type

The predominant shore type observed for Whitetail Lake was gravel (6,411 m; 65%) followed by wetland (3,504 m; 35%) (Figure 3). Small areas of stream mouth and rocky shore were also observed within segments that were classified as gravel or wetland. Most of the wetland (98%) and gravel (76%) segment length was classified as natural.

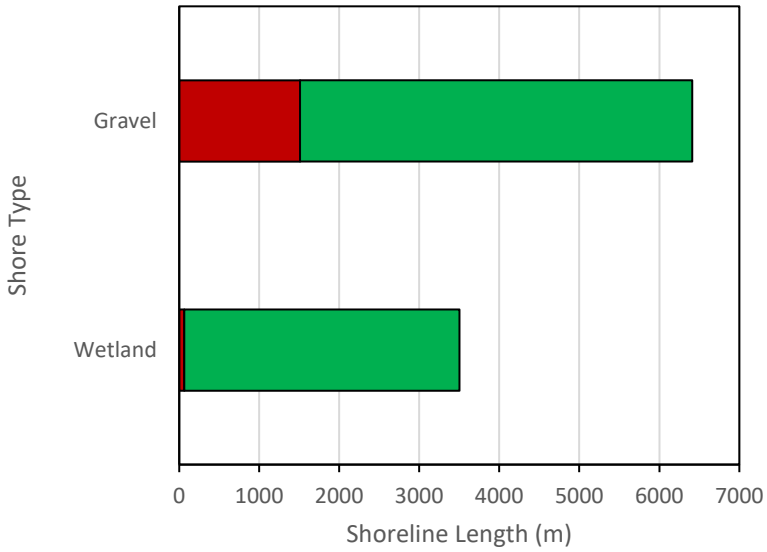

Figure 3: Shore types and length of natural (green) versus disturbed (red) shoreline for Whitetail Lake.

3.1.3 Land Use

The predominant land use observed for Whitetail Lake was rural which covered 6,414 m (65%) of the total shoreline (Figure 4). The remainder of the shoreline was forestry which covered 3,501 m (35%). A small area of single-family residential land use (approximately 65 m) was observed in Segment 3 which had an overall classification of rural land use. Rural segments were mostly (94%) classified as natural; disturbance in these areas was related to lake access modifications (e.g., docks, substrate modification and riparian clearing). Forestry segments were mostly (66%) classified as natural; disturbance in these areas was primarily related to a road modification with small areas of lake access modifications similar to those observed in rural segments.

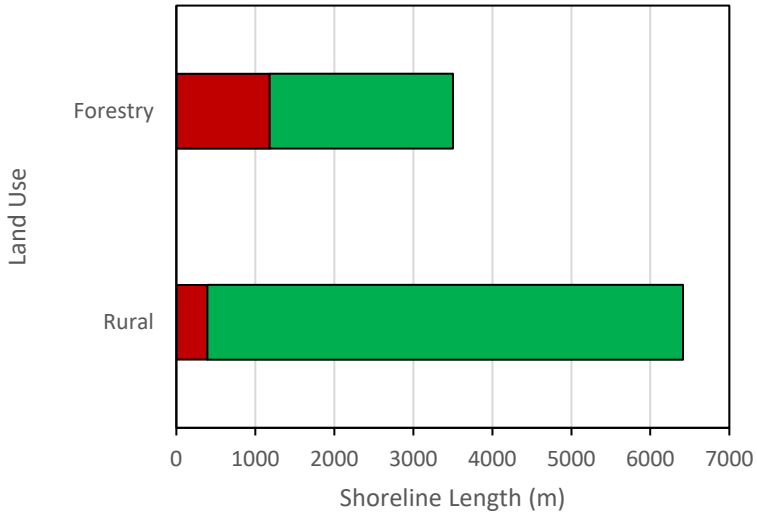

Figure 4: Land use types and length of natural (green) versus disturbed (red) shoreline for Whitetail Lake.

3.1.4 Aquatic Vegetation

Aquatic vegetation was observed along 1,834 m (19%) of the Whitetail Lake shoreline (Figure 5). Water clarity was very good during the survey and observers were able to clearly see to the benthos and identify submergent aquatic vegetation in water depths up to approximately 10 m. Emergent vegetation was the dominant aquatic vegetation type observed (1,834 m). Submergent vegetation was a minor component (47 m). Aquatic vegetation was observed in all segments. The majority of aquatic vegetation was observed in Segment 3 (1,277 m; 100% of segment shoreline). Segments 2 and 5 had the smallest areas of aquatic vegetation (17 m; 5% and 1% of the segment shorelines, respectively). Wetlands were identified in Segments 3 and 5. Segment 3 consisted of both submergent and emergent aquatic vegetation while only a small area of emergent vegetation was observed in Segment 5.

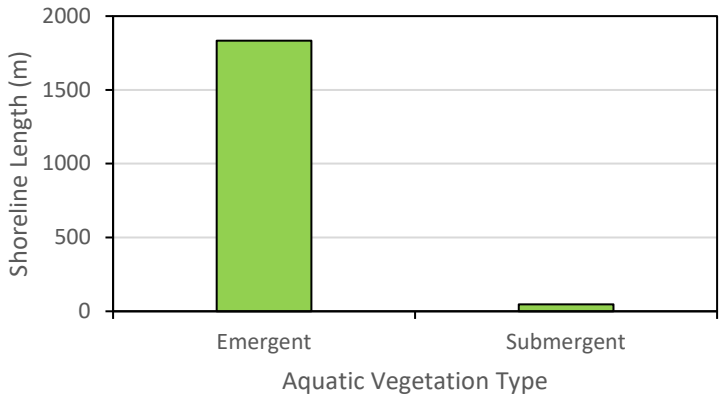

Figure 5: Aquatic vegetation types observed along the shoreline of Whitetail Lake.

3.1.5 Shoreline Characteristics

Characteristics of foreshore, littoral, riparian and wetland areas are described below.

3.1.5.1 Foreshore Areas

Large Woody Debris (LWD) was observed along the foreshore of all segments and the number of LWD pieces ranged from 6 to 23 pieces per segment (Appendix B). An exception was Segment 5, which did not have any LWD observed. Clusters of LWD (e.g., ≥5 pieces of LWD clumped together) were observed in Segment 4 (n=1) and Segment 6 (n=7) only.

Gravel (4,624 m; 47%) and cobble (3,180 m; 32%) were the predominant substrate types observed along the foreshore of Whitetail Lake (Figure 6). Lesser amounts of marl (706 m; 7%), sand (547 m; 6%), boulder (451 m; 5%), fines (243 m; 2%), organic (118 m; 1%) and mud (30 m; <1%) were recorded.

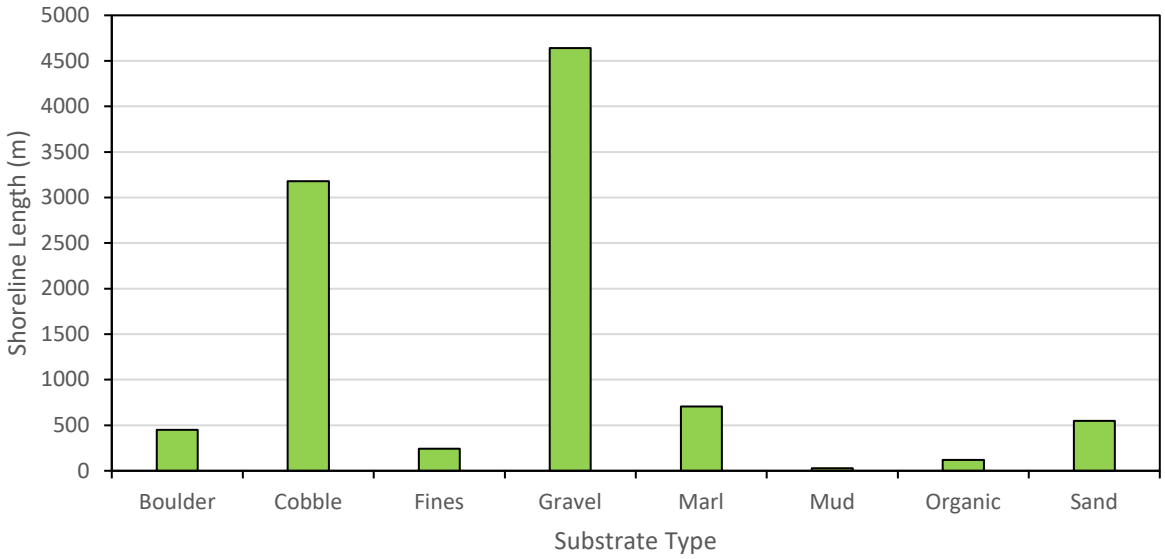

Figure 6: Substrate types observed along the foreshore of Whitetail Lake.

3.1.5.2 Littoral Areas

The littoral area in all segments was classified as wide (>50 m). Shallow, littoral areas extended across the entire width of the north and south ends of the lake. LWD was observed in littoral areas of Segments 3, 4, 5 and 6 with total numbers in each segment ranging between 3 and 78 pieces; Segments 4 and 6 had the most significant accumulations of LWD (≥70 pieces).

Marl (8,774 m; 89%) was the predominant littoral substrate type observed, and ranged from 78% to 100% of littoral substrates across all segments (Figure 7). Small amounts of mud (463 m; 5%), organics (295 m; 3%), fines (168 m; 2%), sand (30 m; <1%), gravel (92 m; <1%), cobble (62 m; <1%), and boulder (31 m; <1%) were also observed in some segments (Figure 7).

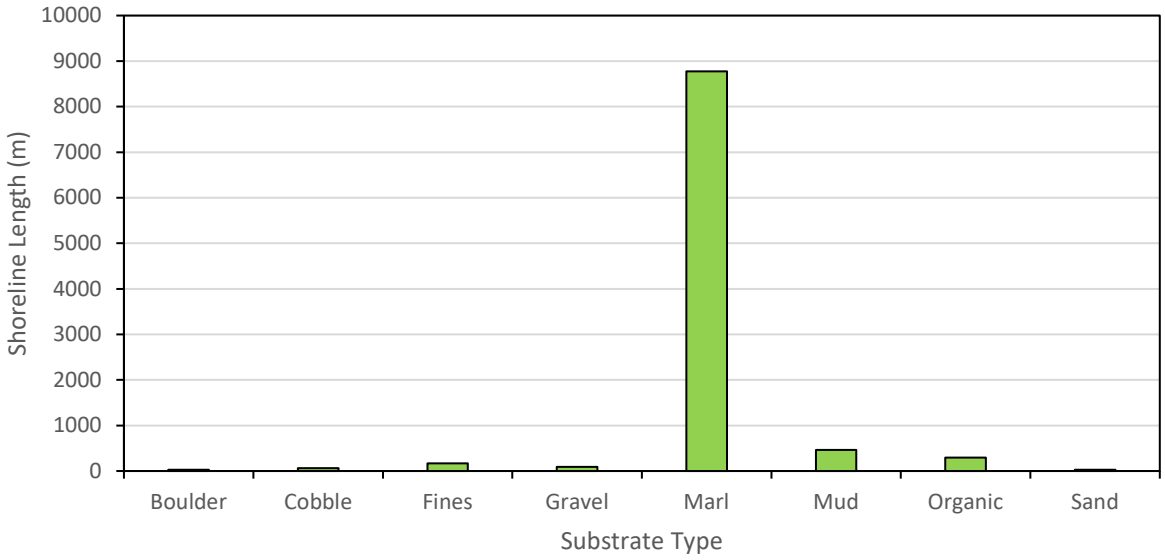

Figure 7: Substrate types observed in littoral areas of Whitetail Lake.

3.1.5.3 Riparian Areas (Vegetation Bands 1 and 2)

Overhanging vegetation was observed along all shoreline segments ranging between 15-80% of the segment length with the except of Segment 3 where no overhanging vegetation was observed. The width of the nearshore riparian vegetation band (Vegetation Band 1) ranged between 5 and 50 m and was continuous within all segments. Natural wetlands were observed in Vegetation Band 1 for Segments 1, 3 and 5 and these areas had medium (10-50%) or abundant (>50%) shrub layers and sparse (<10%) tree cover. Coniferous, mature forests with primarily abundant (>50%) shrub and tree coverage were observed in Vegetation Band 1 for Segments 2 and 4 while tall shrubs with abundant (>50%) shrub coverage were observed in Segment 6. Mature coniferous forests with medium (10-50%) or abundant (>50%) coverage were observed in Vegetation Band 2 which ranged between 10 and 45 m in Segments 1, 4, 5 and 6. Segments 2 and 3 did not have two unique riparian vegetation layers within 50 m of the shoreline and therefore the entire layer was classified as Vegetation Band 1. Vegetation Band 2 was patchy in Segments 4 and 5 and continuous in Segments 1 and 6. Patchy riparian vegetation observed in Segments 4 and 5 was the result of land clearing within upland areas and were observed along 4,797 m (48%) of the lake shoreline.

Segment 4 was the only segment where veteran trees (>25) were observed. The highest abundance of snags was observed in Segment 6 (>25 trees) followed by Segment 4 (5 – 25 trees). Snags were also observed in Segments 1, 3 and 5 (<5 trees) though none were observed in Segment 3 (Appendix B).

3.1.6 Fish Species Information

Two fish species were documented during recent inventories of Whitetail Lake: Rainbow Trout and non-native Eastern Brook Trout (Table 2; Cena 2012). The lake was chemically treated with rotenone in 1970 to remove native Mountain Whitefish (*Prosopium williamsoni*) and Longnose Dace (*Rhinichthys cataractae*) but this did not entirely eliminate non-native Eastern Brook Trout, introduced to the lake in 1967 (MWLAP 2004, 2005, Cena 2012). Since 1979 the lake has been stocked annually with different strains of Rainbow Trout; Rainbow Trout were also sporadically released between 1961 and 1974 (FIDQ 2020). Today, Whitetail Lake has an active fishery for trophy-sized Rainbow Trout and Eastern Brook Trout. During a recent stock assessment the maximum fork length of Rainbow Trout captured was 621 cm and the oldest was age 7+ while the maximum fork length of Brook Trout captured was 518 cm and the oldest was age 6 (Cena 2012). Kokanee Forest Consulting Ltd. (2001) sampled tributaries to Whitetail Lake and observed most tributaries to be dry/intermittent channels that provide little fish habitat. The exception was one tributary (Watershed Code: 330-992500-30700-48100, 2nd order stream) on the northwest side of the lake (Segment 1) where Eastern Brook Trout juveniles and fry, assumed to be spawned by fish from Whitetail Lake, were captured and low stream gradient, abundant spawning gravel and instream cover provided excellent fish habitat (Kokanee Forest Consulting Ltd. 2001). Whitetail Creek, a 3rd order stream and the primary outflow at the north end of the lake, was dry at the time of sampling though it was recommended the creek be sampled in the spring to determine its stream classification as it was suspected that fish may use the creek when wetted (Kokanee Forest Consulting Ltd. 2001).

Table 2: Fish species known to occur or have occurred in Whitetail Lake including current provincial conservation status and federal Species-At-Risk (SARA) Listing.

Common Name	Species Name	BC Provincial Conservation Status	Federal Species-At-Risk-Act (SARA) Listing
Rainbow Trout	*Oncorhynchus mykiss*	Yellow	-
Eastern Brook Trout	*Salvelinus fontinalis*	Yellow	-

3.1.7 Wildlife and Wildlife Habitat Observations

Wildlife observations are included in the FIM dataset in Appendix B and summarized by segment below:

- Segment 1 - one Bald Eagle (*Haliaeetus leucocephalus*) observed.
- Segment 3 – seven Common Goldeneyes (*Bucephala clangula*) observed.
- Segment 4 – one Bald Eagle, two Common Loons (*Gavia immer*), and 28 Common Goldeneyes observed.
- Segment 5 – numerous wildlife trails were scattered throughout the shrubs along the foreshore. Bear (*Ursus* sp.), Moose (*Alces alces*) and Elk (*Cervus canadensis*) scat observed.
- Segment 6 – one Belted Kingfisher (*Megaceryle alcyon*), two Canadian Geese (*Branta canadensis*) and two Common Loons observed.

No wildlife species of conservation concern are recorded on the CDC iMap tool in proximity to Whitetail Lake (CDC 2020). Forest cover was generally mid age with closed canopies on the western side and open to patchy along the remaining shoreline (Appendix C). Wildlife trees were relatively scarce, especially on the eastern shoreline where disturbance was greater. No stick nests or other significant nests were observed.

3.1.8 Shoreline Modifications

Docks were the most prevalent shoreline modification observed in Whitetail Lake. Docks (n=36) were observed in 4 segments with the majority (n=22) occurring on the east side of the lake (Segment 4; Figure 8 and Figure 9). The next most common shoreline modification was sheds (n=3) which were all observed in Segment 4. Boat launches (n=2; Figure 9), fences (n=2), as well as a boat lift, a dock groyne, a mooring buoy, a retaining wall, a staircase and a swim dock were also observed (Figure 8).

Lineal shoreline modifications observed included roadways and substrate modification (Figure 10). Lineal shoreline modifications were observed along 2,792 m (28%) of the Whitetail Lake shoreline. The most prevalent lineal development was roadways that occurred along 2,719 m (28%). The majority of road observed was in Segment 6 and consisted mainly of an abandoned roadway with a section that remains active within the Whitetail Lake BC Forest Recreation Site. A small amount of road was observed in Segment 4 (62 m; 2%). Substrate modification due to beach grooming and boat launch access was observed along 73 m (<1%) of the shoreline in Segments 3, 4 and 6.

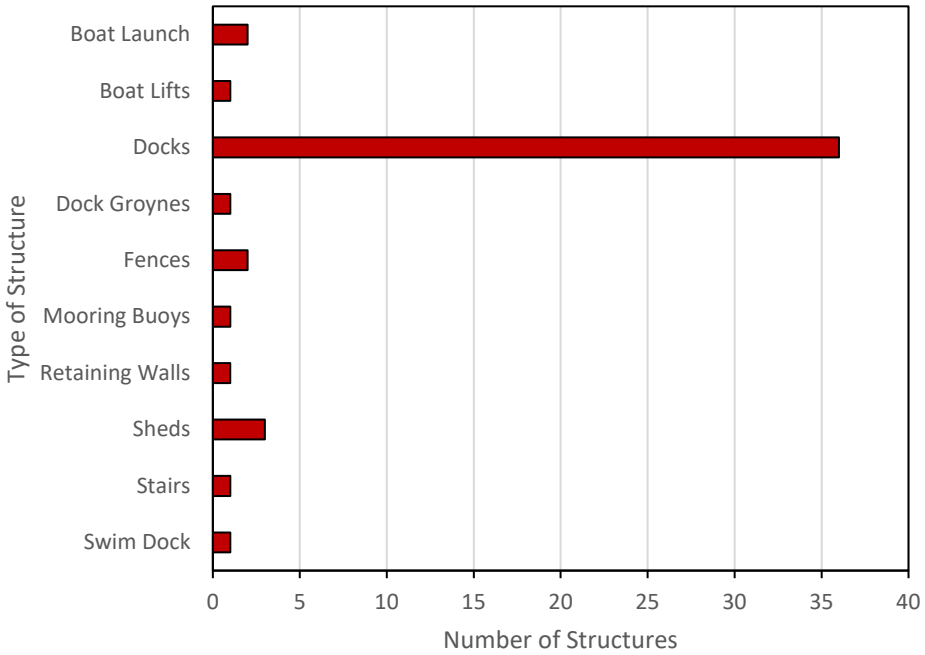

Figure 8: Total number of modifications observed along the shoreline of Whitetail Lake.

Figure 9: Example of shoreline modifications observed in Whitetail Lake including a dock in Segment 4 (left) and a boat launch and dock in Segment 6 (right).

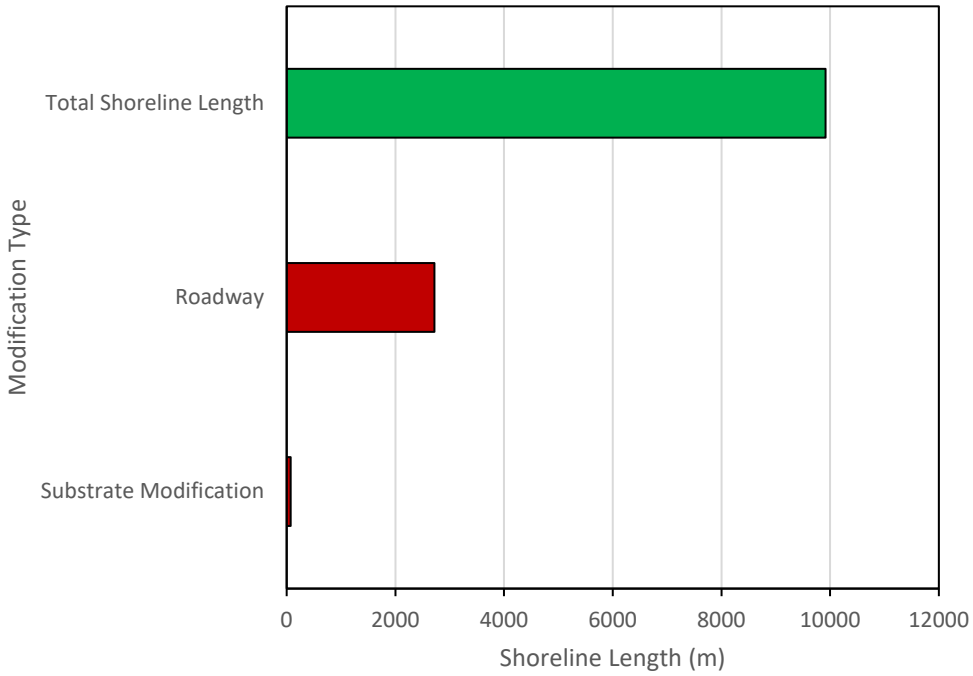

Figure 10: Total shoreline length that has been impacted by substrate modification and roadways along the shoreline of Whitetail Lake.

3.1.9 Level of Impact

The majority of the Whitetail Lake shoreline was classified as having a low level of impact (Figure 11). In total, 4,737 m (48%) of the shoreline was considered to have a low level of impact (<10% disturbance). Areas with medium level of impact (10-50% disturbance) were observed along 2,951 m (30%) of the shoreline while no impact (0%) disturbance was observed along the remaining 2,227 m (23%) of the shoreline (Figure 11). None of the Whitetail Lake shoreline was classified as having a high level of impact. Examples of the different levels of impact assessed along the shoreline of Whitetail Lake are illustrated in Figure 12.

The highest level of disturbance (40%) was observed in along the west shore (Segment 6; Medium level of impact) of Whitetail Lake including and adjacent to the Whitetail Lake Recreation Site. The primary modification observed in this segment was a partially abandoned roadway that paralleled approximately 2,656 m (90%) of the segment shoreline; the majority of the road was separated from the shoreline by a buffer of intact riparian shrubs and trees. Other modifications in the segment included docks (n=8; 2.7 docks/km), boat launches (n=2), a fence and small areas of substrate modification (Figure 12). A low level of disturbance was observed along the north and east shores of Whitetail Lake (Segments 2, 3, and 4) where intermittent modifications, primarily docks, were observed. The east shore of the lake (Segment 4) had the highest number of docks of any segment (n=22; 7 docks/km) though a smaller segment at the northwest end of the lake (Segment 2) had the highest density of docks (n=3; 8.8 docks/km). Segment 5 was the only segment where sheds (n=3), stairs (n=1) and a mooring buoy (n=1) were observed. No impacts were observed along a wetland on the west shoreline to the north of the Recreation Site (Segment 2) and along a wetland along the southeast/south shoreline (Segment 5).

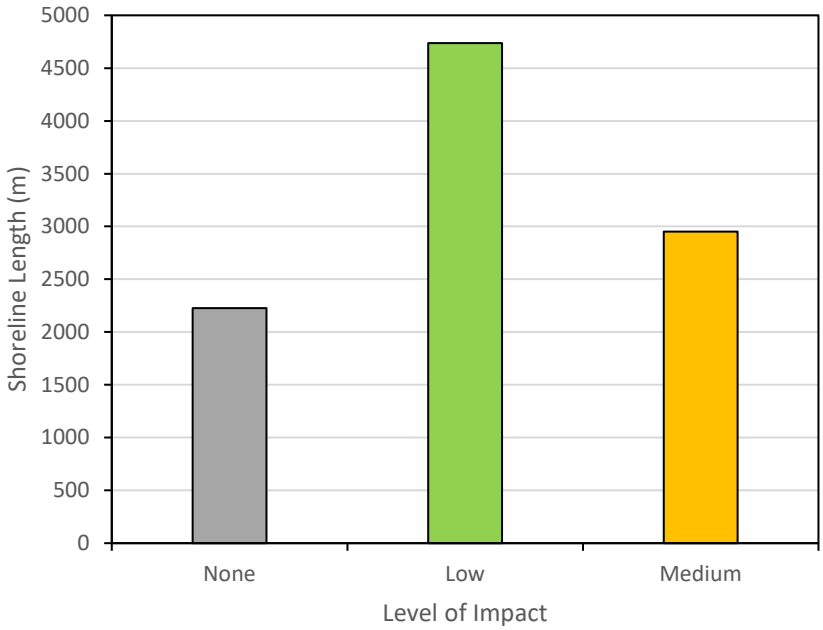

Figure 11: Level of Impact (None, Low or Medium) observed along the shoreline of Whitetail Lake.

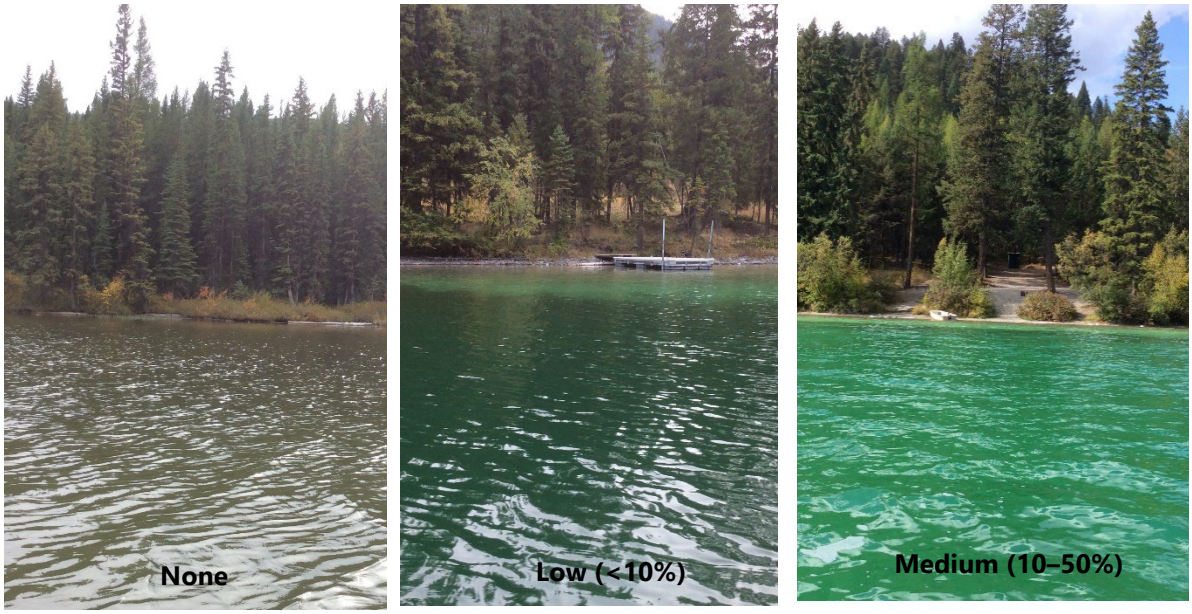

Figure 12: Examples of the different levels of impact assessed along the shoreline of Whitetail Lake.

3.2 FHSI

A summary of the current FHSI values for Whitetail Lake is provided in Table 3. Maps of shoreline segments with FHSI Ecological Ranking are provided in Appendix A. Calculations for each criterion and category, as well as Ecological Rank breaks are provided in Appendix D.

Most of the shoreline of Whitetail Lake was ranked as Moderate (64.5%) ecological value followed by High (18.4%) and Very High (16.9%) (Table 3). None of the shoreline was rated as Low or Very Low ecological value. All High and Very High ecological value segments had wetland shore types while all Moderate ecological value segments had gravel shore types (Table 4). No or limited disturbance was observed in segments ranked Very High and High ecological value which were 100% and 97% natural, respectively, while some disturbance was observed in segments ranked Moderate ecological value (76% natural; Figure 13).

Very High ecological value shoreline was identified in Segment 5 where the shoreline consisted of a large wetland and a tributary confluence that was in natural condition with no shoreline modification or disturbance observed. Important juvenile rearing and staging habitat for fish was identified while numerous wildlife trails were observed throughout nearshore riparian habitat. High ecological value shoreline was identified in Segments 1 and 3. Segment 1 contained a wetland, abundant LWD and a documented spawning tributary (Section 3.1.6). Segment 3 was also a wetland with abundant aquatic vegetation and included the Whitetail Creek confluence, which is the outflow of the lake. Low dock density was observed in Segment 3 though the overall level of disturbance in the segment was low (5% disturbed).

Moderate ecological value shoreline was observed in Segments 2, 4 and 6. Moderate value segments had lower ranking biophysical (i.e., FIM criteria), fish and wildlife habitat values compared with those ranked High or Very High, however, shoreline habitat remained largely intact. Modifications including docks and/or boat launches were observed in Moderate ecological value segments though the overall level of disturbance was low and the segments were mainly in natural condition (5% to 40% disturbed).

Table 3: Whitetail Lake FHSI Ecological Rankings.

FHSI Ecological Rank	# of Segments	Shoreline Length (m)	% of Shoreline
Very High	1	1,677	16.9
High	2	1,827	18.4
Moderate	3	6,411	64.7
Low	0	0	0
Very Low	0	0	0
Total	6	9,915	100

Table 4: Whitetail Lake FHSI Ecological Rankings by shore type.

FHSI Ecological Rank	Wetland		Gravel	
	Shoreline Length (m)	% of Shore Type Category	Shoreline Length (m)	% of Shore Type Category
Very High	1,677	48	0	0
High	1,827	52	0	0
Moderate	0	0	6,411	100
Low	0	0	0	0
Very Low	0	0	0	0

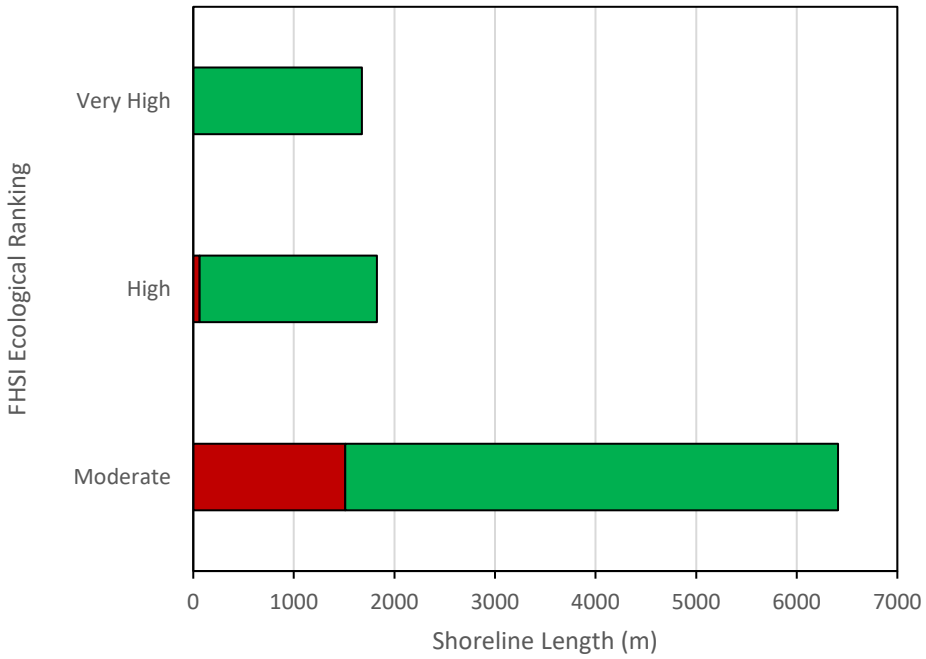

Figure 13: FHSI Ecological Rankings and length of natural (green) versus disturbed (red) shoreline for Whitetail Lake.

3.2.1 Zones of Sensitivity (ZOS)

ZOS identified during the FIM field assessment and during the background data review are described below and delineated on Appendix A maps.

- Wetlands – Wetlands are an important component of a healthy ecosystem that provide unique habitat, flood control, water filtration, fish habitat and diverse food resources (Mitsch and Gosselink 1993; Kennedy and Mayer 2002). Wetlands were observed in Segments 1, 3 and 5 and all were associated with inflow or outflow tributaries. The wetland in Segment 1 was the smallest of the three wetland areas and was located in an embayment area directly adjacent to the shoreline. Wetlands in Segments 3 and 5 were located at the north and south ends of the lake, respectively, and extended 400-500 m inland from the lake at their furthest extents. The primary vegetation type identified in the wetlands were scrub birch (*Betula nana*) and Labrador tea (*Ledum groenlandicum*) with common cattails (*Typha latifolia*) occurring within the littoral transition zone.
- Tributary Mouths – Tributary mouth areas provide important habitat for fish rearing, migration and staging (Rice et al. 2008). Tributaries to Whitetail Lake may provide spawning, egg incubation and juvenile rearing habitat for salmonids. Tributary mouths can also provide cool water refuge during summer when there are periods of higher water temperatures (Rice et al. 2008). The mouths of tributaries where salmonid spawning/migration has been documented (Segment 1) or is likely (Whitetail Creek; Segment 3) were identified as ZOS. Note that other tributary mouths, though not identified as ZOS at this time, may still provide important fish habitat and tributary mouths identified as ZOS can be updated if additional information becomes available.

3.2.2 Potential Conservation Zones

It is recommended that the two wetlands at the south end of Whitetail Lake (Segment 5) be considered for designation as conservation areas (Appendix A). These wetlands provide important habitat for fish and wildlife species and are also an important component of the entire Whitetail Lake ecosystem. It is recommended that these wetlands be considered as conservation zones and be protected from habitat alteration and permanent development.

Sensitive habitats were also identified in shorelines with High FHSI Ecological Rankings (Segments 1 and 3) and though these areas have not been identified as potential conservation zones at this time, guidance provided in the FDG herein, aim to limit potential negative impacts in these areas (Section 3.3). Shoreline conservation recommendations should be reviewed if additional information, including TEK, becomes available in the future.

3.3 FDG

The FDG for Whitetail Lake are provided in Appendix E. The FDG are also provided under separate cover for distribution to landowners, regulators and other stakeholders.

4.0 Discussion

Whitetail Lake is primarily undeveloped and was classified as having mostly natural shorelines with intact riparian vegetation immediately surrounding the foreshore. Past logging and associated road developments were observed in upland areas outside of the FIM assessment boundary (e.g., greater than 50 m from the HWM). In addition to being relatively pristine, Whitetail Lake also has a high recreational value owing to a stable trophy-sized Rainbow Trout fishery. The lake also has good access for campers and boaters with two boat launches and numerous campsites at the Recreation Site (Appendix A). However, all land parcels that surround the lake are private ownership, with some Crown land to the south of the lake away from the foreshore (BC LTSA 2020). It is unknown whether these privately owned parcels will be further developed for residential use.

Though this is the first FIMP conducted on Whitetail Lake and there is no pre-existing FIM dataset to which shoreline characteristics and modification comparisons can be made, orthophoto and satellite imagery can provide an indication of the rate of change observed in recent years. The most recent orthophotos of the lake were taken in 2009. During development of FIM mapping products, recent Bing satellite imagery was used on basemaps instead of orthophotos because during imagery review it was clear that significant development had occurred along the east shoreline since the initial orthophotos were taken. Consequently, those the orthophotos do not accurately represent the current state of the foreshore.

Comparing the 2009 orthophotos with recent Bing imagery (date unknown but assumed to be recent based on field observations) provides a visual indication of the rate of development over the past approximately 11 years and depicts numerous new roads, upland clearing, recreational access and docks along the east shore of the lake (Figure 14). The east shore of Whitetail Lake (Segment 4; Moderate FHSI Ecological Rank) was observed to have numerous docks on most of these private parcels in addition to other recreational structures such as sheds and RV pads and had roads and land clearing beyond the immediate (~50 m) riparian area during the 2020 FIM survey. These structures were not present in the 2009 orthophotos (Figure 14). It would be prudent to ensure that any development along the lake foreshore occurs in a manner that preserves its natural state and that fish and wildlife habitats remain as unaltered as possible to maintain Whitetail Lake's high ecological and recreational value. The Whitetail Lake FDG (Appendix E) provides development planning guidelines, aimed at protecting ecologically sensitive areas identified during this process. Guidance is provided for landowners, regulators and other stakeholders on the

permitting and review process for shoreline development and the FDG also identify areas where development should be avoided.

Figure 14: Example of recent development along the eastern shoreline (Segment 4) of Whitetail Lake depicted in orthophotos (2009; left) and recent satellite imagery (unknown date; right).

5.0 Recommendations

The following are recommendations to protect sensitive habitats around Whitetail Lake and improve the FIMP if additional data becomes available in the future:

1. Consider designating the two wetlands at the south end of Whitetail Lake (Segment 5) as conservation zones. The wetlands provide important habitat for fish and wildlife species and are also an important component of the entire Whitetail Lake ecosystem.
2. Incorporate (i.e., append) First Nations TEK into the Whitetail Lake FIMP process if it becomes available in the future.
3. Update the FHSI to include additional categories and/or criteria if sufficient data becomes available in the future. For example, categories such as waterfowl, herptiles, ecosystem, species-at-risk, etc. were not included in the current FHSI due to lack of data though important and sensitive habitat features related to these categories may be present along the foreshore of Whitetail Lake.
4. Update the ZOS to include additional sensitive habitat features as polygons, points or lines in the FIMP process if additional data becomes available in the future.

5. Complete a fish and fish habitat inventory of tributaries to Whitetail Lake in various seasons. The limited information available at this time was conducted during the low water period, did not include assessment of all tributaries and it was recommended additional surveys be conducted during other seasons, specifically during the spring. Following the inventory, review and update tributary mouth ZOS as required.
6. Conduct a UAV (drone) survey along the shoreline of Whitetail Lake during low water to visually document the shoreline. The UAV survey could not be conducted in 2020 due to wildfires within the vicinity of Whitetail Lake which restricted its use.

6.0 References

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Appendix A – Segment Maps

568750 569000 569250 569500 569750

5564750 5564500 5564250 5564000 5563750 5563500 5563250

N

Whitetail Creek

Segment Number 3
Shore Type: Wetland
Land Use: Rural
Level of Impact: Low (< 10%)
FHSI Ecological Rank: High

Segment Number 2
Shore Type: Gravel
Land Use: Rural
Level of Impact: Low (< 10%)
FHSI Ecological Rank: Moderate

Segment Number 1
Shore Type: Wetland
Land Use: Forestry
Level of Impact: None
FHSI Ecological Rank: High

Segment Number 4
Shore Type: Gravel
Land Use: Rural
Level of Impact: Low (< 10%)
FHSI Ecological Rank: Moderate

Segment Number 6
Shore Type: Gravel
Land Use: Forestry
Level of Impact: Medium (10-50%)
FHSI Ecological Rank: Moderate

Whitetail Lake Rd

Whitetail Lake Rd

bing

Legend

Vegetation Polygon
- Emergent
- Submergent

Zones of Sensitivity
- Ecosystem - Wetland
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

- Shoreline Segment Break

FHSI Rank
- Very High
- High
- Moderate

Modifications
- Boat Launch
- Dock
- Mooring Buoy

- Road
- Watercourse
- Parcel Boundary

0 50 100
Meters
Scale: 1:5,000

References:
DataBC Data Distribution Service
Open Government License
(http://www.data.gov.bc.ca/)
Geogratis/Geobase
Open Government License - Canada
(http://data.gc.ca/eng/about-datagcca)

CLIENT: LivingLakes	PROJECT: Whitetail Lake FIMP
TITLE: Whitetail Lake Foreshore Habitat Sensitivity Index (FHSI) Mapping	DATE: February 11, 2021 · ANALYST: PK · QA/QC: LP · Page 1 of 3
	GIS FILE: 02-01-010_whitetail_lake_fhsi_maps.mxd
	JOB No: VE52823
	COORDINATE SYSTEM: NAD 1983 UTM Zone 11N

wood.

Last updated by paul.kwon

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569000 569250 569500 569750 570000 570250

5563250 5563000 5562750 5562500 5562250 5562000 5561750 5561500

N

Segment Number 4
Shore Type: Gravel
Land Use: Rural
Level of Impact: Low (< 10%)
FHSI Ecological Rank: Moderate

Segment Number 6
Shore Type: Gravel
Land Use: Forestry
Level of Impact: Medium (10-50%)
FHSI Ecological Rank: Moderate

Whitetail Lake Rd

Whitetail Lake Rd

bing™

Legend

Vegetation Polygon
- Emergent
- Submergent

Zones of Sensitivity
- Ecosystem - Wetland
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

- Shoreline Segment Break

FHSI Rank
- Very High
- High
- Moderate

Modifications
- Boat Launch
- Dock
- Mooring Buoy

- Road
- Watercourse
- Parcel Boundary

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Meters
Scale: 1:5,000

References:
DataBC Data Distribution Service
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CLIENT: LivingLakes	PROJECT: Whitetail Lake FIMP
TITLE: Whitetail Lake Foreshore Habitat Sensitivity Index (FHSI) Mapping	DATE: February 11, 2021 · ANALYST: PK · QA/QC: LP · **Page 2 of 3**
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569750 570000 570250 570500 570750

5562000 5561750 5561500 5561250 5561000 5560750 5560500

N

Segment Number 4
Shore Type: Gravel
Land Use: Rural
Level of Impact: Low (< 10%)
FHSI Ecological Rank: Moderate

Segment Number 6
Shore Type: Gravel
Land Use: Forestry
Level of Impact: Medium (10-50%)
FHSI Ecological Rank: Moderate

Segment Number 5
Shore Type: Wetland
Land Use: Rural
Level of Impact: None
FHSI Ecological Rank: Very High

Whitetail Lake Rd

Whitetail Lake Rd

bing

Legend

Vegetation Polygon
- Emergent
- Submergent

Zones of Sensitivity
- Ecosystem - Wetland
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

I Shoreline Segment Break

FHSI Rank
- Very High
- High
- Moderate

Modifications
- Boat Launch
- Dock
- Mooring Buoy

Road
Watercourse
Parcel Boundary

0 50 100
Meters
Scale: 1:5,000

References:
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Open Government License - Canada
(http://data.gc.ca/eng/about-datagcca)

CLIENT: LivingLakes

PROJECT: Whitetail Lake FIMP

TITLE: Whitetail Lake Foreshore Habitat Sensitivity Index (FHSI) Mapping

DATE: February 11, 2021 | ANALYST: PK | QA/QC: LP

GIS FILE: 02-01-010_whitetail_lake_fhsi_maps.mxd

JOB No: VE52823

COORDINATE SYSTEM: NAD 1983 UTM Zone 11N

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Appendix B – Segment Summaries

Whitetail Lake Segment 1



General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
550	Wetland	None	Low (> 5%)	Forestry	None	No	0%	100%	

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	0%	0%	0%	0%	100%	0%	modified shore

Land Use:

Agriculture	Commercial	Conservation	Forestry	Industrial	Institutional	Multi-Family	Natural Area	Park	Rural	Single Family	Transportation	Urban Park	Utility Corridor	Land Use Comment
0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	

Foreshore Substrates:

Marl	Mud	Organic	Fines	Sand	Gravel	Gravel Fine	Gravel Coarse	Cobble	Cobble Fine	Cobble Coarse	Boulder	Bedrock	Embeddedness	Shape
100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	High (>75%)	Smooth

Littoral Substrates:

Marl	Mud	Organic	Fines	Sand	Gravel	Gravel Fine	Gravel Coarse	Cobble	Cobble Fine	Cobble Coarse	Boulder	Bedrock	Embeddedness	Shape
100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	High (>75%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Natural Wetland	Low Shrubs	Abundant (> 50%)	Sparse (< 10%)	Continuous	10	15%	

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)
Coniferous	Mature Forest	Sparse (< 10%)	Abundant (> 50%)	Continuous	40

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating
40%	0%	40%	0%

Large Woody Debris (LWD):

LWD Range	LWD (#)	Littoral LWD (#)	LWD Clusters
6 - 25 Pieces	12	0	0

Littoral Area:

Littoral Zone	Littoral Width
Wide (> 50 m)	N/A

Shoreline Modifications:

Ret. Walls	%Ret.Wall	Docks	Docks/km	Dock Groyne	Swim Float	Boat House_Float	Boat House_Land	Boat Cover	Groynes	Groynes/km	Boat Launch	Marine Rail	Marinas	Fences	Stairs	Mooring Buoys	Boat Rack/Lift	Boat Basin	Shed	Pumphouse	Geothermal	Other	Pond_Pool	Pilings	Pile Support Struct	Tram
0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
0%	0%	No	0%	0%	

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Comments	Flora Comments	Fauna Comments
No	< 5 Trees	0	0	0	0	0	0			Bald Eagle

Whitetail Lake Segment 2

General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
340	Gravel	None	Low (> 5%)	Rural	Low (< 10%)	No	5%	95%	

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	0%	95%	0%	0%	5%	0%	

Land Use:

Agriculture	Commercial	Conservation	Forestry	Industrial	Institutional	Multi-Family	Natural Area	Park	Rural	Single Family	Transportation	Urban Park	Utility Corridor	Land Use Comment
0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	

Foreshore Substrates:

Marl	Mud	Organic	Fines	Sand	Gravel	Gravel Fine	Gravel Coarse	Cobble	Cobble Fine	Cobble Coarse	Boulder	Bedrock	Embeddedness	Shape
0%	0%	0%	0%	20%	80%	0%	0%	0%	0%	0%	0%	0%	Low (0 - 25%)	Smooth

Littoral Substrates:

Marl	Mud	Organic	Fines	Sand	Gravel	Gravel Fine	Gravel Coarse	Cobble	Cobble Fine	Cobble Coarse	Boulder	Bedrock	Embeddedness	Shape
100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	High (>75%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Coniferous	Mature Forest	Medium (10 - 50%)	Abundant (> 50%)	Continuous	50	40%	

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)
N/A	N/A	N/A	N/A	N/A	N/A

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating
5%	1%	5%	0%

Large Woody Debris (LWD):

LWD Range	LWD (#)	Littoral LWD (#)	LWD Clusters
6 - 25 Pieces	6	0	0

Littoral Area:

Littoral Zone	Littoral Width
Wide (> 50 m)	N/A

Shoreline Modifications:

Ret. Walls	%Ret.Wall	Docks	Docks/km	Dock Groyne	Swim Float	Boat House_Float	Boat House_Land	Boat Cover	Groynes	Groynes/km	Boat Launch	Marine Rail	Marinas	Fences	Stairs	Mooring Buoys	Boat Rack/Lift	Boat Basin	Shed	Pumphouse	Geothermal	Other	Pond_Pool	Pilings	Pile Support Struct	Tram
0	0%	3	8.83	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
0%	0%	No	0%	0%	Other mod - permanent platform with hot tub within 5 m of HWM

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Comments	Flora Comments	Fauna Comments
No	< 5 Trees	0	0	0	0	0	0			

Whitetail Lake Segment 3



General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
1277	Wetland	None	Low (> 5%)	Rural	Low (< 10%)	No	5%	95%	

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	0%	0%	0%	0%	100%	0%	

Land Use:

Agriculture	Commercial	Conservation	Forestry	Industrial	Institutional	Multi-Family	Natural Area	Park	Rural	Single Family	Transportation	Urban Park	Utility Corridor	Land Use Comment
0%	0%	0%	0%	0%	0%	0%	0%	0%	95%	5%	0%	0%	0%	

Foreshore Substrates:

Marl	Mud	Organic	Fines	Sand	Gravel	Gravel Fine	Gravel Coarse	Cobble	Cobble Fine	Cobble Coarse	Boulder	Bedrock	Embeddedness	Shape
0%	0%	0%	19%	1%	80%	0%	0%	0%	0%	0%	0%	0%	Low (0 - 25%)	Smooth

Littoral Substrates:

Marl	Mud	Organic	Fines	Sand	Gravel	Gravel Fine	Gravel Coarse	Cobble	Cobble Fine	Cobble Coarse	Boulder	Bedrock	Embeddedness	Shape
100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	High (>75%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Natural Wetland	Low Shrubs	Abundant (> 50%)	Sparse (< 10%)	Continuous	50	0%	

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)
N/A	N/A	N/A	N/A	N/A	N/A

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating
100%	1%	100%	0%

Large Woody Debris (LWD):

LWD Range	LWD (#)	Littoral LWD (#)	LWD Clusters
6 - 25 Pieces	7	3	0

Littoral Area:

Littoral Zone	Littoral Width
Wide (> 50 m)	N/A

Shoreline Modifications:

Ret. Walls	%Ret.Wall	Docks	Docks/km	Dock Groyne	Swim Float	Boat House_Float	Boat House_Land	Boat Cover	Groynes	Groynes/km	Boat Launch	Marine Rail	Marinas	Fences	Stairs	Mooring Buoys	Boat Rack/Lift	Boat Basin	Shed	Pumphouse	Geothermal	Other	Pond_Pool	Pilings	Pile Support Struct	Tram
0	0%	3	2.35	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
0%	0%	Yes	1%	0%	Boat rack made of wood. Canoe rack also present on shore.

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Comments	Flora Comments	Fauna Comments
No	No	0	0	0	0	0	0			7 Golden Eyes

Whitetail Lake Segment 4



General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
3120	Gravel	None	Low (> 5%)	Rural	Low (< 10%)	No	10%	90%	

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	10%	80%	0%	0%	10%	0%	

Land Use:

Agriculture	Commercial	Conservation	Forestry	Industrial	Institutional	Multi-Family	Natural Area	Park	Rural	Single Family	Transportation	Urban Park	Utility Corridor	Land Use Comment
0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	

Foreshore Substrates:

Marl	Mud	Organic	Fines	Sand	Gravel	Gravel Fine	Gravel Coarse	Cobble	Cobble Fine	Cobble Coarse	Boulder	Bedrock	Embeddedness	Shape
5%	0%	0%	0%	0%	50%	0%	0%	40%	0%	0%	5%	0%	Low (0 - 25%)	Smooth

Littoral Substrates:

Marl	Mud	Organic	Fines	Sand	Gravel	Gravel Fine	Gravel Coarse	Cobble	Cobble Fine	Cobble Coarse	Boulder	Bedrock	Embeddedness	Shape
95%	0%	0%	0%	0%	2%	0%	0%	2%	0%	0%	1%	0%	High (>75%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Coniferous	Mature Forest	Abundant (> 50%)	Abundant (> 50%)	Continuous	30	80%	

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)
Coniferous	Mature Forest	Sparse (< 10%)	Medium (10 - 50%)	Patchy	20

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating
5%	1%	5%	0%

Large Woody Debris (LWD):

LWD Range	LWD (#)	Littoral LWD (#)	LWD Clusters
6 - 25 Pieces	23	70	1

Littoral Area:

Littoral Zone	Littoral Width
Wide (> 50 m)	N/A

Shoreline Modifications:

Ret. Walls	%Ret.Wall	Docks	Docks/km	Dock Groyne	Swim Float	Boat House_Float	Boat House_Land	Boat Cover	Groynes	Groynes/km	Boat Launch	Marine Rail	Marinas	Fences	Stairs	Mooring Buoys	Boat Rack/Lift	Boat Basin	Shed	Pumphouse	Geothermal	Other	Pond_Pool	Pilings	Pile Support Struct	Tram
1	1%	22	7.05	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	3	0	0	0	0	0	0	0

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
0%	2%	Yes	1%	0%	

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Comments	Flora Comments	Fauna Comments
> 25 Trees	5 - 25 Trees	0	0	0	0	0	0			Bald eagle; 28 Golden Eyes; 2 Loons

Whitetail Lake Segment 5



General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
1677	Wetland	None	Low (> 5%)	Rural	None	No	0%	100%	

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	0%	0%	0%	5%	95%	0%	

Land Use:

Agriculture	Commercial	Conservation	Forestry	Industrial	Institutional	Multi-Family	Natural Area	Park	Rural	Single Family	Transportation	Urban Park	Utility Corridor	Land Use Comment
0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	

Foreshore Substrates:

Marl	Mud	Organic	Fines	Sand	Gravel	Gravel Fine	Gravel Coarse	Cobble	Cobble Fine	Cobble Coarse	Boulder	Bedrock	Embeddedness	Shape
0%	0%	0%	19%	1%	80%	0%	0%	0%	0%	0%	0%	0%	High (>75%)	Smooth

Littoral Substrates:

Marl	Mud	Organic	Fines	Sand	Gravel	Gravel Fine	Gravel Coarse	Cobble	Cobble Fine	Cobble Coarse	Boulder	Bedrock	Embeddedness	Shape
80%	10%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	High (>75%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Natural Wetland	Low Shrubs	Medium (10 - 50%)	Sparse (< 10%)	Continuous	40	20%	Bog; bandwidth ranges from >50 in bog areas to narrow section of coniferous

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)
Coniferous	Mature Forest	Medium (10 - 50%)	Medium (10 - 50%)	Patchy	10

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating
1%	0%	1%	0%

Large Woody Debris (LWD):

LWD Range	LWD (#)	Littoral LWD (#)	LWD Clusters
None	0	12	0

Littoral Area:

Littoral Zone	Littoral Width
Wide (> 50 m)	N/A

Shoreline Modifications:

Ret. Walls	%Ret.Wall	Docks	Docks/km	Dock Groyne	Swim Float	Boat House_Float	Boat House_Land	Boat Cover	Groynes	Groynes/km	Boat Launch	Marine Rail	Marinas	Fences	Stairs	Mooring Buoys	Boat Rack/Lift	Boat Basin	Shed	Pumphouse	Geothermal	Other	Pond_Pool	Pilings	Pile Support Struct	Tram
0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
0%	0%	No	0%		

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Comments	Flora Comments	Fauna Comments
No	< 5 Trees	0	0	1	0	0	0	Many wildlife trails scattered throughout; cannot count		Bear, moose, elk scat; juvenile trout observed

Whitetail Lake Segment 6

General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
2951	Gravel	Roadway	Low (> 5%)	Forestry	Medium (10-50%)	No	40%	60%	Disturbance is old forestry road; has intact riparian area

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	20%	79%	0%	1%	0%	0%	

Land Use:

Agriculture	Commercial	Conservation	Forestry	Industrial	Institutional	Multi-Family	Natural Area	Park	Rural	Single Family	Transportation	Urban Park	Utility Corridor	Land Use Comment
0%	0%	0%	80%	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	

Foreshore Substrates:

Marl	Mud	Organic	Fines	Sand	Gravel	Gravel Fine	Gravel Coarse	Cobble	Cobble Fine	Cobble Coarse	Boulder	Bedrock	Embeddedness	Shape
0%	1%	4%	0%	5%	60%	0%	0%	20%	0%	0%	10%	0%	Medium (25 - 75%)	Smooth

Littoral Substrates:

Marl	Mud	Organic	Fines	Sand	Gravel	Gravel Fine	Gravel Coarse	Cobble	Cobble Fine	Cobble Coarse	Boulder	Bedrock	Embeddedness	Shape
78%	10%	10%	0%	1%	1%	0%	0%	0%	0%	0%	0%	0%	High (>75%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Shrubs	Tall Shrubs	Abundant (> 50%)	Sparse (< 10%)	Continuous	5	80%	

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)
Coniferous	Mature Forest	Sparse (< 10%)	Abundant (> 50%)	Continuous	45

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating
5%	0%	5%	0%

Large Woody Debris (LWD):

LWD Range	LWD (#)	Littoral LWD (#)	LWD Clusters
6 - 25 Pieces	18	78	7

Littoral Area:

Littoral Zone	Littoral Width
Wide (> 50 m)	N/A

Shoreline Modifications:

Ret. Walls	%Ret.Wall	Docks	Docks/km	Dock Groyne	Swim Float	Boat House_Float	Boat House_Land	Boat Cover	Groynes	Groynes/km	Boat Launch	Marine Rail	Marinas	Fences	Stairs	Mooring Buoys	Boat Rack/Lift	Boat Basin	Shed	Pumphouse	Geothermal	Other	Pond_Pool	Pilings	Pile Support Struct	Tram
0	0%	8	2.71	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
0%	90%	Yes	1%	0%	

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Comments	Flora Comments	Fauna Comments
No	> 25 Trees	0	0	0	0	0	0			2 Loons; 2 Canada geese; 1 Kingfisher

Appendix C – Wildlife Survey Data

Appendix C. Whitetail Lake Wildlife and Wildlife Habitat Observations, 21-22 September 2020.

		Sample Site	Segment 3 (3-1)	Segment 4 (4-1)	Segment 4 (4-2)	Segment 5 (5-2)	Segment 6 (6-2)
Habitat Attributes	**Forest Cover**	**Age/Canopy**	N/A	Young/ closed	Mature - old/closed - patchy	None - sparse	Mature/ closed
		Species	N/A	Larch, spruce, fir	Spruce, fir, larch	Spruce	Spruce, fir, larch
		Wildlife Trees	None	One	Few	None	Few
		CWD/LOD	Few	None	Few	None	Few
	Shrubs	**Amount**	Abundant	Moderate - abundant	Abundant	Abundant	Moderate
		Species	Rose, birch, red-osier dogwood, willow	Rose, birch, red-osier dogwood, willow	Rose, birch, red-osier dogwood, willow	Birch, Labrador tea	Rose, birch, red-osier dogwood, willow
	Other	**Clay bank/ Cliff**	No	No	Clay bank	No	No
		Adjacent Wetland	Yes	No	No	Yes	No

Appendix D – Foreshore Habitat Sensitivity Index Calculations

Appendix Table D1. Whitetail Lake FHSI values by criteria.

FIM									Fisheries			Wildlife	Modifications				
Segment Number	Shore Type	Foreshore Substrate	Percent Natural	Aquatic Vegetation	Overhanging Vegetation	Large Woody Debris	Riparian Band 1	Riparian Band 2	Juv Rear	Migration	Staging	High Use	Ret Walls	Docks	Groynes	Boat Launches	Marinas
1	14.4	9.2	8.6	1.84	0.42	3.5	5.16	2.8	10	5	5	0	0	0	0	0	0
2	11.664	10.35	8.17	0.23	1.12	3.5	6.88	2.8	1	0	0	0	0	1.5	0	0	0
3	14.4	10.35	8.17	4.6	0	2.1	8.6	3.5	10	5	5	0	0	1	0	0	0
4	11.808	11.27	7.74	0.23	2.24	3.5	6.88	2.8	5	0	5	0	0.025	1.5	0	0	0
5	14.4	10.35	8.6	0.046	0.56	2.1	8.6	1.68	10	0	5	12.5	0	0	0	0	0
6	11.5488	10.8675	5.16	0.23	2.24	3.5	3.44	2.8	5	0	5	0	0	1	0	1	0

Appendix Table D2. Whitetail Lake FHSI values by category and rank.

Segment Number	FIM	Fish	Wildlife	Modifications	FHSI Value	FHSI Rank
1	45.9	20	0	0	65.9	High
2	44.7	1	0	-1.5	44.2	Moderate
3	51.7	20	0	-1	70.7	High
4	46.5	10	0	-1.525	54.9	Moderate
5	46.3	15	12.5	0	73.8	Very High
6	39.8	10	0	-2	47.8	Moderate

Appendix Table D3. Whitetail Lake FHSI Ecological Rank Categories

FHSI Ecological Rank	FHSI Value Range
Very Low	0-27
Low	28-42
Moderate	43-57
High	58-72
Very High	≥73

Appendix E – Foreshore Development Guidelines

Foreshore Development Guide

Whitetail Lake

Prepared For:

Living Lakes Canada

March 2021

Suggested Citation

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- Ministry of Forests, Lands, Natural Resource Operations and Rural Development (MFLNRORD) Branches include:
  - Water Stewardship
  - Habitat
  - Lands
- Okanagan Nation Alliance
- Ktunaxa Nation Council
- Regional District of East Kootenay
- Regional District of Central Kootenay
- Wood Environment & Infrastructure
- Foreshore Inventory and Mapping Technical Committee

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1.0 Introduction

In recent years, environmental impacts to lake shorelines (e.g., degraded habitat, recreational use conflicts, and water quality impacts) have prompted government agencies to initiate projects focused on increasing our understanding of lake shorelines to support evidence-based lake management strategies. For example, Living Lakes Canada has partnered with local, provincial and federal regulators to provide guidance on how to balance shoreline development with protection of important habitats. The guidelines presented in this document are founded on the concept that sustainable management is the shared responsibility of all stakeholders, including proponents, professionals and all levels of government.

This Foreshore Development Guide (FDG) provides development planning guidelines, aimed at protecting sensitive fish and wildlife species and their habitats identified through the previous Foreshore Inventory and Mapping (FIM) and Foreshore Habitat Sensitivity Index (FHSI) analyses. The FDG is an initial tool used when planning for, prescribing, or reviewing riparian and shoreline alterations. Based on the environmental (species and habitat) values, the FGD identifies the levels of risk associated with shoreline alteration from various types of development activities. The risks identify the anticipated regulatory steps required to proceed with the project. The guidelines provide important information to support both the landowner in preparing foreshore work applications, and the government agencies during their review of the applications.

The FDG recommends areas to be conserved, where development may present very high or significant risk to high value species and their habitats that require shoreline areas to carry out their life-cycle. Additionally, the FDG describes how restoration opportunities should be sought to improve habitat previously disturbed, and to potentially aid in obtaining regulatory support for new proposed projects.

The FDG methods were first developed for Windermere Lake by the East Kootenay Integrated Lake Management Partnership (EKILMP et al. 2009). These methods used the BC Ministry of Environment (BC MoE) document - High Value Habitat Maps and Associated Protocol for Works along the Foreshore of Large Lakes within the Okanagan (BC MoE 2008), and input from the various EKILMP members, including: Fisheries and Oceans Canada (DFO), BC MoE, Regional District of East Kootenay (RDEK), and Wildsight. Additional lake projects followed and expanded on the initial EKILMP FDG. Notable projects included: Moyie Lake (Schleppe 2009), Tie Lake (McPherson et al. 2012), and Kootenay Lake (Kootenay Lake Partnership 2019). With each iteration of these documents, the general process for developing a FDG were refined.

2.0 Important Contact Information

Proponents may use the contact information provided below when planning their proposed activities. Even with the use of this document, it is recommended that anyone who is planning work on Crown Land (such as the shoreline), first contact FrontCounterBC or retain the services of a Qualified Environmental Professional (QEP) who will contact FrontCounterBC on their behalf. Depending on the situation, FrontCounterBC will provide guidance on whether the proposed works are allowed or not allowed under the respective legislation. Similarly, works on private lands must also consider local government’s requirements (e.g., permitting or notifications).

FrontCounterBC - *FrontCounterBC* should be contacted for any works planned on Crown Land, including work along the lake shoreline.
Phone: 1-877-855-3222
Email: FrontCounterBC@gov.bc.ca

Regional District – Regional District of East Kootenay should be contacted for any works planned on private land within the region's jurisdiction.
Phone: 250-489-2791 (Cranbrook) or 250-342-0063 (Invermere)
Email: info@rdek.bc.ca

First Nations - The following should be contacted for any works that require First Nation engagement.
Shuswap Indian Band
Phone: 1-250-341-3678
Email: reception@shuswapband.ca

Ktunaxa Nation Council
Phone: 1-250-489-2464
Email: news@ktunaxa.org

2.1 First Nations Traditional Ecological Knowledge (TEK)

First Nations Traditional Ecological Knowledge (TEK) was not obtained for Whitetail Lake during the FIMP process and has not been included in these FDG at this time. These FDG may be updated to incorporate TEK if it is available at a future time.

3.0 FDG Process Overview

The FDG provides a step-wise process to help direct applicants through the initial planning stages for their proposed shoreline development, project or activity (Figure 1).

Step 1: identify the fish and wildlife habitat values where the project is situated using the FDG map. The FDG map was prepared using the FHSI outputs, and depicts: a) values by segment, with different colours representing Very High to Very Low values; and b) where Zones of Sensitivity (ZOS) may be present. ZOS are areas with exceptionally high value, which should if at all possible, be conserved according to local, provincial or federal plans or through private land agreements.

Step 2: review the general recommendations for the applicable colour zone and ZOS to understand associated habitat sensitivity of the area, and risk anthropogenic disturbances pose.

Step 3: use the Activity Risk Matrix (ARM) to identify the level of risk of the proposed project on the habitat. The risk is indicative of the acceptability of a project to regulators.

For areas of greater risk, a very high level of detail is needed in order to submit an application that can be considered for regulatory review. In these cases, it should not be expected that because information is submitted that approvals are forthcoming.

Step 4: determine the necessary regulatory approvals/permits/authorizations (collectively 'approvals') that must be obtained. This final step is project dependent and depends on many

factors and is subject to change based on government policy. Hence, only an overview is provided here, along with logistical considerations.

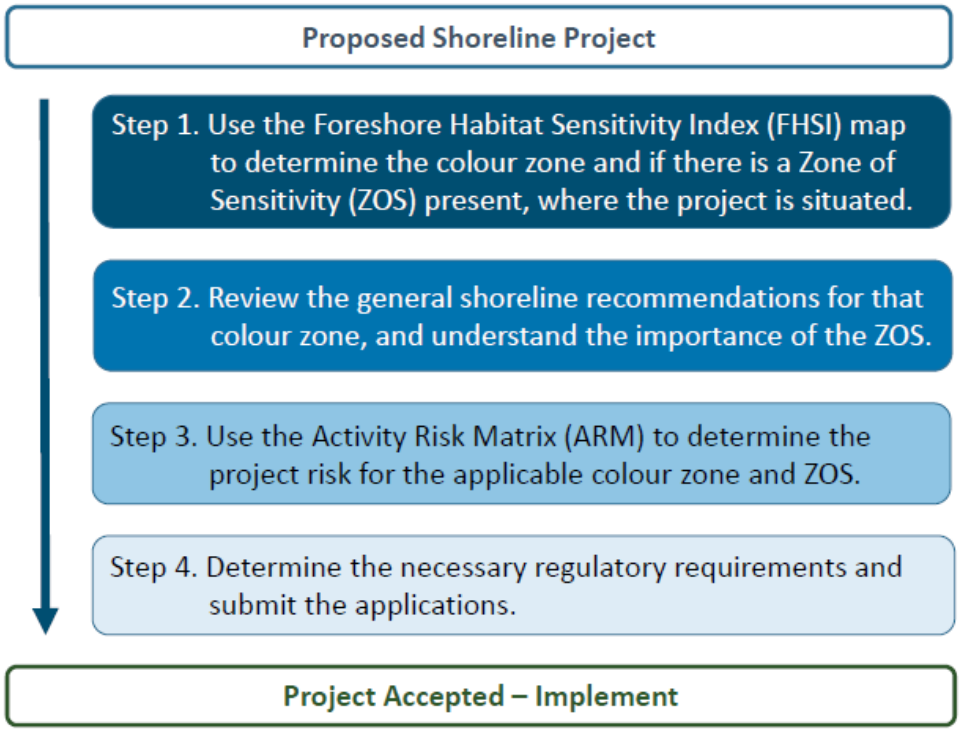


Figure 1. Four steps when planning to develop or modify foreshore habitat.

3.1 Interpret the FDG Map

The key results of the FIM and FHSI were presented in tables and maps in Wood (2021). When planning foreshore development, the FDG map is the primary reference tool because it synthesises the pertinent fish and wildlife information into an easy-to-understand map (Appendix A). In the FDG map, the FHSI ecological rankings for each segment are depicted as one of five colour zones, ranging from very high to very low value (Table 1).

Table 1. FHSI ecological rank and ZOS color scheme applied to the FDG map.

Value type	Rank/Sensitivity	Map Colour
Ecological Rank	Very High	Red
	High	Orange
	Moderate	Yellow
	Low & Very Low	Grey
Zones of Sensitivity	Fisheries	Blue
	Wildlife	Brown
	Herptiles	Mauve

Waterfowl	Teal
Ecosystem	Green
Rare occurrences	Purple
Vegetation	Olive

The FDG map also depicts each ZOS in a specific colour scheme. Each ZOS is presented as either a polygon, line, or point, with an outer buffer. This buffer accounts for unknowns of the ZOS full extent,and protects the core ZOS from potential impacts from adjacent activities (Figure 2). Details on each ZOS, including how each was defined, and how the buffers were determined are presented in Section 5.2.

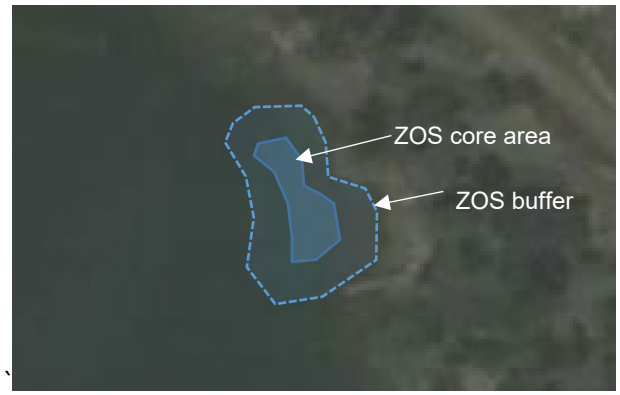


Figure 2. Zone of Sensitivity with an appropriate buffer.

4.0 Step 1. Locate Project Relative to Shoreline Color Zones and Zones of Sensitivity

Use the FDG map to identify the values present along or within their proposed development area. Together, the FHSI colour zone and the ZOS mapped features provide a science-based tool to guide development planning. The fish and wildlife value/risk and subsequent regulatory review process are highest in red zones and areas with ZOS. Since these areas have the highest natural value and are at greatest risk to shoreline alteration, they require the highest level of on-going protection. The values/risk in the grey zones are lowest. Since there is already likely significant impact from development in grey zones, future development is less likely to cause negative impacts. The specific recommendations for each color zone and ZOS are provided in the next section.

5.0 Step 2 – Review Colour Zone, ZOS and Conservation Recommendations

For this step, review the recommendations for the respective colour zone and ZOS that aligns with the proposed development. The summary tables below provide detail on the values present, and identify how to potentially minimize impacts. Also, refer to the conservation recommendations to see how your project may align with an area that has been identified as a candidate for protection. Proposed development should adhere to these recommendations to reduce impacts on sensitive fish and wildlife values. Opportunities for restoration or re-development should be explored in any zone where work is proposed.

5.1 Shoreline Colour Zone Recommendations

Red Shoreline	
Defined by:	Very High FHSI ecological rank.
FHSI summary:	Red zones account for 17% of the total shoreline length of Whitetail Lake.
Sensitivity Summary:	Red shoreline areas have been identified as essential for the long-term maintenance of fish and/or wildlife values through the FHSI Analysis. These areas are essential for fish and/or wildlife populations. Shoreline areas with Very High FHSI ecological rank consisted of a large wetland and tributary confluence complex that were in natural condition with no shoreline modification or disturbance observed. Important juvenile rearing and staging habitat for fish were identified and numerous wildlife trails were observed throughout nearshore riparian habitat.
Recommen-dations:	Due to their high value (sensitive communities present), Red shoreline areas are recommended to have limited development to promote conservation use (Section 5.3). Low impact water access recreation and traditional First Nation uses are examples of acceptable activities in these areas, while permanent structures or alteration of habitats are not. Invasive aquatic plant removal is often acceptable, provided there is an approved aquatic plant removal program, including trained personnel, and appropriate permitting in place. Habitat restoration may be appropriate in these areas, where applicable.

Orange Shoreline	
Defined by:	High FHSI ecological rank.
FHSI summary:	Orange zones account for 18% of the total shoreline length of Whitetail Lake.
Sensitivity Summary:	Orange shoreline segments have been identified as high value habitat areas for fish and/or wildlife. These areas are comprised of relatively natural undisturbed habitats and contained wetlands, aquatic vegetation, large woody debris, and documented or highly suspected spawning tributaries. These areas are sensitive to development, continue to provide important habitat functions, but may be at risk from adjacent development pressures.
Recommen-dations:	Proponents should consider moving high risk activities to other areas if possible, or pursuing activities that have lower associated risks. The lake environment can benefit from having orange shoreline areas set aside to contribute to the overall lake conservation area. The conservation options identified in Section 5.3 would likely apply through most of the orange areas, benefitting the lake. Restoration opportunities potentially exist in these areas.

Yellow Shoreline	
Defined by:	Moderate FHSI ecological rank.
Lake summary:	Yellow zones account for 65% of the total shoreline length of Whitetail Lake.
Sensitivity summary:	These areas have experienced a moderate amount of development disturbance and pressures. Shorelines have been modified by installation of docks and development of rustic boat launches. Important aquatic habitat features including aquatic vegetation and large woody debris are present. The nearshore riparian area remains mainly intact though upland riparian habitat has been cleared in some areas. Although Yellow shoreline areas have been impacted to some degree, they still are largely intact.
Recommen-dations:	Development along Yellow shoreline areas would likely result in less of an impact, than along Red or Orange areas. However, activities should incorporate protection of habitat features that remain, be well above the high water mark, and and/or be situated outside of the riparian area. Restoration may be an option in some areas that have experienced past developments. Development may proceed for low risk activities provided a Best Management Practice (BMP) or Regional Operating Statement (ROS) is available and followed (Appendix B). High risk activities without a BMP or ROS will require an environmental assessment from a QEP.

Grey Shoreline	
Defined by:	Low and Very Low FHSI Ecological Rank.
Lake summary:	Grey zones account for 0% of the total shoreline length of Whitetail Lake.
Sensitivity summary:	Grey shorelines have a lower ecological ranking. However, they still may contain valuable habitats requiring some protection, such as aquatic or riparian vegetation. Their importance as corridors to neighboring high value areas should also be considered during development.
Recommen-dations:	Human development has been concentrated in these areas and has resulted in disturbances to the natural fish and wildlife habitat. Important habitats do exist in degraded and developed areas, and at least minimal standards are required to protect fish and wildlife habitat in the grey zone areas. In keeping with the objective of concentrating development in areas that are already disturbed or of low value, new developments may be considered in these areas. Re-development will also be considered. Proposals should incorporate fish and wildlife habitat restoration or improvement features, where feasible and practicable. For example, a retaining wall redevelopment may be moved back from the HWM and/or incorporate re-vegetation or other fish and wildlife features in the design. Obtain advice from a QEP for habitat restoration techniques.

5.2 Zones of Sensitivity Recommendations

A total of two types of ZOS were identified through the FHSI analysis. The ZOS with their corresponding buffers are identified on the FDG map. For this step, use the map and identify if the proposed development aligns with any of the mapped ZOS (use outer edge of buffer). Then refer to the corresponding ZOS summary table(s) below for general information on the values present and recommendations to reduce impacts.

Fisheries – Tributary Mouth	
Lake summary:	Tributary mouths are located at the confluence of Whitetail Lake and a creek where fish spawning has been documented or is very likely to occur. Spawning has been documented in one tributary to Whitetail Lake, in Segment 1, and is likely to occur in Whitetail Creek which is the lake outlet located in Segment 3. Tributary mouth areas were mapped as polygons that capture the confluence of the two waterbodies. A 10 m buffer was applied to the ZOS around its perimeter. Note that other tributary mouths, though not identified as ZOS at this time, may still provide important fish habitat and tributary mouths identified as ZOS can be updated if additional information becomes available.
Sensitivity summary:	Tributary mouths provide important habitat for fish rearing, migration and staging. Tributaries to Whitetail Lake may provide

Fisheries – Tributary Mouth	
	spawning, egg incubation and juvenile rearing habitat for salmonids. Tributary mouths can also provide a cool water refuge during summer when there are periods of higher water temperatures.
Recommen-dations:	These sensitive habitats are to be protected, with no permanent developments recommended both within and adjacent to the mapped polygon areas. A buffer of 30 m is recommended.

Ecosystem - Wetland	
Lake Summary:	Wetlands were mapped as polygons by reviewing orthophoto and satellite imagery and digitizing the area (Segments 3 and 5) and by field observation and orthophoto review (Segment 1). The wetland in Segment 1 was the smallest of the three wetland areas and was located in an embayment area directly adjacent to the shoreline. Wetlands in Segments 3 and 5 were located at the north and south ends of the lake, respectively, and extended 400-500 m inland from the lake. A 10 m buffer was applied to the ZOS, around its full perimeter. This buffer was recommended to protect wetlands from neighboring development risks, and to capture peripheral areas that may have been missed in wetland assessments or delineation.
Sensitivity summary:	Wetlands are an important component of a healthy ecosystem providing habitat, flood control, water filtration and food resources. Wetlands provide important rearing habitat for juvenile fish and foraging, migration and breeding habitat for wildlife in Whitetail Lake.
Recommen-dations:	These sensitive habitats are to be protected, with no permanent developments recommended both within and adjacent to the mapped polygon areas. A buffer of 30 m is recommended.

5.3 Shoreline Conservation Recommendations

It is recommended that the two wetlands at the south end of Whitetail Lake (Segment 5) be considered as conservation zones (Appendix A). The wetlands provide important habitat for fish and wildlife species and are also an important component of the entire Whitetail Lake ecosystem. It is recommended that these wetlands be considered as conservation zones and be protected from habitat alteration and permanent development.

Potential options to protect the wetlands, which are located on private property, as conservation zones may include:

a) through private land conservation agreements, such as tenure covenants or direct land sales to land conservancy organizations such as the Land Conservancy of Canada; or,
b) regional or municipal official community plans (OCPs) which designate these areas as development permit areas of limited development potential, if an OCP is developed for Whitetail Lake.

Sensitive habitats were also identified in shorelines with High and Very High FHSI Ecological Rankings and though these areas have not been identified as potential conservation zones at this time, guidance provided in this document should be followed to limit potential negative impacts in these areas. Shoreline conservation recommendations should be reviewed if additional information, including TEK, becomes available in the future.

6.0 Step 3. Refer to the Activity Risk Matrix (ARM) to Determine Project Risk.

This step involves using the Activity Risk Matrix (ARM) to determine what the predicted level of risk is for your specific proposed activity, given the shoreline colour zone and ZOS present. It is a well understood concept that the potential for negative environmental impacts is greatest in areas where values and risk are highest (Figure 3; DFO 2006). In the ARM, each colour zone and activity combination has been rated as having a risk of either: Very High (VH), High (H), Moderate (M), or Low (L) (Table 2). These risk ratings reflect the potential impacts on fish and wildlife, with a Very High risk posing the greatest potential concern, and the Low Risk a lower level of concern. The ARM also identifies that if a ZOS is present, the risk also increases.

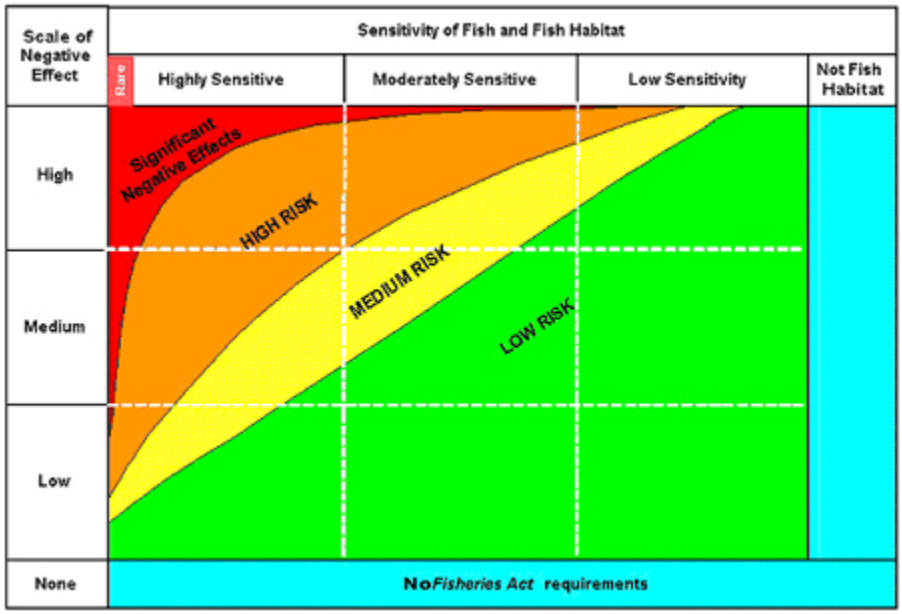


Figure 3. How the potential for negative effects relates to sensitivity and risk (DFO 2006).

6.1 Using the ARM

Clarifications for using the ARM are listed below:

1. If your activity is not listed, assume High Risk and contact FrontCounterBC for advice.
2. Where several activities with differing risk rating are proposed for a single Project, the cumulative risk may increase. Consequently, it is recommended to seek the advice of a QEP to determine if the higher of the two risk ratings effectively captures the cumulative risk, or if the highest risk rating should be used [e.g., Very High]).

3. The ARM distinguishes between several activities above and below the present natural boundary (NB). The NB is the legal term BC Crown Land Branch uses to define the Crown Land property boundary along the shoreline. High Water Mark (HWM) is a similar standard term used by DFO when considering impacts to fish values. The NB and HWM are often located in the same location, but this can vary. Only a registered BC Legal Land Surveyor may determine the NB.
4. In some instances, the project may not seem to have a high degree of risk. However, the ARM also accounts for other accompanying impacts likely to occur once the modification is in place. For instance, once a dock is in place, other likely associated impacts are: prop wash, maintenance, and boat traffic.

Table 2. Activity Risk Matrix (Risk ratings: NA = Not Allowed, VH = Very High, H = High, M = Moderate, and L = Low)

Activity[1]	Risk rating based on Ecological Ranking				Risk rating if Zone of Sensitivity Present[2]
	Very High	High	Moderate	Low / Very low	
Aquatic Vegetation Removal					
Removing native aquatic vegetation - by hand, or mechanical cutting for swimming areas and private beach access	VH	VH	VH	VH	NA
Removing non-native/invasive aquatic vegetation - by hand or mechanical cutting for swimming areas and private beach access	VH	VH	H	M	NA
Dredging, Infilling and Beach Creation					
Dredging - new or expansion works, no current tenure	VH	VH	VH	VH	NA
Maintenance dredging - dredged in last 10 years, no increase in footprint below the NB*, dredged material deposited on land, within existing tenure.	VH	VH	VH	VH	NA
Lake infilling - e.g. extension of upland landscaping	VH	VH	VH	VH	NA
Beach creation below the lake NB	VH	VH	VH	VH	NA
Beach creation above the lake NB, assumes on the applicant's land.	Refer to DFO Land Development Guidelines[3]				NA
Foreshore sediment disturbance and removal of lakebed substrate (e.g., beach grooming)	VH	VH	H	M	NA
New groyne construction or increase in existing footprint	VH	VH	VH	VH	NA
Maintenance of existing groyne, no increase in existing footprint, within existing tenure	M	M	L	L	NA
Erosion control (e.g., concrete, rip rap, vegetation, etc.)	VH	VH	H	M	NA

Activity[1]	Risk rating based on Ecological Ranking				Risk rating if Zone of Sensitivity Present[2]
	Very High	High	Moderate	Low / Very low	
Infill breakwaters or boat basins	VH	VH	H	H	NA
Wave control structures (e.g., log booms)	VH	VH	H	M	NA
Construction of new hard surface boat launch or repair/upgrade of existing hard surface boat launch without land tenure	VH	VH	VH	H	NA
Upgrade/repair of existing hard surface boat launch with land tenure and within existing footprint	VH	H	H	M	NA
Upgrade/repair of existing hard surface boat launch with land tenure and increasing size of the existing allowable footprint	VH	VH	H	M	NA
Construction of new boat rail launch or repair/upgrade of existing boat rail launch without land tenure	VH	H	M	L	NA
Upgrade/repair of existing boat rail launch with land tenure and within existing footprint	H	H	M	M	NA
Placement of up to 2 helical screw anchor mooring buoys for non-commercial use.	VH	H	M	L	NA
Placement of up to 2 non-helical screw mooring buoys for non-commercial use.	VH	H	H	M	NA
Placement mooring buoys for commercial use	Moorage # dependent - see Marina Activity rankings				NA
Docks - floating, pile supported or removable	VH	H	M	L	NA
Floating or lake access boat house, covered boat storage, or permanent non-moorage structures	VH	VH	VH	VH	NA
Land boat house - located on land with access directly to the water.	VH	VH	VH	H	NA
Pumphouse	VH	VH	VH	H	NA
Boat lifts	VH	H	L	L	NA
Float homes and house boats - refers to long term storage area.	VH	VH	VH	VH	NA
Float home/ house boats - refers to short term mooring (in bays).	VH	H	M	L	NA

Activity[1]	Risk rating based on Ecological Ranking				Risk rating if Zone of Sensitivity Present[2]
	Very High	High	Moderate	Low / Very low	
Submarine cables, including related land clearing and equipment access.	VH	VH	VH	H	NA
Submarine cables - no land clearing necessary.	L	L	L	L	NA
Overwater piled structure (e.g. building, deck, etc.)	VH	VH	VH	VH	NA
Elevated boardwalk over water	VH	H	H	H	NA
Private dock moorage = < 6	VH	H	M	M	NA
Small Marina = 6 – 20 slips	VH	H	H	H	NA
Marina Large = >20 slips	VH	VH	VH	VH	NA
Water Withdrawal, Use or Discharge					
Waterline - directional drilling	H	H	M	M	NA
Waterline - open excavation	VH	VH	H	M	NA
Geothermal heating/cooling - commercial, industrial, strata or multi-family	VH	VH	VH	H	NA
Geothermal heating/cooling - single family residence	H	H	M	M	NA
Treated effluent discharge pipe	VH	VH	VH	VH	NA
Commercial water withdrawals	VH	VH	H	M	NA
Application to purchase crown land (crown grant)	VH	H	M	L	NA
Native Vegetation modification / removal	VH	VH	VH	H	NA
Non-native vegetation modification / removal	VH	H	M	L	NA
Drilling and blasting	VH	VH	VH	H	NA
Boathouses / covered boat storage / permanent non-moorage structures	**Refer to Applicable Local Government**				NA
Building and development permit application	**Refer to Applicable Local Government**				NA
Landscaping with Native Vegetation	**Refer to Applicable Local Government**				NA
Landscaping with Non-native Vegetation	**Refer to Applicable Local Government**				NA
Septic application	**Refer to Interior Health Authority**				NA

Legend:

Activity[1]	Risk rating based on Ecological Ranking				Risk rating if Zone of Sensitivity Present[2]
	Very High	High	Moderate	Low / Very low	

[1]NB refers to present natural boundary. NB is the legal term BC Crown Land Branch uses to define the property boundary. Often NB and High Water Hark (HWM) are similar. Only a registered BC Legal Land Surveyor may determine NB.

[2]For all activities, if species or Critical Habitat listed under the Species at Risk Act are present, refer to DFO Projects Near Water Website for next steps (https://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html).

[3]Refer to DFO Land Development Guidelines (http://stewardshipcentrebc.ca/PDF_docs/StewardshipSeries/LandDevelopmentGuidelines.pdf)

6.2 General Mitigation Hierarchy

The general principles of shoreline development are to design in such a way that there is "No Net Loss" in the quantity or quality of existing habitat. These principles are supported by the federal and provincial policy[1,2]). In general, these principles are achieved through application of the following mitigation options: (1) avoidance of environmental impacts and associated components; (2) minimization of unavoidable impacts on environmental values and associated components; (3) restore on site environmental values and associated components, and, (4) offset impacts to environmental values of components for residual impacts that cannot be minimized.

6.3 Very High and High Risk Activities

Most instream works in Red and Orange shoreline zone areas are considered Very High and High Risk activities. All activities in a ZOS are considered Very High Risk. Development in these areas has the potential to cause long-term or irreparable disturbance to the highly sensitive/unique values present. The Very High Risk activities in particular, are known to have significant challenges related to providing adequate mitigation to address the loss of fish and/or wildlife habitat values. For example, the dredging activity is considered Very High Risk in all colour zones, since it results in a major disturbance to the substrate, aquatic vegetation that may be present, and has the potential for direct impacts on aquatic life, and processes (wave climate and sediment transport). There may also be indirect impacts, such as on water quality, if for example the dredge is to support a marina.

If your activity is identified as being Very High or High Risk, determine if you can modify the activity or location to reduce the risk. This may involve moving the project to a colour zone with less sensitive habitat, or selecting a lower risk activity (Figure 4). If reducing the risk is not possible by re-designing or re-locating the project, there is a high likelihood that a detailed environmental assessment would be required to support the project application. In these areas, the high risks may trigger a request for a Harmful Alteration, Disruption or Destruction of Fish Habitat (HADD) authorization under the federal *Fisheries Act*. If residual effects cannot be mitigated, compensation may be required. Acceptable mitigation and compensation

[1] DFO Projects Near Water website: https://dfo-mpo.gc.ca/pnw-ppe/index-eng.html

[2] BC Environmental Mitigation Policy website: https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/laws-policies-standards-guidance/environmental-guidance-and-policy/environmental-mitigation-policy.

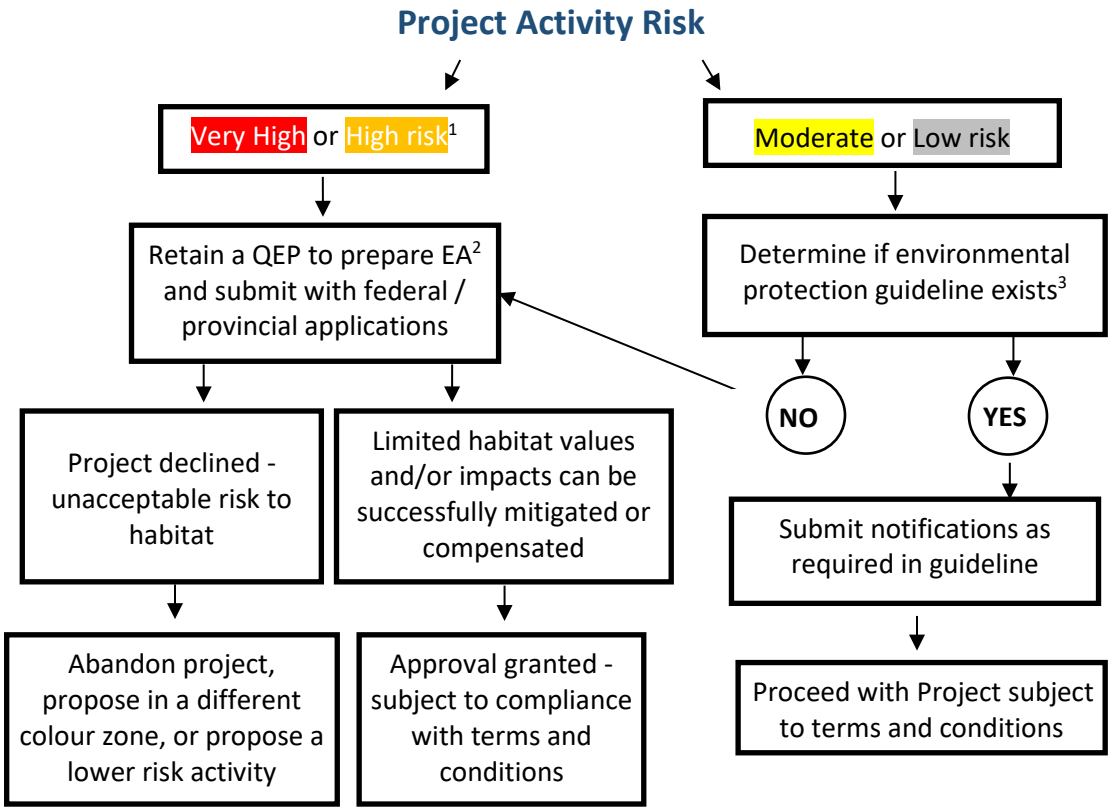
measures would likely be very costly to implement. It is highly advised that a QEP be retained to assist with the project planning in all High and Very High Risk areas. A QEP should be knowledgeable about both the permitting and application process for proposed activities and will be able to provide guidance on potential environmental risks and impacts. A QEP would likely conduct an environmental assessment within the project area, confirm risks, and make recommendations to reduce impacts to aid in the regulatory permitting process. Applications for these types of developments may not be supported by regulators and may not be approved, even if extensive and detailed information is provided as part of a permitting process.

As an example, the type of information that might be required to support an application for a proposed project located in a sensitive area could include, a detailed erosion control plan that might require a BC Legal Land Surveyor to determine the location of NB and property boundaries, a QEP to provide recommendations to mitigate construction works as part of an environmental assessment, or an engineer may be needed to provide a detailed design for submission of permits under regulatory processes.

6.4 Moderate and Low Risk Activities

With appropriate design and planning, Moderate and Low Risk activities could be incorporated along the foreshore with fewer impacts on fish and wildlife habitat values. Where available, these activities should follow applicable Best Management Practices (BMP), Standards and Codes of Practice (collectively BMP; see next section). Where BMPs are not available, or a deviation from the BMP is proposed, a QEP should be retained to complete the application. The application will be reviewed by the applicable agencies.

Figure 4. Typical Environmental Regulatory Review Decision-Making Process



[1] Very High or High Risk activities have the potential to raise significant concerns. These activities have great challenges related to providing adequate mitigation or compensation to address the loss of fish and/or wildlife habitat values, and could be costly to implement (may require compensation).

[2] Environmental Assessment

[3]BMP – Best Management Practice; ROS –Regional Operating Statement

7.0 Step 4 – Determine Regulatory Requirements and Submit Applications

The final step when planning a foreshore development project is to determine the regulatory requirements necessary for the project to proceed and to submit those applications. Regulatory applications are to be made to the federal, provincial, or local governments for necessary permits, authorizations, notifications, and reviews etc. Essentially any shoreline development will require the preparation of at least one regulatory application. The regulatory application's acceptance will be required for the project to proceed legitimately. Commencing work without approval may be considered unlawful and result in infractions such as trespass. Work that has not been approved may also be subject to enforcement actions by the respective agencies, and may require additional effort to mitigate any undesired environmental impacts that occurred. Alternatively, the project proponent could be required to remove all infrastructure and restore the area.

Typical regulatory requirements for each activity listed in the ARM are provided in Appendix B. As well, Provincial BMPs have been listed in Appendix C[3]. Although summarized here, the requirements at the time of planning the project will need to be confirmed, as regulatory changes might occur. Also, the DFO website should be reviewed for applicable Standards and Codes of Practice that may help guide planning and development[4]. Contact FrontCounterBC to determine which provincial permits, approvals or authorizations you need, or retain a QEP for guidance.

This document does not provide a full summary of all potential requirements for a particular project. Proponents must ensure that they have adequately considered, consulted, and determined the necessary approvals required for a project to proceed prior to undertaking any works.

7.1 Other Considerations to Facilitate Project Approvals

This FDG addresses both existing and proposed works. Sometimes there are concerns with the installation of past structures, which may include, if the structures:

- Resulted in extensive impacts along the shoreline;
- Were installed without appropriate permits or approvals in place; and/or,
- Were not compliant with standard BMPs.

If any of the above concerns are present on the property where work is planned, then follow these steps, so that new applications, or applications for maintenance or expansion on existing projects, can be reviewed more effectively:

1. Determine if the existing works are on private land or Crown Land.
2. Determine if they are located in an Application Only Area/Reserve area established under the *Land Act*.
3. Determine if the works were authorized by the appropriate authority. If yes, skip to step 5.
4. Seek approval from the appropriate authority. Approval may or may not be granted depending on the situation. Previous projects installed without appropriate permits or approvals may be required to be removed as part of an application process.
5. Plan and update existing works to current Best Management Practices.
6. Include other mitigation practices, such as landscape restoration (planting native riparian vegetation), substrate improvement (removing or mitigating existing groynes), and other habitat improvements.

[3] A current list of provincial BMP's are available at: https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/laws-policies-standards-guidance/best-management-practices

[4] DFO Project Near Water website: https://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html

8.0 References

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Appendix A. Foreshore Guidance Document Map

568750 569000 569250 569500 569750

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N

Whitetail Creek

Segment Number 3

Segment Number 2

Segment Number 4

Segment Number 1

Segment Number 6

Whitetail Lake Rd

Whitetail Lake Rd

bing

Legend

Zones of Sensitivity
- Ecosystem - Wetland
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

I Shoreline Segment Break

FHSI Rank
- Very High
- High
- Moderate

- Road
- Watercourse
- Parcel Boundary

0 50 100
Meters
Scale: 1:5,000

References:
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TITLE: Whitetail Lake Foreshore Development Guidelines	DATE: February 11, 2021 · ANALYST: PK · QA/QC: LP · Page 1 of 3
	GIS FILE: 02-01-011_whitetail_lake_fdg_maps.mxd
	JOB No: VE52823
	COORDINATE SYSTEM: NAD 1983 UTM Zone 11N

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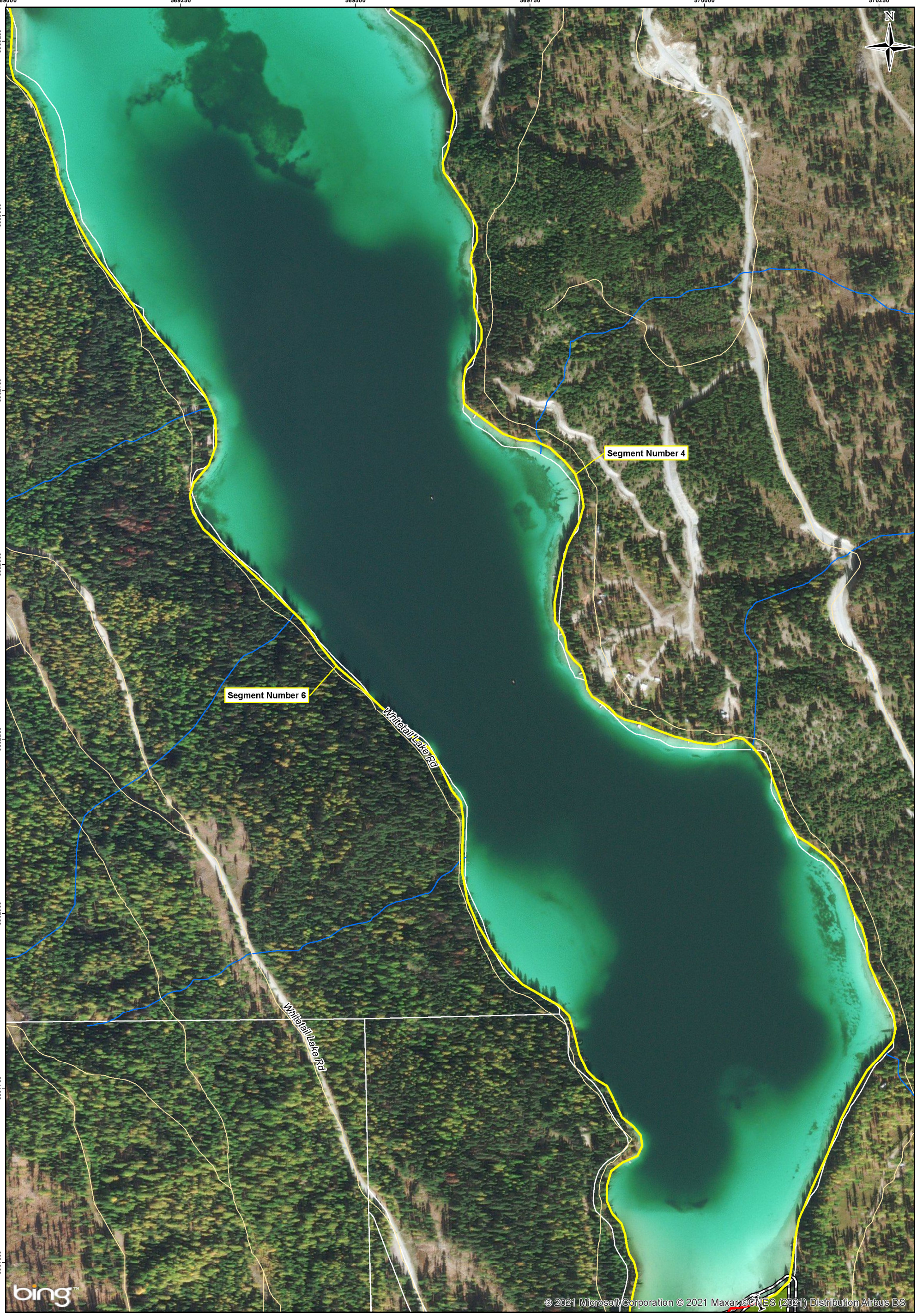

Legend

Zones of Sensitivity
- Ecosystem - Wetland
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

I Shoreline Segment Break

FHSI Rank
- Very High
- High
- Moderate

- Road
- Watercourse
- Parcel Boundary

0 50 100
Meters
Scale: 1:5,000

References:
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5562000 5561750 5561500 5561250 5561000 5560750 5560500

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Segment Number 4

Segment Number 6

Segment Number 5

Whitetail Lake Rd

Whitetail Lake Rd

bing

Legend

Zones of Sensitivity
- Ecosystem - Wetland
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

I Shoreline Segment Break

FHSI Rank
- Very High
- High
- Moderate

- Road
- Watercourse
- Parcel Boundary

0 50 100
Meters
Scale: 1:5,000

References:
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Appendix B. Legal Requirements and Policy

The following provides a brief summary of environment related legislation that may be applicable to a proponent's project. While this list is fairly inclusive, other pieces of legislation may be applicable, and proponents are to ensure that they have identified all legislation that may apply to their project. The Federal Project Near Water website may be updated to reflect the integration of permitting under the *Species at Risk Act* and *Fisheries Act.* It is the proponents' responsibility to refer to the Projects Near Water website for any updates.

Federal Acts:

- *The Department of Environment Act*
- *Fisheries Act*
- *Species at Risk Act (SARA)*
- *Migratory Birds Convention Act*
- *Canada Wildlife Act*
- *Navigable Waters Protection Act*
- *Pesticides Act*
- *Canadian Environmental Assessment Act (CEAA)*
- *Indian Act*

Federal Regulations:

- *Canada Environmental Protection Act* Regulations
- *Migratory Birds Regulations*
- *Fisheries Act Regulations*
- *Wildlife Area Regulations*

Provincial Acts:

- *Water Sustainability Act*
- *Fish Protection Act*
- *Wildlife Act*
- *Land Act*
- *Weed Control Act*
- *Environmental Management Act* (Contaminated Sites Regulations)
- *Local Government Act*
- *Heritage Conservation Act*

Local Government:

- Development Permit Areas (DPAs)
- Subdivision Servicing Bylaw
- Official Community Plans
- Floodplain Management Bylaw
- Building Bylaw
- Zoning Bylaws

The Legal Requirements table, provided below (Table B1) identifies the main fish and wildlife habitat regulatory requirements for typical foreshore activities. These requirements involve three regulatory processes:

1. Obtaining a BC Crown Land tenure - to request permission for use of provincial Crown land.
2. Obtaining a BC Water Sustainability Act Section 11 notification or approval for making changes in and about a stream.

3. Obtaining necessary DFO acceptance through a Project Review. DFO staff will review the project plans to identify the potential risks of the project to the conservation and protection of fish and fish habitat. During the review, it will be determined if the project will: a) impact an aquatic species at risk, result in the death of fish and the harmful alternation, disruption or destruction of fish habitat, or need authorization under the *Fisheries Act*.

Although potential regulatory requirements (e.g., permits) are listed, the requirements at the time of planning the project should be confirmed, as regulatory changes do occur. FrontCounterBC should be contacted to confirm these requirements.

The Legal Requirements table only provides direction related to protecting fish and wildlife habitat values, and as such, does not consider other development factors (such as erosion hazards, drinking water quality, or navigation considerations). Proposed works may be subject to requirements such as: local government zoning or permitting, BC *Water Sustainability Act* approvals or notifications (in addition to those noted above) and Water License applications, Heritage Conservation Act permits, Land Act permits, licenses or permissions for occupation of Crown Lands, or Navigable Waters Protection Act approvals. It remains the responsibility of the project proponent to verify this information and meet all regulatory requirements that may apply to their project.

Table B1. Summary of typical legal environmental requirements for select development activities.

Activity[1]	Crown Land Tenure	BC Water Sustainability Act-Section 11[2]	Canada Fisheries Act Review[4]	Other
Aquatic Vegetation Removal				
Removing native aquatic vegetation - by hand, or mechanical cutting for swimming areas and private beach access	N	Y	See DFO website	-
Removing non-native/invasive aquatic vegetation - by hand or mechanical cutting for swimming areas and private beach access	N	Y	See DFO website	-
Dredging, Infilling and Beach Creation				
Dredging - new or expansion works, no current tenure	Y	Y	Y	-
Maintenance dredging - dredged in last 10 years, no increase in footprint below the NB, dredged material deposited on land, within existing tenure.	N	Y	See DFO website, likely N	-
Lake infilling - e.g., extension of upland landscaping	Y	Y	Y	-
Beach creation below the lake NB	Y[3]	Y	Y	-
Beach creation above the lake NB, assumes on the applicant's land	N	Y	See DFO website, likely N	See DFO Land Development Guidelines[5]
Foreshore sediment disturbance and removal of lakebed substrate (e.g., beach grooming)	N	Y	See DFO website, likely Y	-
Foreshore Erosion, Sediment or Wave Control Structures				-
New groyne construction or increase in existing footprint	Y	Y	Y	-
Maintenance of existing groyne, no increase in existing footprint, within existing tenure	N	Y	N	-
Erosion control (e.g., concrete, rip rap, vegetation, etc.)	N	Y	See DFO website	-
Infill breakwaters or boat basins	Y	Y	See DFO website	-
Wave control structures (e.g., log booms)	Y	Y	See DFO website	-
Boat Launches				-
Construction of new hard surface boat launch or repair/upgrade of existing hard surface boat launch without land tenure	Y	Y	See DFO website	-
Upgrade/repair of existing hard surface boat launch, within land tenure, and within existing footprint	N	Y	N	-

Activity[1]	Crown Land Tenure	BC Water Sustainability Act-Section 11[2]	Canada Fisheries Act Review[4]	Other
Upgrade/repair of existing hard surface boat launch, within land tenure, and increasing size of the existing allowable footprint	Y	Y	Y	-
Construction of new boat rail launch or repair/upgrade of existing boat rail launch without land tenure	Y	Y	See DFO website	-
Upgrade/repair of existing boat rail launch with land tenure and within existing footprint	N	Y	N	-
Buoys				
Placement of up to 2 helical screw anchor mooring buoys for non-commercial use.	Y[3]	Y	N	Federal Navigable Waters Act
Placement of up to 2 non-helical screw mooring buoys for non-commercial use.	Y[3]	Y	N	Federal Navigable Waters Act
Placement mooring buoys for commercial use	Y	Y	N	-
Docks, boathouses, pile supported structures, float home structures, and other - below NB				-
Docks - floating, pile supported or removable	Y[3]	Y	See DFO website	-
Floating or lake access boat house, covered boat storage, or permanent non-moorage structures	Y	Y	Y	-
Land boat house - located on land with access directly to the water.	Y	Y	See DFO website	-
Pumphouse	Y	Y	Y	-
Boat lifts	Y[3]	Y	See DFO website	-
Float homes and house boats - refers to long term storage area.	Y	Y	Y	-
Float home/ house boats - refers to short term mooring (in bays).	Y	Y	See DFO website	-
Submarine cables, including related land clearing and equipment access.	N	Y	See DFO website	-
Submarine cables - no land clearing necessary.	N	Y	N	-
Overwater piled structure (e.g., building, deck, etc.)	Y	Y	See DFO website	-
Elevated boardwalk over water	Y	Y	See DFO website	-
Marinas				
Private dock moorage = < 6	Y[3]	Y	See DFO website, likely Y	-

Activity[1]	Crown Land Tenure	BC Water Sustainability Act-Section 11[2]	Canada Fisheries Act Review[4]	Other
Small Marina = 6 – 20 slips	Y	Y	Y	-
Marina Large = >20 slips	Y	Y	Y	-
Water Withdrawal, Use or Discharge				
Waterline - directional drilling	N	Y	See DFO website	May require a Water License
Waterline - open excavation	N	Y	See DFO website	May require a Water License
Geothermal heating/cooling - commercial, industrial, strata or multi-family	Y[3]	Y	See DFO website	May require a Water License
Geothermal heating/cooling - single family residence	Y[3]	Y	See DFO website	May require Water License
Treated effluent discharge pipe	Y[3]	Y	N	Environment Canada
Commercial water withdrawals	Y[3]	Y	See DFO website	Requires Water License
Transition to Private Land from Crown Land				-
Application to purchase crown land (crown grant)	Y	N	N	-
Land development, on private land - above NB				-
Native Vegetation modification / removal	N	Y[3]	See DFO website	-
Non-native Vegetation modification / removal	N	Y[3]	See DFO website	-
Drilling and blasting	N	N	See DFO website	If < 30 m NB, contact local government
Boathouses / covered boat storage / permanent non-moorage structures	N	Y[3]	See DFO website	?
Building and development permit application	N	Y[3]	Y[3]	Refer to Local Government
Landscaping with Native Vegetation	N	N	See DFO website	Refer to Local Government
Landscaping with Non-native Vegetation	N	N	See DFO website	Refer to Local Government
Septic application	Y[3]	N	N	Refer to Health Authority

Legend:

Activity[1]	Crown Land Tenure	BC Water Sustainability Act-Section 11[2]	Canada Fisheries Act Review[4]	Other

[1]NB refers to present natural boundary. NB is the legal term BC Crown Land Branch uses to define the property boundary. Often NB and High Water Hark (HWM) are similar. Only a registered BC Legal Land Surveyor may determine NB.

[2] BC Water Sustainability Act Approval or Notification

[3] Although indicated as Yes, the requirement is structure/location dependant. Refer to FrontCounterBC.

[4]DFO Projects Near Water Website (https://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html). For all activities, if species or Critical Habitat listed under the Species at Risk Act are present, refer to this website.

[5]Refer to DFO Land Development Guidelines (http://stewardshipcentrebc.ca/PDF_docs/StewardshipSeries/LandDevelopmentGuidelines.pdf)

Appendix C. Best Management Practices

The BC Ministry of Environment (MOE 2019) defines best management practices (BMPs) as "guidelines that help development projects meet necessary legislation, regulations and policies. For example, legislation might dictate that projects cannot harm a stream, while best management practices provide practical methods to avoid harming a stream."

The table below provides a summary of potentially applicable environmental and archaeological BMPs. This list is not exhaustive, other applicable BMPs may be available for a given project, and updates occur regularly. Thus, it is recommended that the website be accessed at the following link for a current updated list: https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/laws-policies-standards-guidance/best-management-practices.

FrontCounterBC or a QEP should be contacted for more information on recent Provincial BMP's that may be specifically applicable to the Project. For Federal documents, the *Projects Near Water* website by Fisheries and Oceans Canada should also be referred to (https://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html).

Table C1. Summary of BMPs and guidelines that may be applicable to development in the Kootenay Region (Source: Kootenay Lake Partnership 2019).

Provincial BMPs	Target - species habitat	Applicability	Web Link
Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia (2014)	Sensitive Species Terrestrial Aquatic Riparian	Works involving any form of land development.	https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/laws-policies-standards-guidance/best-management-practices/develop-with-care
Guidelines for Amphibian and Reptile Conservation during Urban and Rural Land Development in British Columbia (2014)	Amphibians and Reptiles	Ecosystems comprised of aquatic habitats, rocky outcrops and forested areas.	https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/best-management-practices/herptilebmp_complete.pdf
Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia (2013)	Raptors	Terrestrial ecosystems comprised of mature coniferous and mixed woodlands.	http://www.env.gov.bc.ca/wld/documents/bmp/raptor_conservation_guidelines_2013.pdf
Best Management Practices Guidelines for Bats during Urban and Rural Land Development in British Columbia in BC (2016)	Bats	Terrestrial ecosystems, insect rich riparian zones, as well as wetlands, forest edges and open woodland.	http://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=BDP&documentId=12460
Standards and Best Practices for Instream Works (2004)	Aquatic	Works undertaken instream.	http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf
General BMPs and Standard Project Considerations	Aquatic	Any projects undertaken in and around a stream.	http://www.env.gov.bc.ca/wld/instreamworks/generalBMPs.htm
Bank Stabilization Specific BMPs	Terrestrial Aquatic	Bank stabilization works that could impact fish or wildlife habitat.	http://www.env.gov.bc.ca/wld/instreamworks/bankstabilization.htm
Best Management Practices for Hazard Tree and Non-Hazard Tree Limbing, Topping or Removal (2009)	Terrestrial Aquatic	Works involving tree removal.	https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/best-management-practices/hazardtree_26may_09.pdf
Standards and Best Practices for Instream Works	Terrestrial Aquatic	Wharves, piers, docks, boathouses, and small moorings in and about a stream	http://www.env.gov.bc.ca/wld/instreamworks/downloads/Docks.pdf
Best Management Practices for Boat Launch Construction & Maintenance on Lakes (2006)	Terrestrial Aquatic	Boat Launch Construction & Maintenance on Lakes (Okanagan specific)	http://www.env.gov.bc.ca/okanagan/documents/BMPBoat_LaunchDraft.pdf
Best Management Practices for Small Boat Moorage on Lakes (2006)	Terrestrial Aquatic	Small Boat Moorage on Lakes (Okanagan specific)	http://www.env.gov.bc.ca/okanagan/documents/BMPSmallBoatMoorage_WorkingDraft.pdf

Table C1. Summary of BMPs and guidelines that may be applicable to development in the Kootenay Region (Source: Kootenay Lake Partnership 2019).

Provincial BMPs	Target - species habitat	Applicability	Web Link
Best Management Practices for Installation and Maintenance of Water Line Intakes (2006)	Aquatic	Installation and Maintenance of Water Line Intakes (Okanagan specific)	http://www.env.gov.bc.ca/okanagan/documents/BMPIntakes_WorkingDraft.pdf
Beaver Management Guidelines (2001)	Aquatic	Areas that support beaver communities.	http://www.env.gov.bc.ca/van-island/pa/pdf/Beaver-Guide.pdf
Tree replacement criteria (1996)	Terrestrial	Works involving tree removal and replacement.	http://www.env.gov.bc.ca/wld/documents/bmp/treereplcrit.pdf
Kootenay-Boundary Water Sustainability Regulation Terms and Conditions (2018)	Aquatic	Changes in and around a stream of the kind listed in Part 3 of the *Water Sustainability Regulation.*	https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/best-management-practices/iswstdsbpsmarch2004.pdf
Fish Habitat Rehabilitation Procedures (1997)	Aquatic	Works with an erosion and sediment risk near water.	https://www.for.gov.bc.ca/hfd/library/ffip/Slaney_PA1997_A.pdf
Guidelines for Wetland Protection and Conservation in British Columbia: Land Development (2009)	Wetlands	Wetland protection near development sites.	https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/best-management-practices/wetland_ways_ch_10_development.pdf
Land Development Guidelines for the Protection of Aquatic Habitat (1992)	Aquatic	Works undertaken in areas adjacent to riparian features.	http://www.dfo-mpo.gc.ca/Library/165353.pdf
Ktunaxa Nation Council BMPs	**Target Area**	**Applicability**	**Web Link**
Guidelines for Conducting Archaeological Assessment in Ktunaxa Territory	Archaeology	Activities with moderate to high risk to Archaeological values	http://www.ktunaxa.org/four-pillars/lands-resource-agency/archaeology-engagement-guidelines/