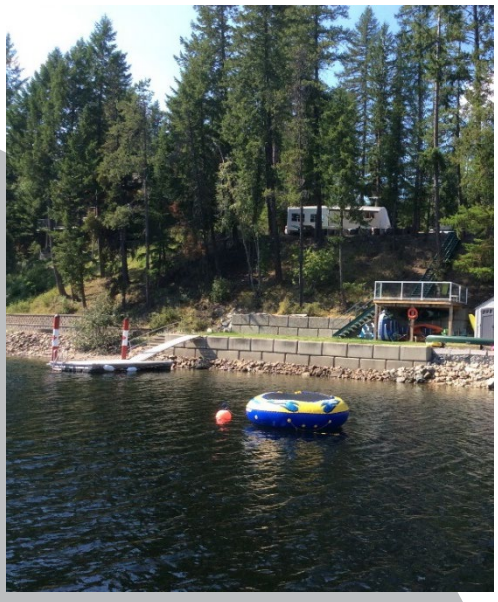
Moyie Lake Foreshore Integrated Management Planning – 2021

Wood Project# VE52823-2020A



Prepared for:

Living Lakes Canada
Nelson, BC

31 March 2021

Moyie Lake Foreshore Integrated Management Planning – 2021

Wood Project# VE52823-2020A

Prepared for:

Living Lakes Canada
Nelson, BC

Prepared by:

Wood Environment & Infrastructure Solutions
Suite 601E, 601 Front St.
Nelson, BC
Canada
T: 250-354-1600

31 March 2021

Copyright and non-disclosure notice

Third-party disclaimer

Wood Environment & Infrastructure Solutions

Registered office: 2020 Winston Park Drive, Suite 700, Oakville, Ontario L6H 6X7
Registered in Canada No. 773289-9; GST: 899879050 RT0008; DUNS: 25-362-6642

Project # VE52823-2020A

Executive Summary

Moyie Lake, located in the Purcell Mountains in BC, is a unique "kettle pond" lake, the result of a depression created at the outflow of a glacier. The lake consists of 37.6 km of shoreline with a north and south basin connected by a ecologically productive narrows region in the middle. Moyie Lake is a recreation destination that has seen an increase in recreational property development in recent years.

In response to concerns over the fast pace of development and potential for important fish and wildlife habitat to be lost, the first Foreshore Integrated Management Planning (FIMP) project was initiated in 2008. The project included Foreshore Inventory and Mapping (FIM) field surveys, the development of an Aquatic Habitat Index (AHI) and a corresponding Shoreline Guidance Document (SGD). The Regional District of East Kootenay has since included the results of the 2008 FIMP in the Moyie & Area Official Community Plan (OCP) that identifies areas with important ecological values and provides guidance on authorizations required for shoreline development as well as the type of activities that are acceptable in a given area. Twelve years had passed since the original FIMP was conducted and there was an interest in updating the previous field surveys and corresponding analyses to evaluate rates of change (e.g., development), observe whether integrated policies have been working (i.e., the adoption of SDG into the OCP), identify additional critical habitat and species at risk and update the Moyie Lake FIM dataset using new standard FIMP methods. The following includes all three phases of FIMP for Moyie Lake: FIM survey; development of the Foreshore Habitat Sensitivity Index (FHSI, formerly called AHI) to rank the relative value of shoreline habitats; and the Foreshore Guidance Document (FDG, formerly called SGD).

In 2020, a FIM survey was completed along 37,638 m of the Moyie Lake shoreline, the majority of which was observed in relatively natural condition (20,889 m; 55%) while the remainder was classified as disturbed (16,749 m; 45%). The lakes' shoreline was classified as having a high level of impact (17,274 m; 46%), followed by low (16,327 m; 43%), medium (3,578 m; 10%) or no (460 m; 1%) impact. Prevalent land use included rural (10,146 m; 27%), single family (9,876 m; 26%) and transportation (9,862 m; 26%) with lesser amounts of classified as natural area (6,887 m; 18%), park (636 m; 2%) and urban park (231 m; <1%). Shore type classifications observed included rocky shore (16,113 m; 43%) followed by stream mouth (10,804 m; 29%), gravel (9,163 m; 24%), wetland (1,118 m; 3%) and cliff/bluff (438 m; 1%).

Aquatic vegetation was observed along 10,163 m (27%) of the Moyie Lake shoreline primarily consisting of emergent vegetation. Foreshore and littoral substrates consisted primarily of cobble and gravel with lesser amounts of boulder, bedrock, sand, cobble fine, fines and mud. Large woody debris (LWD) was observed in foreshore areas of two thirds of the segments and ranged from 2 to 20 pieces per segment while in littoral areas LWD was observed in approximately one third of the segments and ranged from 1 to 15 pieces per segment. The littoral area width of most segments (17,309 m; 46%) was classified as medium (10-50 m), whereas narrow (<10 m) and wide (>50 m) littoral areas were found along 11,595 m (31%) and 8,734 m (23%) of the shoreline, respectively. Nearshore riparian vegetation was both continuous and patchy along the shoreline depending on area and consisted of primarily tall shrubs and mature forest with lesser amounts of low shrubs, sparse vegetation, grass/herbs and young forests. A second vegetation type/band was observed along two thirds of the shoreline and mainly consisted of mature forest.

The most prevalent lineal modification was substrate modification, which occurred along 13,539 m (36%) of the shoreline, followed by erosion protection (13,463 m; 36%), railway (11,110 m; 30%) and roadway (2,203 m; 6%). Other shoreline modifications included docks (n=208), retaining walls (n=140), stairs (n=123), mooring buoys (n=63), pilings (n=62), sheds (n=58), groynes (n=54), boat launches (n=15), boat covers (n=12), pumphouses (n=12), marine rail (n=6), boat houses on land (n=4), boat lifts (n=4), marinas (n=4), swim floats (n=4), fences (n=2) and dock groynes (n=1).

Comparison between the 2008 and 2020 FIM surveys indicated that the total length of disturbed shoreline increased by 471 m (1.2% of the total shoreline) from 16,278 m (43.3%) to 16,749 m (44.5%) and the observed shoreline rate of change was approximately 0.1% per year. Between 2008 and 2020, the number of docks increased by 95% (from 109 to 208), retaining walls increased by 83% (from 84 to 140), boat launches increased by 50% (from 10 to 15), marine rail increased by 100% (from 3 to 6) while the number of marinas and floating boat houses remained the same. Between 2008 and 2020, the amount of the shoreline modified by retaining walls increased by 593 m (1.8%) and substrate modification increased by 219 m (0.7%) while that modified by railways and roadways was unchanged. Comparison of shoreline modifications observed in 2008 (during the FIM survey and on orthophotos), 2016 (on orthophotos) and 2020 (during the FIM survey) suggests the number of docks and/or retaining walls have increased by up to 100% in some areas within the south basin of Moyie Lake over the past 12 years. Increased disturbance and more shoreline modifications, however, did not result in changes to riparian area characteristics (i.e., Vegetation Band 1) nor did this result in redefining Level of Impact for delineated segments which remained unchanged between 2008 and 2020. Natural areas where limited or no disturbance had been documented in 2008 were in similar condition in 2020. Detailed fish and wildlife surveys were conducted during the 2008 FIM and were not resurveyed in 2020. However, 10 bird species were recorded opportunistically during the 2020 FIM surveys.

Most of the shoreline of Moyie Lake was ranked as High (36.9%) ecological value followed by Moderate (36.9%), Very High (21.1%), Low (16.0%) and Very Low (1.4%) ecological value by the FHSI analysis. Most shoreline areas with Very High and High ecological value remained in natural condition (1.9% and 40.7% disturbed, respectively) while most shoreline areas with Moderate, Low and Very Low ecological value were disturbed (58.5%, 82.9% and 99% disturbed, respectively). Compared to the results of the 2008 AHI analysis, the ecological ranks of four segments changed during the 2020 FHSI analysis including two segments that increased in ecological value from Moderate to High and two segments that decreased in ecological value, one from Very High to High and the other from Moderate to Low. The 2020 data was also analyzed using the 2008 AHI and through this evaluation the ecological rank of nine segments decreased resulting in a reduction of the overall amount of shoreline ranked as Very High and High ecological value and an increase in that ranked Moderate, Low and Very Low. However, it is likely most of these changes were due to inventory, evaluation and observer related issues and not due to actual changes to shoreline habitat quality. Four productive littoral/wetland complex areas in Moyie Lake with Very High or High ecological value as well as one or more Zones of Sensitivity (i.e., sensitive habitat areas) are recommended to be considered for designation as conservation zones.

The Moyie 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. Strategies to protect the recommended conservation zones are also provided.

First Nations Traditional Ecological Knowledge (TEK) was not available for Moyie Lake during the FIMP process and therefore was not incorporated into the FHSI or FDG. It is recommended that TEK be incorporated into the Moyie Lake FIMP process if it becomes available in the future. In addition, amendment of the Moyie & Area OCP Bylaw (No. 2912, 2019) to include the 2020 FDG and mapping as well as the development of a stewardship strategy are recommended.

Table of Contents

List of Figures

List of Tables

List of Appendices

List of Acronyms and Abbreviations

AHI	Aquatic Habitat Index (now referred to as FHSI)
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
MFLRORD	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
UAV	Unpiloted Aerial Vehicle
UTM	Universal Transverse Mercator
WSC	Water Survey of Canada
ZOS	Zones of Sensitivity

Acknowledgements

The following people are gratefully acknowledged for assistance and information contributions during this study:

Living Lakes Canada

Ryan Cloutier M.Sc., R.P.Bio., Acting Project Manager

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.

Foreshore Inventory Management Planning Technical Committee

Bruce Mac Donald, B.Sc., B.Ed., FIMP Program Director, Terra Limnic Consulting

Heather Leschied, B.E.S. (Hons), FIMP Program Manager, Living Lakes Canada

Jason Schleppe, M.Sc., R.P.Bio., Senior Biologist, Ecoscape Environmental Consultants Ltd.

Teri Ridley, Senior Integrated Planning Biologist, Fisheries and Oceans Canada

Brad Mason, M.R.M, Director, Community Mapping Network

Louise Porto, M.Sc., R.P.Bio., Wood Canada Ltd.

Peter Holmes, B.Sc., Habitat Biologist (retired), Forests, Lands, Natural Resource Operations and Rural Development

Sherri McPherson, B.Sc., R.P.Bio., Aquatic Biologist, Lotic Environmental. Consulting Ltd

Kristen Murphy, Habitat Biologist, Forests, Lands, Natural Resource Operations and Rural Development

Andrea Evans (and Julia Podealuk, RFT), Authorization Specialist, Forests, Lands, Natural Resource Operations and Rural Development

David De Rosa, B.Sc., P.Ag., Wildlife Biologist, Okanagan Nation Alliance

The following employees of **Wood Environment & Infrastructure Solutions** contributed to the collection of data and preparation of this report:

Crystal Lawrence B.Sc., R.P.Bio.	Aquatic Biologist, Author
Louise Porto M.Sc., R.P.Bio.	Senior Aquatic Habitat Biologist, Senior Review
Peter Holmes, B.Sc.	Wildlife Biologist
Paul Kwon, B.Sc.	GIS

Financial and in-kind contributions were provided by:

Fisheries and Oceans Canada

Regional District of Central Kootenay

Regional District of East Kootenay

Ministry of Forests, Lands, Natural Resource Operations and Rural Development

Living Lakes Canada gratefully acknowledges the financial support of the Fish and Wildlife Compensation Program for its contribution to the Foreshore Inventory Mapping for Aquatic Species at Risk project.
www.fwcp.ca

Recommended Citation

Wood Canada Ltd. 2021. Moyie Lake Foreshore Integrated Management Planning - 2021. Report Prepared for Living Lakes Canada, Nelson, BC. 43 pp. + 6 App.

1.0 Introduction

Moyie Lake is a unique "kettle pond" lake, the result of a depression created at the outflow of a glacier, located in the Purcell Mountains in BC (Figure 1). Moyie Lake consists of 37.6 km of shoreline with a north and south basin connected by a productive narrows region in the middle. The north basin is 583 ha in size, while the south basin is 316 ha in size (Schleppe 2009). The lake is located between Cranbrook and Creston and the community of Moyie is located on the southeast side of the lake. Moyie Lake Provincial Park is at the north end of the north basin and has public camping, a boat launch, recreational trails and a swimming area. The watershed is home to several red and blue listed plants, as well as the red listed American Badger (*Taxidea taxus*) and Mountain Caribou (*Rangifer tarandus*) and the blue listed Williamson's Sapsucker (*Sphyrapicus thyroideus*), Painted Turtle (*Chrysemys picta*), Great Blue Heron (*Ardea herodias*) and Grizzly Bear (*Ursus arctos*; RDEK 2019). Grassland habitat provides forage for ungulate populations, nesting areas for grassland birds and hunting areas for birds of prey (RDEK 2019). Moyie Lake is home to several native fish species including one of the only populations of Burbot (*Lota lota*) in BC that is considered 'healthy' at approximately 10,000 individuals (e.g., Evans et al. 2019). Gametes from Moyie Lake Burbot are collected annually by the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (MFLNRORD) to support hatchery-based restoration efforts of the red-listed lower Kootenay Burbot population (Evans et al. 2019). Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*) are the only fish species listed under the federal Species At Risk Act (SARA) present in Moyie Lake.

Moyie Lake is a recreation destination and has seen an increase in recreational property development in recent years (RDEK 2019). The East Kootenay Integrated Land Management Partnership (EKILMP) was formed in 2006 in response to concerns from the public, resource agencies and non-government organizations over the fast pace of foreshore development in places such as Moyie Lake. EKILMP initiated the initial Foreshore Inventory and Mapping (FIM) within Moyie Lake in 2008 that included field mapping surveys (FIM), the development of an Aquatic Habitat Index (AHI) and a corresponding Shoreline Guidance Document (SGD) (Schleppe 2009). Results of the FIM program in Moyie Lake were adopted in the "RDEK Moyie & Area Official Community Plan (OCP)" (RDEK 2019). Key findings not only highlighted areas of high development impact (e.g., south basin private campground at Moyie River mouth) but also where areas included sensitive species/habitats associated with the undisturbed foreshore areas (e.g., Lamb Creek floodplain) (Schleppe 2009, RDEK 2019).

Twelve years had passed since the original FIM was conducted and there was an interest in updating the previous field surveys and corresponding analyses. For example, between 2008 and 2011 there were 14 new lots created and 61 new dwelling units constructed within the area (27 of which were in the Westview Road area) (RDEK 2019). It is important to determine whether any changes have occurred since the original FIM program to evaluate rates of change (e.g., development), observe whether integrated policies have been working (i.e., the adoption of SDG into the OCP), identify additional critical habitat and species at risk and update the Moyie Lake FIM dataset using new standard inventory methods.

Living Lakes Canada contracted Wood Environment & Infrastructure Solutions (Wood) to complete a Foreshore Integrated Management Planning (FIMP) program on Moyie Lake. FIMP is the redesigned version of Sensitive Habitat Inventory and Mapping (SHIM) procedures for lake foreshore habitat. Recently, standardized methodologies and guidelines were developed for the three main FIMP components including FIM, the 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 the core technical analysis completed using FIM and non-FIM data to determine the relative habitat value of a shoreline. The FHSI uses data collected during the FIM survey, additional field reviews (e.g., fish and wildlife surveys) and data from other sources to determine the relative habitat value of a shoreline segment (one of five Ecological Ranks are assigned) and identify zones of sensitivity. The FHSI rankings are a relative measure of habitat value or sensitivity that are waterbody-specific.
3. Foreshore Development Guide (FDG) – is a report that used the FHSI results to recommend development guidelines that aim to protect sensitive foreshore habitats. 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 Ecological Rankings for all shoreline areas, an activity risk table and a decision-making flow chart for proposed works along the shoreline. The FDG also contains fish and wildlife habitat conservation areas and/or strategies.

The following report includes all three phases of FIMP, which includes reporting on the FIM survey, the FHSI and the FDG. In this case it is a redoing of the FIM survey (herein referred to as re-FIM) that was conducted in 2008 but using the recently updated 2020 standards (Schleppe et al. 2020). Comparisons were made between 2008 and 2020, where appropriate.

Legend

- Railway
- Highway
- Road
- Watercourse
- Waterbody

0 1 2
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: Moyie Lake FIMP

TITLE: Moyie Lake Overview Map

DATE:	SCALE:	
March 18, 2021	1:70,000	**Figure 1**

GIS FILE: 02-01-007_moyie_lake_overview.mxd

COORDINATE SYSTEM:	JOB No:	ANALYST:	QA/QC:
NAD 1983 UTM Zone 11N	VE52823	PK	CL

wood.

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-007_moyie_lake_overview.mxd Last updated by paul.kwon

2.0 Methods

Methods presented herein provide a summary of the three phases of FIMP pertaining to Moyie Lake, which was previously completed in 2008 (Schleppe 2009). FIMP methods (including re-FIM comparisons) are outlined in Schleppe et al. (2020), unless otherwise specified below.

2.1 Foreshore Inventory 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 acquired.

GIS map file layers including Regional District of East Kootenay (RDEK) legal boundaries/jurisdiction/ cadastral/zoning land uses, provincial data layers (e.g., Freshwater Atlas, TRIM, etc.), and Conservation Data Centre (CDC) BC Species and Ecosystems Explorer plants, animals and ecosystem mapping were obtained from online platforms. FIM segment breaks/points/polygons and any additional points/polygons (shapefiles) from fish and wildlife surveys and aquatic vegetation mapping collected during the 2008 Moyie Lake survey were obtained from Living Lakes Canada. The most recent and complete set of orthophotos for Moyie Lake were purchased from the BC Government Base Map Online Store (2016; Map Sheet #82G.031 and 82G.021; 1:20,000; colour; pixel size of 0.5 m).

Baseline maps were prepared in ArcGIS using orthophoto imagery and overlay of GIS layers from the 2008 FIM analysis (e.g., segment breaks, high water mark, aquatic vegetation polygons and wetlands). The high-water mark (HWM) delineated during the 2008 FIM analysis was reviewed using updated orthophoto imagery (interpretation to within ±5 m). Small changes were made to a few areas and this was incorporated into an updated shoreline layer for Moyie Lake. Moyie Lake does not have an active hydrometric data station maintained by Environment Canada and Climate change, so the HWM (i.e., shoreline layer) cannot be determined using staff gauge measurements (MOE 2009 as cited in Schleppe et al. 2020). Historical hydrometric data is available from 1944-1970 for a station that was located at Moyie (Station No. 08NH111) but this data would not be sufficient to determine the current HWM. In addition, there was no LIDAR available to use for HWM determination (RDEK 2020). Average littoral width was calculated during the pre-assessment by taking an average of, at minimum, three measurements from the shoreline out to the area where there was an obvious colour change on the 2016 orthophoto that identified deeper water.

The 2008 FIM segment breaks were reviewed against the more recent orthophoto imagery. Any changes in land use, riparian vegetation, wetlands and aquatic vegetation between the 2008 (original FIM) and 2016 orthophotos (re-FIM) were identified for field verification as were any locations that may also warrant additional segment breaks. Land use and riparian vegetation changes were identified between the 2008 and 2016 orthophotos for Segment 4. It was determined that the changes observed along the shoreline were greater than 50 m and thus Segment 4 was broken into three sub-segments and re-labelled as 4.1, 4.2 and 4.3 as per Schleppe et al. (2020); these sub-segments were verified during the re-FIM field survey.

A literature review was conducted to obtain any more recent studies for Moyie Lake and included reviewing previous FIM, AHI and SDG documents (Schleppe 2009). 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 other web-based searches were consulted.

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 the pre-field assessment (Section 2.1) were loaded into the ArcGIS Collector application. The Moyie Lake data dictionary with the 2008 FIM dataset 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 that needed to be included in the re-FIM were created for any additional data collection that was outside of the segment break data dictionary (e.g., photographs and aquatic vegetation polygons). 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 Moyie 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 and back ups also included bringing the following into the field daily:

- 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 Foreshore Inventory and Mapping Field Surveys

The re-FIM field survey was conducted over a 3-day period on 18-20 August 2020. Moyie Lake was accessed via the boat launch at Moyie Lake Provincial Park. 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. Data collection was accomplished via tablet using the ArcGIS Collector data dictionary (Section 2.1.2). The survey began at a segment break close to the boat launch and proceed along the shoreline in a sequential segment order which in this case was a counter-clockwise direction. Within each segment, all lake characteristics (i.e., data fields) outlined by Schleppe et al. (2020) were inventoried following standard methods. One exception was that % 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).

The Moyie Lake ArcGIS data dictionary contained the 2008 FIM dataset that was used to verify and update the data collection fields during the re-FIM. Those data fields that remained similar between the 2008 and 2020 surveys were left as documented by the original observers to avoid documenting changes that were solely due to observer differences and potential changes/interpretation of the definitions from the updated methodology. One crew member, Peter Holmes, was present during both the 2008 and 2020 field surveys and provided consistency and background information on how original values were determined, when necessary. Potentially erroneous data in the 2008 FIM dataset was highlighted for further office review. Digital and hard copies of Schleppe et al. (2020) were available in the field and used as reference during inventory of all data entry fields. At least one photograph of each single-family residential lot, each shoreline modification as well as representative photographs of each segment was taken.

2.1.3.1 Fish Survey

Fish surveys were not conducted as part of the Moyie Lake re-FIM survey. Information on fish and other aquatic resources 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., SARA and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)) and provincial (e.g., CDC) listings (Government of Canada 2021, CDC 2021). The information was summarized and presented in Section 3.1.6.

2.1.3.2 Wildlife Survey

Wildlife surveys, outside of observational data collected during the standard FIM procedure, were not conducted as part of the re-FIM survey as detailed wildlife surveys were conducted during the 2008 FIM survey (Schleppe 2009). Information on wildlife and other terrestrial resources in Moyie Lake was compiled during the background literature review. 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). The information was summarized and presented in Section 3.1.7.

2.1.3.3 Unpiloted Aerial Vehicle (UAV) Survey

Videography and still image photography via an Unpiloted Aerial Vehicle (UAV) (drone) survey was also conducted during early morning on 19 and 20 August 2020. The UAV survey was conducted to collect video and still images with a focus on areas with greater development, extensive aquatic vegetation/wetlands and any areas suspected to have changed compared since the 2008 FIM. The UAV survey was conducted up to a maximum height of 122 m (operator's permitted use) to capture these foreshore features as well as any areas that were not visible from the boat (e.g., vegetation bands in steeper areas). The UAV survey could not be conducted over the Moyie Lake Provincial Park area as this required a permit which was not acquired prior to conducting the survey; the permit review may not have been completed in time and it was deemed unnecessary.

2.1.4 Post-Processing and QA/QC

Post-processing included extracting photos, converting data, modifying feature layers, shoreline mapping to match orthophoto representation of high-water mark, and another QA/QC of entire dataset. Shape files for each lake segment by section breaks were created. GIS polygons (e.g., aquatic vegetation) delineated during the pre-field survey were updated with field observations, where necessary. After post-processing, data were imported into map templates for report map production.

QA/QC of the 2008 FIM dataset was initially conducted during field surveys (Section 2.1.3) and completed during post-processing prior to comparing 2008 and 2020 datasets. The following revisions were made to the 2008 FIM dataset based on field and desktop review:

- Substrate percentages in Segments 2 and 20 were revised based on foreshore substrates observed in the field in 2020 so the total of all percentages equalled 100% as opposed to 145% and 105%, respectively. Significant substrate modification since 2008 was not observed and it was assumed overall substrate composition remained similar.
- Retaining walls in Segment 9 were reduced from 21 to 0 and percent retaining walls in Segment 9 reduced from 70% to 0%. A data entry error had occurred in the 2008 dataset and Segment 10 data for retaining walls had been inadvertently copied to Segment 9; photos from 2008 were reviewed to confirm that no retaining walls had been present.
- Marinas in Segment 10 were reduced from 2 to 0 and in Segment 9 increased from 0 to 1. A marina can be seen in Segment 9 in 2008 photos/orthophotos and no marinas were observed in Segment 10 orthophotos. This may have also been a data entry error where data from Segment 9 was inadvertently entered into Segment 10 and included an extra non-existent marina.
- Lineal modification percentages were changed in Segment 16 from 100% roadway to 100% railway, in Segment 23 from 0% railway to 100% railway, in Segment 26 from 100% roadway to 0% roadway. And,
- Level of impact for Segments 25 and 31 was changed from Low (<10%) to None, for Segment 21 was changed from Medium (10-50%) to Low (<10%), and for Segment 9 was changed from High (>50%) to Medium (10-50%). These fields were updated to match the level of disturbance documented during the 2008 surveys and confirmed by reviewing photo documentation. During this review Segment 30, which had 60% disturbance though it was classified as having a Medium (10-50%) level of impact was left unchanged as both classifications were reasonable for the level of disturbance observed in the segment.

The 2008 FIM dataset was not updated to include counts/evaluation of new variables that were included in the 2020 FIM dataset (e.g., sheds and boat racks) that had not been included in 2008 as outlined by Schleppe et al. (2020) as a preliminary review of historic orthophotos suggested obtaining the data this way would be inaccurate. The following exception was made to ensure comparisons between the 2008 and 2020 data sets were accurate (Section 2.1.6):

- During the evaluation of natural versus disturbed shoreline lengths in 2008 and 2020, it was necessary to update the 2008 FIM dataset for Segment 4 which had been delineated into three sub-segments in 2020 (Segments 4.1, 4.2 and 4.3). In the 2008 dataset, the percentage of disturbance in Segments 4.1 and 4.3 was updated to match those observed in 2020 as no additional disturbance was observed in these shoreline areas. However, the percentage of disturbance in Segment 4.2 in 2008 was determined by reviewing orthophotos and photos taken during the 2008 survey (assigned 30% disturbed). If Segment 4 was not updated, the result would have been that the area appeared to have become less disturbed and more natural, however, it would have been due to segment delineation differences and not to actual changes that occurred along the shoreline.

The UAV footage was reviewed during post-processing to help QA/QC field survey data and extract relevant still images for reporting that highlight specific features of interest. In addition, UAV images were used to verify and update the 2008 aquatic vegetation polygons. This entailed reviewing UAV images against the GIS maps and re-digitizing polygons as required. Floating vegetation could only be verified on the UAV images and was thus the only update applied to the 2008 aquatic vegetation polygons.

2.1.5 Data Analyses and Management

The following shoreline characteristics were summarized by evaluating the proportions of each category within a segment and summing each category for Moyie Lake:

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

Note that the segment classification for shore type and land use, not the proportion within each segment, were evaluated against the proportion of the segment that was disturbed versus natural. 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.

2.1.6 Comparison of 2008 FIM and 2020 re-FIM Datasets

The 2008 and 2020 datasets were scrutinized on a segment-by-segment basis to determine which categories were comparable between years. Segment length data measured in 2020 was used for all comparisons to remove bias in the data from GIS mapping differences between years. Shoreline categories that typically remain static through time (e.g., land use, shore type, substrate type, littoral zone width, and some riparian characteristics) were not formally compared between years since no change was expected (Schleppe et al. 2020). Each dataset was reviewed to confirm that no change had been documented.

The following shoreline categories were compared between the 2008 and 2020 Moyie Lake datasets:

- Natural versus disturbed shoreline.
- Level of Impact.
- Shoreline modifications including docks, retaining walls, boat launches, marine rail, and marinas. And,
- Lineal shoreline modifications including retaining walls, railway, roadway, and substrate modification.

While groynes were recorded in both datasets, the 2008 counts were often zero despite photos evidence that suggested they were indeed present. Consequently, a comparison of groynes was omitted because any change detected would have likely been due to observer classification differences (and potentially not real changes in the number of groynes). A cursory review suggested updating the 2008 database for groynes by reviewing available imagery was not a feasible way to obtain an accurate count and this task was also beyond the scope of this report. A rate of change analysis was conducted by comparing the percent natural shoreline for the entire lake in 2008 versus 2020 (Schleppe et al. 2020). Rate of change was also calculated

for individual segments where a percentage of the segment in natural condition changed between 2008 and 2020. Orthophoto and still images available from the original FIM were reviewed against orthophoto, still images, and UAV and to compare survey outputs, where possible.

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 (see Section 2.1.1) to develop a points-based index that assigns positive values to important and sensitive habitat features and negative values to modifications 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 Moyie Lake FHSI, calculation of segment FHSI scoring and determination of FHSI Ecological Ranks. Additional details are also provided below.

2.2.1 Moyie Lake FHSI Criteria

The FHSI developed for Moyie Lake followed the example provided by Schleppe et al. (2020) and used both FIM and non-FIM data. The Moyie Lake FHSI included four categories:

1. Biophysical (FIM).
2. Fisheries (non-FIM).
3. Wildlife (non-FIM). And,
4. Modifications (FIM).

Biophysical and modification criteria used data collected during the FIM survey, fisheries criteria used information compiled during the 2008 fish survey and background literature review, and wildlife criteria used 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 Moyie 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 Moyie Lake FHSI is provided by Schleppe et al. (2020) and for non-FIM criteria (fisheries and wildlife) are provided below:

- Fisheries Category
    a. Burbot Spawning – Burbot (*Lota lota*) spawning areas were provided by the Ministry of Environment during the 2008 Moyie Lake FIM and were based on fish population surveys conducted during 2006 and 2007 (Schleppe 2009). Spawning areas were reviewed with Ministry of Forests, Lands, Natural Resource Operations and Rural Development (MFLNRORD) staff in August 2020 who confirmed the original dataset still includes all confirmed spawning areas though recent studies have not focused on identifying other spawning locations (Sarah Stephenson, Rare & Endangered Fish Biologist, MFLNRORD, pers. comm). Two spawning areas that are targeted during annual gamete collection surveys by MFLNRORD (Evans et al. 2019) were also added to the FIM and FHSI maps as point locations.

b. Staging – Staging areas were identified in the 2008 Moyie Lake FIM dataset (Schleppe 2009). Field staff identified locations where fish were known to stage or hold prior to migration (Schleppe 2009). The only exception to this was the addition of fish staging potential to Segment 17 based on the presence on an inflowing tributary and proximity to the narrows between the two lake basins.

c. Juvenile Rearing Habitat – Juvenile rearing areas were identified in the 2008 Moyie Lake FIM dataset (Schleppe 2009). Juvenile rearing areas were identified as present or absent in the 2008 dataset and updated in 2020 to a habitat value ranking (high, moderate, low or none) relative to other shoreline segments. The quality of juvenile rearing habitat in each shoreline segment was determined by reviewing the prevalence of individual habitat characteristics necessary for juvenile rearing. 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, wide littoral areas, substrates that provide nutrients and interstitial space for cover, and are adjacent to tributaries potentially used for spawning. Segments adjacent to known Burbot spawning areas were also given higher ranking.

- Wildlife Category

  a. Badger Habitat – Potential habitat for American Badger (*Taxidea taxus*), provincially red-listed and federally listed under SARA as endangered, are documented in the north basin of Moyie Lake and the upstream section of the narrows between the lakes (CDC 2020). Detailed American Badger habitat quality mapping was included in the Moyie Official Community Plan that identified areas with high and very high-quality habitat (OCP; RDCK 2019). Each segment was ranked as having high, potential or no habitat documented for American Badger.

Note that ungulate winter range has been mapped adjacent to the Moyie Lake shoreline (see Section 3.1.7). However, it was not included as a criterion in the FHSI because mapping suggests ungulate winter habitat is found in all segments except for two (Segments 28 and 29) though field inspections suggested this ~500 m shoreline area could also be considered potential ungulate winter range. Therefore, since all segments would receive full value for this criterion, it was not included in the index.

Table 1: Foreshore Habitat Sensitivity Index for Moyie Lake

Category	Criteria	Percentage of FHSI	Percent Within Category	Calculation	Uses Weighted FIM Data	Value Categories
Biophysical	Shore Type	17.0	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	8.8	13	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	13.6	20	Proportion of Segment Natural * Percentage of the FHSI	No	
	Aquatic Vegetation	6.8	10	Proportion of Segment with Aquatic Vegetation * Percentage of the FHSI	No	
	Overhanging Vegetation	2.7	4	Proportion of Segment with Overhanging Vegetation * Percentage of the FHSI	No	
	Large Woody Debris*	5.4	8	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	8.2	12	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	5.4	8	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		**68.0**	**100**			
Fisheries	Burbot Spawning	7.5	50	Present (Percentage of the FHSI), Absent (0)	No	
	Staging Area	3.8	25	Present (Percentage of the FHSI), Absent (0)	No	
	Juvenile Rearing Area	3.8	25	High (Percentage of the FHSI), Moderate (0.5*Percentage of the FHSI), Low (0.1*Percentage of the FHSI)	No	
Category Subtotal		**15.0**	**100**			

Category	Criteria	Percentage of FHSI	Percent Within Category	Calculation	Uses Weighted FIM Data	Value Categories
Wildlife	Badger Habitat	5.0	100	High Quality Habitat Near Shoreline (Percentage of the FHSI), Potential Habitat or Occurrences (0.5*Percentage of the FHSI), No Habitat Documented (0)	No	
Category Subtotal		**5.0**	**100**			
Modifications	Retaining Wall	-2.4	20	Proportion of Segment with Retaining Walls * (Percentage of the FHSI)	No	
	Docks	-3.0	25	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)	Yes	>0-5 docks/km (Low); >5-10 docks/km (Moderate); >10 docks/km (High)
	Groynes	-1.8	15	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)	Yes	>0- 5 groynes/km (Low); >5-10 groynes/km (Moderate); >10 groynes/km (High)
	Boat Launch	-2.4	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)	Yes	>0-1 boat launch/km (Low); >1-2 boat launches/km (Moderate); >2 boat launches/km (High)
	Marina	-2.4	20	Present (Percentage of the FHSI), Absent (0)	No	
Category Subtotal		**12.0**	**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 was calculated by summing littoral and foreshore counts.

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 is initially equal, except for shoreline modifications, then weights of categories were adjusted based on the expected 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 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 created and scores calculated, 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 Moyie Lake was selected as a preferred version.

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, 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 conducted to determine if the ranks were reflective of values along the shoreline. Iterations were reviewed, mapped (Section 2.2.3) 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 moderate 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 and Burbot in Moyie 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 large surface area of Moyie Lake and 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. As with overhanging vegetation, the weighting of this criteria was lower than others due to the relatively small habitat contribution given the large size of 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 Burbot spawning criterion was assigned a higher value than staging and juvenile rearing criteria due to the limited spawning areas documented or suspected, the importance of this population to Burbot conservation efforts in southern B.C., and the risk associated with loss of Burbot spawning habitat.

3. Wildlife (non-FIM): Badger habitat was the only wildlife criterion included in the FHSI. Compared to other categories, Wildlife had less influence on the FHSI scoring (5%) because only one criterion is included in the index though the limited areas of high-quality Badger habitat will still influence the output more than general fisheries criteria like staging and juvenile rearing habitat.

4. Modifications (FIM): Similar weights were given to all modification criteria. Docks were weighted slightly higher because they are often associated with various other foreshore modifications (e.g., riparian clearing, substrate modification) and provide habitat for non-native fish species while groynes were weighted slightly lower because groyne density was fairly low relative to docks and retaining walls. 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 and using GIS mapping tools. ZOS often include wetlands, creek mouths, native grasslands, wildlife habitat and corridors, gravel/cobble habitat, biologically productive areas and other unique unimpacted/natural areas because of their value to fish and wildlife (Schleppe et al. 2020, Caskenette et al. 2020, NRC 2002). Moyie 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 20 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. These 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 or High FHSI Ecological Rank that also contain one or more ZOS.

2.2.5 Evaluation of 2020 Data Using the 2008 AHI

Data collected in 2020 was also evaluated using the original AHI (now called FHSI) created for Moyie Lake in 2008. The 2008 AHI was used as a basis for development of the 2020 FHSI though adjustments were made to reflect current FHSI methodology (i.e., criteria added, value categories adjusted, and weighting changed) and though the outcomes of the 2020 FHSI and 2008 AHI could be compared, it was unclear if differences observed were due to actual shoreline changes or variation in the FHSI itself. Therefore, data for 2020 was also evaluated using the 2008 AHI created by Schleppe (2009). FHSI rank categories defined in Schleppe (2009) were used to determine the segment rank based on values calculated using the 2008 AHI.

The results were reviewed on a segment-by-segment basis and summarized by tabulating the total shoreline length of each AHI rank. Results were presented in tabular form with a comparison to the 2008 AHI results.

2.3 First Nations Traditional Ecological Knowledge (TEK)

FIMP recognizes the importance of including First Nation's Traditional Ecological Knowledge, which 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 Moyie 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 cited by SIB in early August 2020, field participation was rescinded. 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 Moyie Lake FIMP. However, TEK data was not available at the time of writing and was therefore not included in the FHSI analysis nor displayed as polygons on mapping products.

Members from the Ktuxana Nation Council (KNC) were not available to provide support during the Moyie Lake FIMP due to COVID-19 restrictions (i.e., field survey participation was not allowed; K. Andreashuk, Stweardship 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 Moyie 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 Moyie Lake are summarized below. Segment maps are provided in Appendix A and segment summaries are provided in Appendix B.

3.1.1 Natural versus Disturbed Shoreline

The re-FIM was completed along the entire 37,638 m of the Moyie Lake shoreline. The shoreline was divided into 33 segments ranging in length from 174 to 5,404 m. The total length of disturbed shoreline was 16,749 m (45%) while the total length of shoreline that remained in natural condition was 20,889 m (55%); (Figure 2).

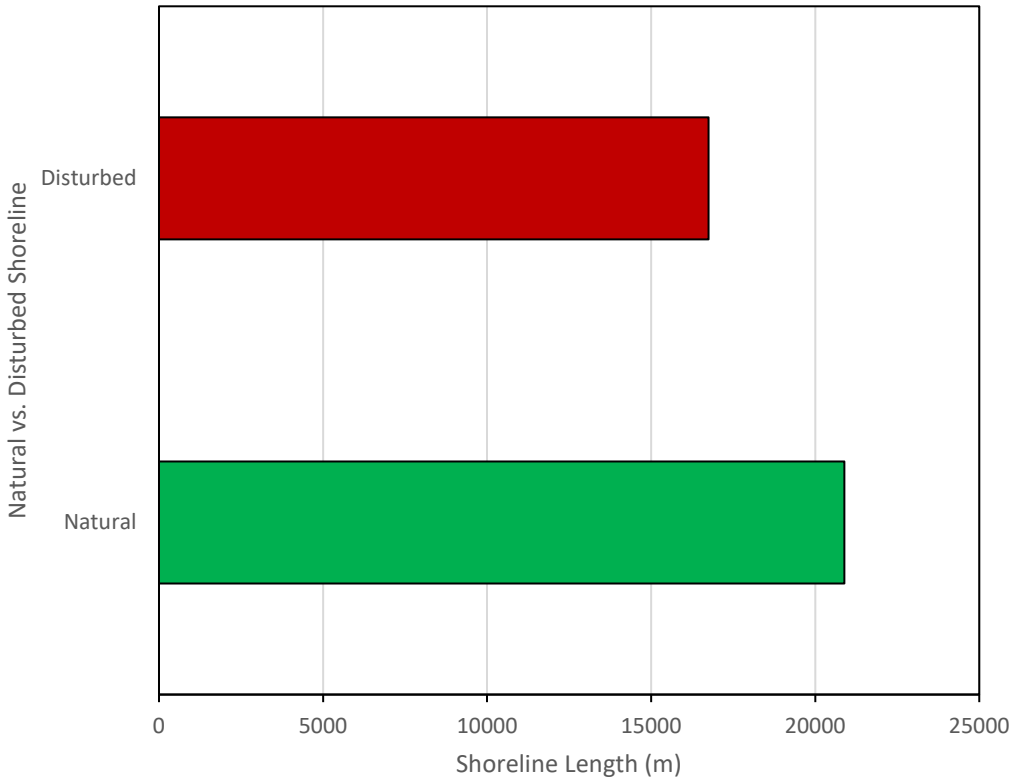


Figure 2: Total shoreline length (m) that is disturbed or natural for Moyie Lake.

3.1.2 Shore Type

The predominant shore type was rocky shore which was observed along 16,113 m (43%) of Moyie Lake (Figure 3). Other shore types observed included stream mouth (10,804 m; 29%), gravel (9,163 m; 24%) wetland (1,118 m; 3%) and cliff/bluff (438 m; 1%). No segments were classified as sand though small areas of sand were observed within segments classified as other shore types. In areas with rocky shore and gravel shore types, just over half of the shoreline was disturbed (51% and 56%, respectively) while in areas with stream mouth, wetland and cliff/bluff lesser amounts of the shoreline was disturbed (30%, 6% and <1%, respectively.

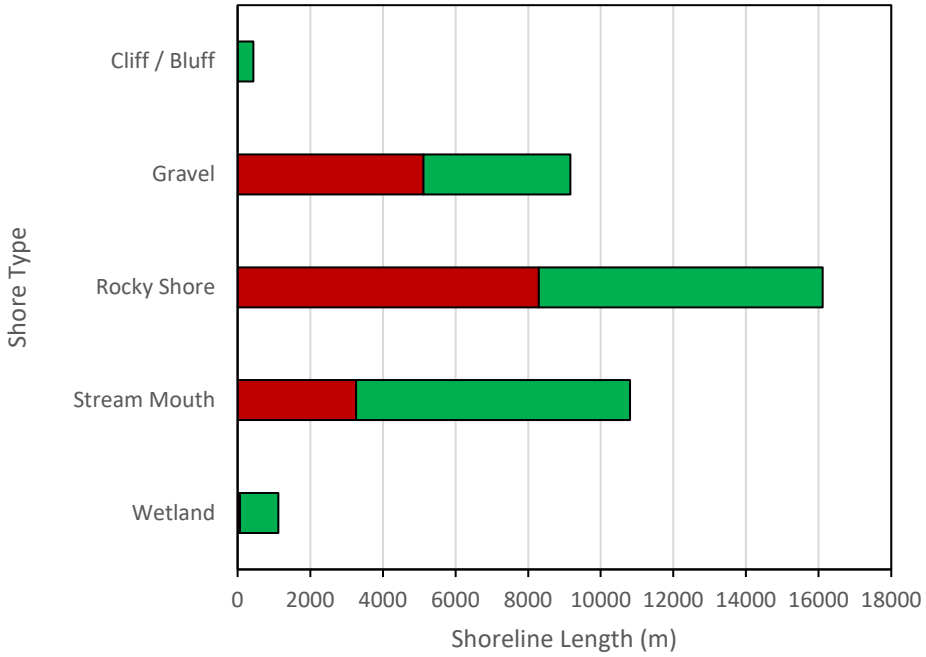


Figure 3: Shore types and length of natural (green) versus disturbed (red) shoreline for Moyie Lake.

3.1.3 Land Use

The predominant land use along the Moyie Lake shoreline was rural (10,146 m; 27%) followed by single family (9,876 m; 26%) and transportation (9,862 m; 26%), which were observed in similar amounts (Figure 4). Natural area covered 6,887 m (18%) of the shoreline while lesser amounts of park (636 m; 2%) and urban park (231 m; <1%) were also observed. One area of agricultural land use (approximately 816 m) was observed in Segment 5, which had an overall classification of rural land use.

Most of the shoreline in segments classified as rural or natural area were mostly in a natural state (4% and 1% disturbed, respectively) (Figure 4) as the limited amount of disturbance in these areas was mostly related to lake access modifications (e.g., docks, stairs, and substrate modification) or historic infrastructure (e.g., pilings). Higher levels of disturbance were observed in shoreline segments classified as transportation (84% disturbed), urban park (80% disturbed), single family residential (76% disturbed) and park (60% disturbed) land uses. Disturbed shorelines observed in areas with transportation land use were due to railway lines and associated erosion protection while disturbance in areas with single family residential land use included a wide variety of shoreline modifications (e.g., marinas, docks, retaining walls, groynes, stairs, sheds, and roads). Disturbance in segments with urban park and park land uses were primarily due to substrate modification and retaining walls.

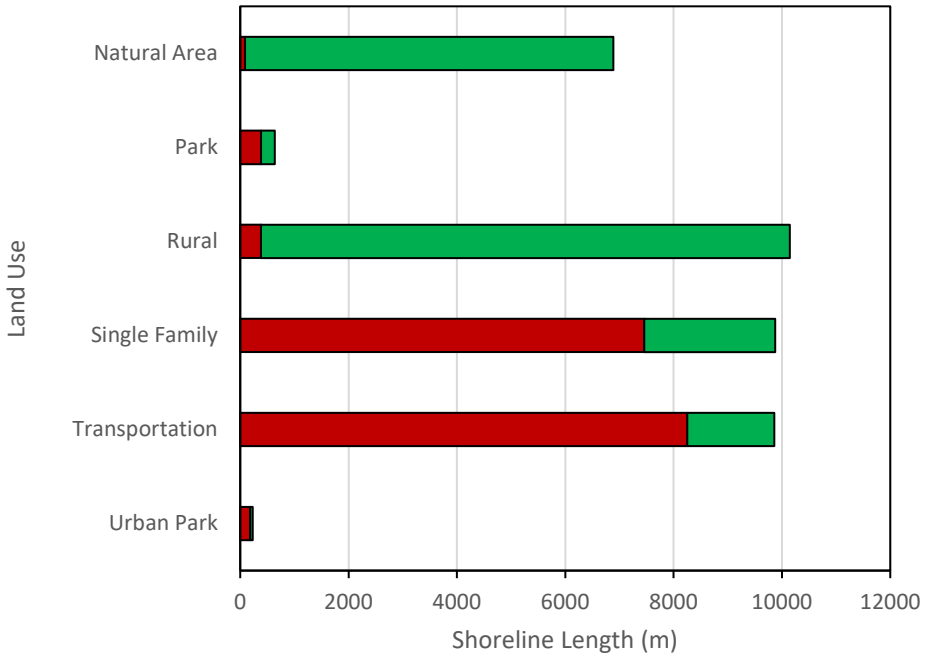


Figure 4: Land use types and length of natural (green) versus disturbed (red) shoreline for Moyie Lake.

3.1.4 Aquatic Vegetation

Aquatic vegetation was observed along 10,163 m (27%) of the Moyie Lake shoreline (Figure 5). Emergent vegetation was the dominant aquatic vegetation type observed (5,653 m; 15%) followed by submergent (4,333 m; 12%) and floating (1,624 m; 4%). Segments with the highest density of aquatic vegetation (≥80% of the segment) had either wetland (Segments 2 and 17), stream mouth (Segments 5, 21, 22 and 27) or gravel (Segment 28, 29 and 30) shore types. Aquatic vegetation was not observed in 14 of the 33 Moyie Lake shoreline segments (Appendix B).

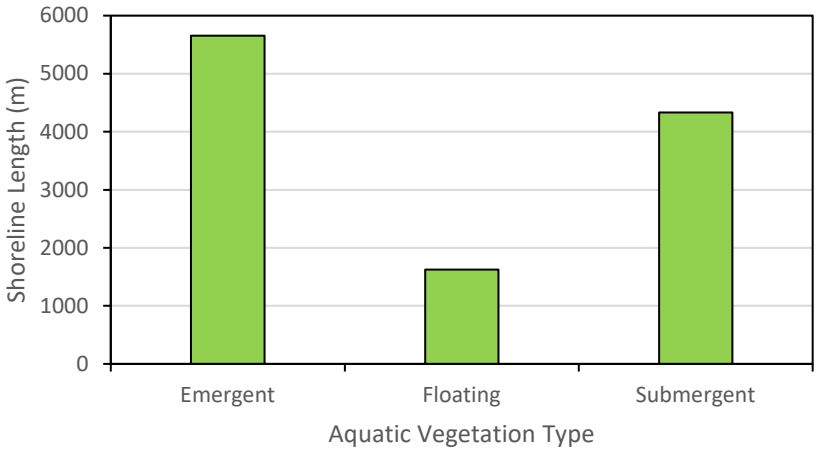


Figure 5: Aquatic vegetation types observed along the shoreline of Moyie Lake.

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 21 of the 33 Moyie Lake shoreline segments and the number of LWD pieces ranged from 2 to 20 per segment when observed (Appendix B). The highest abundances of foreshore LWD were observed along the narrows between the two lake basins (Segments 5, 20, 22), low/medium sloped natural areas along the west shore of the south basin (Segments 6, 8, 11) and a wetland in the north basin (Segment 27).

Cobble (10,659 m; 28%) and gravel (9,538 m; 25%) were the predominant substrate type observed along the foreshore of Moyie Lake (Figure 6). Lesser amounts of boulder (6,793 m; 18%), sand (5,500 m; 15%), mud (2,335 m; 6%), bedrock (2,097 m; 6%), fine cobbles (478 m; 1%) and fines (188 m; <1%) were also observed.

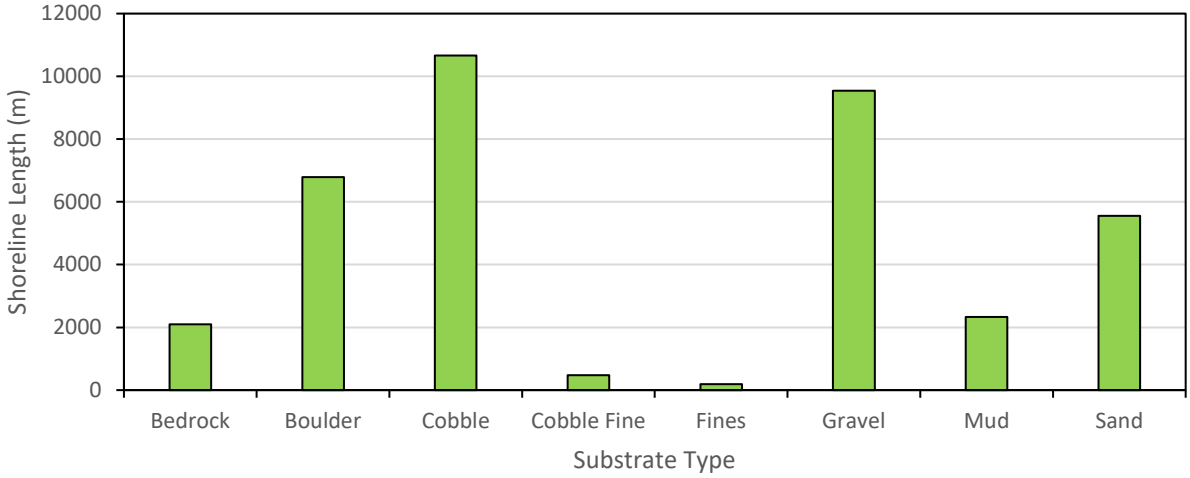


Figure 6: Substrate types observed along the foreshore of Moyie Lake.

3.1.5.2 Littoral Areas

The littoral area was classified as medium width (10 – 50 m) and narrow (<10 m) along 17,309 m (46%) and 11,595 m (31%) of the shoreline, respectively. Wider littoral areas (>50 m) were present along 8,734 m (23%) of the shoreline. Littoral width ranged between 5 and 230 m. The widest littoral areas (>100 m) were observed adjacent to the Moyie River and Peavine Creek confluences at the north side of the north basin (Segments 27 and 28), in a bay on the east side of the north basin (Segments 1, 2 and 30), the south side of the north basin and the narrows between the lakes (Segment 5), and in a wetland within a bay on the north side of the south basin (Segment 17; Appendix A). Littoral LWD was observed in 13 segments and the number of pieces of LWD ranged from 1 to 15 pieces per segment (Appendix B). The highest abundance of littoral LWD was observed along the narrows between the two lake basins (Segments 20, 21 and 22).

Cobble (12,480 m; 33%) was the predominant substrate type observed along the foreshore of Moyie Lake (Figure 7). Lesser amounts of gravel (7,335 m; 20%), boulder (5,931 m; 16%), fines (4,179 m; 11%), organics (3,046 m; 8%), bedrock (2,351 m; 6%), sand (1,879 m; 5%) and mud (437 m; 1%) were also observed.

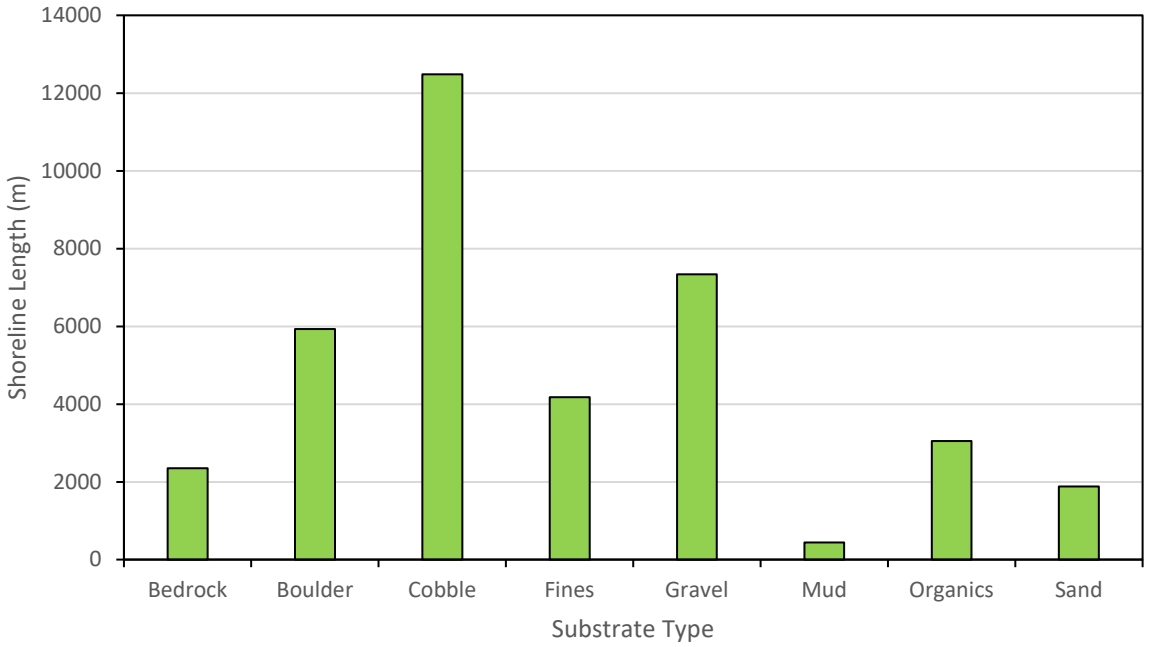


Figure 7: Substrate types observed in littoral areas of Moyie Lake.

3.1.5.3 Riparian Areas (Vegetation Bands 1 and 2)

Overhanging vegetation was observed in all but six segments and covered between 2 and 100% of the segment when present (Appendix B). Areas with significant amounts of overhanging vegetation (≥80%) included the north facing shoreline of a bay on the west side of the north basin (Segment 4.1), a wetland in the south basin (Segment 17) and within the outlet of the narrows between the lake basins (Segment 20).

The width of the nearshore riparian vegetation band (Vegetation Band 1) ranged between 5 and 50 m and half of the segments had continuous riparian vegetation within this band while the riparian areas in the other half were patchy. Tall shrubs (14,277 m; 38%) and mature forest (12,971 m; 35%) were the predominant vegetation stages observed in Vegetation Band 1 (Figure 8). Lesser amounts of low shrubs (6,456 m; 17%), sparse vegetation (3,184 m; 9%), grass/herb (475 m; 1%), and young forest (276 m; <1%) were also observed. The most modified shoreline areas tended to have exposed soils or landscape/lawns with sparse vegetation and/or tree cover within Vegetation Band 1 (e.g., Segments 1, 7, 14 and 28). A transition in riparian vegetation to a second type (i.e., Vegetation Band 2) within 50 m of the shoreline occurred along 23,929 m (63%) of Moyie Lake, the remaining 37% of the shoreline only had Vegetation Band 1, and most of the vegetation observed in Vegetation Band 2 was mature forest (approximately 75%).

Most segments had <5 veteran trees (n=14 segments) and 5-25 snags (n=11 segments; Appendix B). Segments that had no or very few veterans and snags were in areas where shorelines were heavily modified by single family residential (e.g., Segments 7 and 13), urban park (Segment 28) or transportation (e.g., Segments 16 and 26) as well as low slope areas with younger stage riparian vegetation adjacent to wetlands (Segments 2 and 17) or alluvial fans (Segment 24).

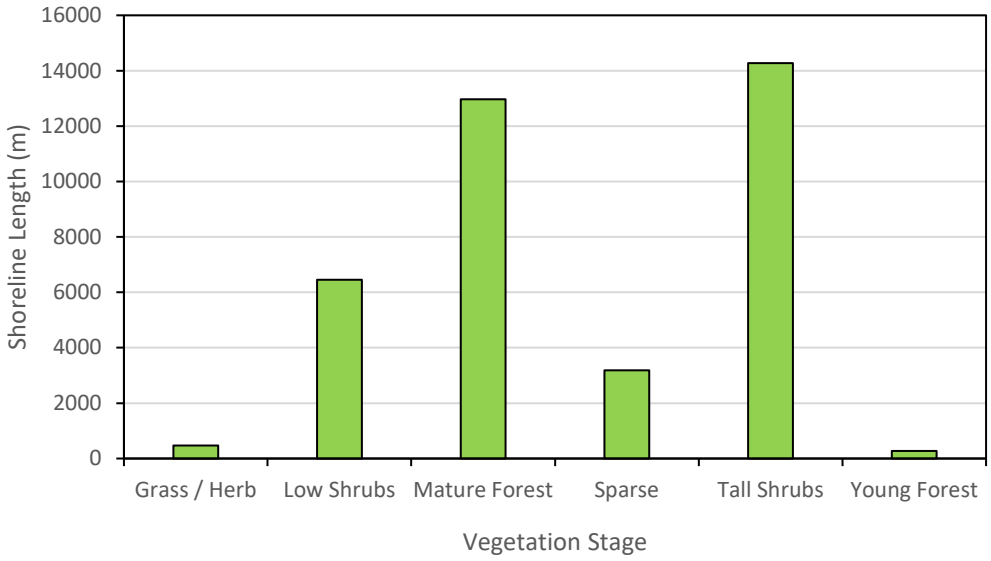


Figure 8: Vegetation stages observed in Vegetation Band 1 for Moyie Lake.

3.1.6 Fish Species Information

Schleppe (2009) provides a summary of fish species information for Moyie Lake as well as the results of fish and fish habitat sampling conducted during the 2008 FIM. Fish species occurrence information provided by Schleppe (2009) updated with information from FIDQ (2020) and CDC (2020) is provided in Table 2.

Two species of conservation concern have been documented in Moyie Lake: Westslope Cutthroat Trout are of conservation concern provincially (blue-listed) and federally (SARA Schedule 1; Of Special Concern) while Bull Trout (*Salvelinus confluentus*) are of conservation concern provincially (blue-listed; Table 2). Westslope Cutthroat Trout were introduced to Moyie Lake sporadically between 1923 and 2005 and it is unknown if a native population was present prior to hatchery introductions (FIDQ 2020).

More recently, Lamson and Phillips (2012) conducted fish sampling in the south basin of Moyie Lake using standard gill nets on 3-4 October 2012 to evaluate the condition and prevalence of stocked Rainbow Trout (*Oncorhynchus mykiss*) and Kokanee (*Oncorhynchus nerka*). Fish species captured included Rainbow Trout, Kokanee, Mountain Whitefish (*Prosopium williamsoni*), Largescale Sucker (*Catostomus macrocheilus*), Westslope Cutthroat Trout, Yellow Perch (*Perca flavescens*) and Burbot (*Lota lota*). At the time, 30,000 Rainbow Trout (100 Rainbow Trout/ha) and 65,000 Kokanee (215 Kokanee/ha) were stocked annually and recommendations were made to reduce the stocking levels to 15,000 and 30,000, respectively, because future stocking in Moyie Lake was being reconsidered as it was likely that survivability, growth and condition of the stocked fish was low (Lamson and Phillips 2012). Rainbow Trout were last stocked in 2018 (n=15,000) and Kokanee were last stocked in 2020 (n=30,000) (FIDQ 2020).

A female Black Bullhead (*Ameiurus melas*; 185 mm fork length), a non-native (i.e., exotic) species, was captured in the south basin of Moyie Lake by the public in July 2019; the specimen was submitted to MFLNRORD to confirm species identification (Chirico 2019).

The Burbot population in Moyie Lake is one of the only populations of Burbot in BC that is considered 'healthy' at approximately 10,000 individuals (e.g., Evans et al. 2019). Gametes are collected annually from Moyie Lake, fertilized eggs are reared in the hatchery and released to the red-listed lower Kootenay Burbot population to support population restoration efforts (Evans et al. 2019). Known Burbot spawning areas, a variable included in the 2008 Moyie Lake AHI (now FHSI), remain the same as those identified by Schleppe (2009) (Sarah Stephenson, Rare and Endangered Fish Biologist, MFLNRORD, pers. comm.).

Table 2: Fish species known to occur or have occurred in Moyie 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) Status
Black Bullhead/Black Catfish	*Ameiurus melas*	Exotic	-
Brook Trout	*Salvelinus fontinalis*	Exotic	-
Bull Trout	*Salvelinus confluentus*	Blue	-
Burbot	*Lota lota*	Yellow	-
Kokanee	*Oncorhynchus nerka*	Yellow	-
Lake Chub	*Couesius plumbeus*	Yellow	-
Largescale Sucker	*Catostomus macrocheilus*	Yellow	-
Longnose Dace	*Rhinichthys cataractae*	Yellow	-
Longnose Sucker	*Catostomus catostomus*	Yellow	-
Mountain Whitefish	*Prosopium williamsoni*	Yellow	-
Pumpkinseed	*Lepomis gibbosus*	Exotic	-
Rainbow Trout	*Oncorhynchus mykiss*	Yellow	-
Redside Shiner	*Richardsonius balteatus*	Yellow	-
Sculpin	*Cottus sp.*	Yellow	-
Westslope Cutthroat Trout	*Oncorhynchus clarkii lewisi*	Blue	Special Concern
White Sucker	*Catostomus commersonii*	Yellow	-
Yellow Perch	*Perca flavescens*	Unknown	-

3.1.7 Wildlife and Wildlife Habitat Observations

Schleppe (2009) provides a summary of wildlife and wildlife habitat observations for Moyie Lake as well as the results of wildlife habitat assessments conducted during the 2008 FIM.

Wildlife observations recorded during the 2020 re-FIM are included in the segment summaries in Appendix B and summarized by segment below:

- Segment 4.1 – three Common Merganser (*Mergus merganser*) observed.
- Segment 4.2 – one Merganser observed.
- Segment 4.3 – one Osprey (*Pandion haliaetus*) observed.
- Segment 5 – one each of Belted Kingfisher (*Megaceryle alcyon*), Mallard (*Anas platyrhynchos*), and Cooper's Hawk (*Accipiter cooperii*) observed.
- Segment 8 – one each of Sandpiper (*Scolopacidae* sp.), Black-capped Chickadee (*Poecile atricapillus*), Dark-eyed Junco (*Junco hyemalis*), and Sparrow (*Passeridae* sp.) observed.

- Segment 10 – one Muskrat (*Ondatra zibethicus*) observed.
- Segment 13 – an inactive Beaver lodge (*Castor canadensis*) observed.
- Segment 20 – one Sandpiper and an unidentifiable duck observed.
- Segment 23 – one Osprey observed.
- Segment 24 – one Osprey observed.
- Segment 25 – one Sandpiper observed.

American Badger, provincially red-listed and federally listed under SARA as endangered, occurs in the East Kootenay Trench and potential habitat and/or occurrences are documented in the north basin of Moyie Lake and the upstream section of the narrows between the lakes (CDC 2020). This includes Segments 1-5 and 22-30 (Appendix A). Detailed American Badger habitat quality mapping was included in the Moyie Official Community Plan (OCP; RDCK 2019) and high-quality badger habitat was identified along the west-facing slopes below the railway line within 50 m of the shoreline in Segments 23 and 26. Ungulate winter range was also mapped in the OCP and was observed to occur within 50 m of the shoreline in all segments except for Segments 28 and 29.

3.1.8 Shoreline Modifications

Docks were the most prevalent shoreline modification observed in Moyie Lake. Docks (n=208) were observed in 16 segments with the majority (n=78) occurring on the east side of south basin adjacent to the community of Moyie (Segment 15; Figure 9; Figure 10). The next most common shoreline modification was retaining walls (n=140) followed by stairs (n=123) and, in similar numbers, mooring buoys (n=63), pilings (n=62), sheds (n=58) and groynes (n=54). Boat launches (n=15), boat covers (n=12), pumphouses (n=12), marine rail (n=6), boat houses on land (n=4), boat lifts (n=4), marinas (n=4), swim floats (n=4), fences (n=2) and dock groynes (n=1) were also observed (Figure 9).

The most prevalent lineal modification was substrate modification, which occurred along 13,539 m (36%) of the shoreline, followed by erosion protection (13,463 m; 36%), railway (11,110 m; 30%) and roadway (2,203 m; 6%; Figure 11). Substrate modification was observed in most segments (n=24) and was mainly caused by beach grooming, imported sand, infilling along roadways and railways, and/or mine tailings. Erosion protection included retaining walls, groynes, and rip rap material along railways and roadways. A railway line is present along the entire east shoreline of the north and south basin (Appendix A). Roadways covering ≥90% of the segment were associated with property access along the east shore of the north (Segments 1 and 2) and south basins (Segments 7 and 13; Appendix A).

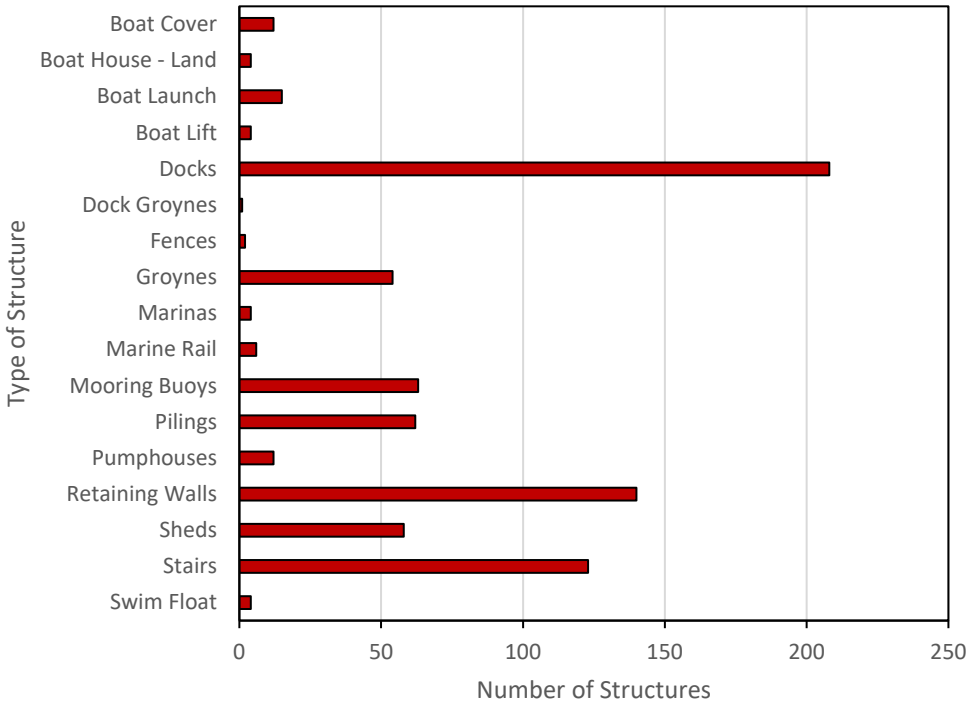


Figure 9: Total number of shoreline modifications observed along the foreshore of Moyie Lake.

Figure 10: Example of shoreline modifications observed on Moyie Lake including docks in Segment 1 (left) and retaining walls, rip rap and a dock in Segment 10 (right).

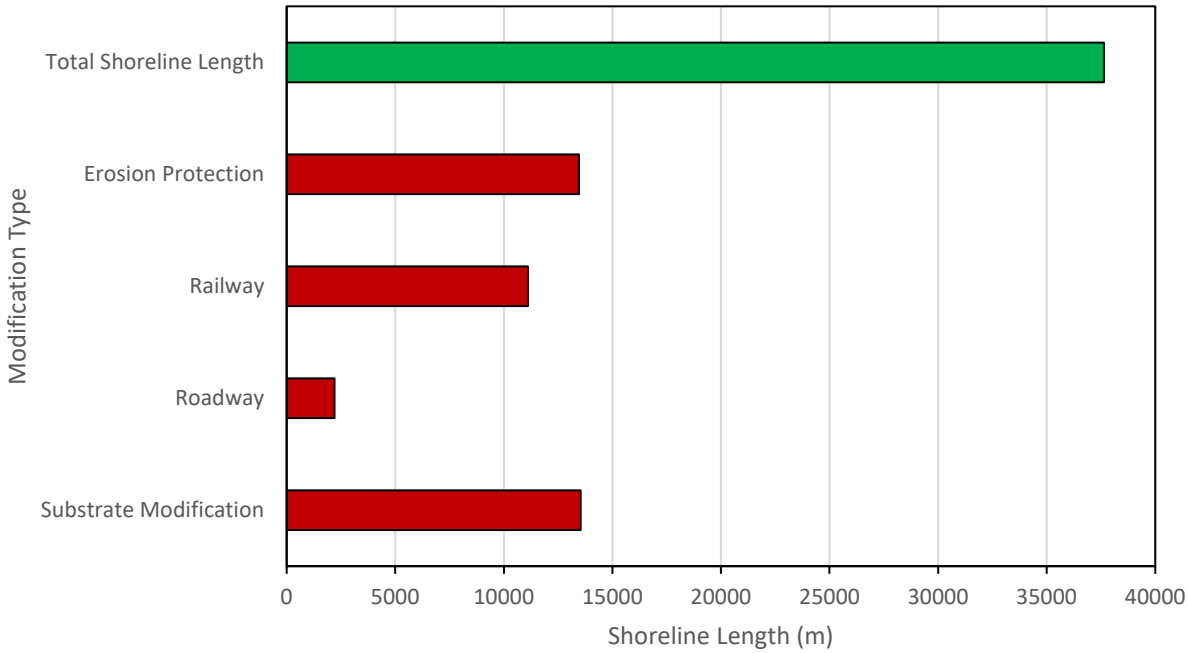


Figure 11: Total shoreline length that has been impacted by lineal modifications along the shoreline of Moyie Lake.

3.1.9 Level of Impact

In total, 17,274 m (46%) of the Moyie Lake shoreline was considered to have a high level of impact (>50% disturbance; Figure 12). Areas with low level of impact (<10% disturbance) were observed along 16,327 m (43%) of the shoreline, with medium level of impact (10-50% disturbance) along 3,578 m (10%) of shoreline, while no impact (0% disturbance) was observed along the remaining 460 m (1%) of the shoreline (Figure 12). Examples of the different levels of impact assessed along the shoreline of Moyie Lake are illustrated in Figure 13.

The highest level of disturbance (≥70%) was observed in segments associated with single family homes where riparian habitat had been modified and numerous shoreline modifications including docks, retaining walls, beach grooming, imported sand, and various structures (e.g., sheds, decks and boathouses) resulted in highly modified shoreline habitat (Segments 1, 7, 10, 12, 13, 15, 18 and 29). A high level of disturbance was also observed in segments where railway lines and associated erosion protection (e.g., rip-rap and retaining walls) were within 5 m of the HWM (Segments 14, 23 and 26) and in segments where the shoreline was modified to create a public beach (Segments 28; Appendix A). Segment 7, on the east side of the south basin, had the highest level of disturbance of any other shoreline area (99% disturbed) due to removal of riparian vegetation and various foreshore modifications including retaining walls, beach grooming, erosion protection, boat houses, and sheds/decks as well the largest number of docks (n=65; 30 docks/km) and boat launches (n=7) observed in any segment (Appendix B).

Areas with no or low level of impact (<10%) were primarily in natural condition and were observed along most of the east shore of both the north basin (Segments 4.1 and 4.3) and south basin (Segments 6, 8 and 11), in the narrows between the two lakes (Segments 5, 20, 21 and 22), and within wetland areas (Segments 2, 17 and 27). No disturbance was observed at an island (Segment 31) and small cliff/bluff area (Segments 25) in the south basin (Appendix A).

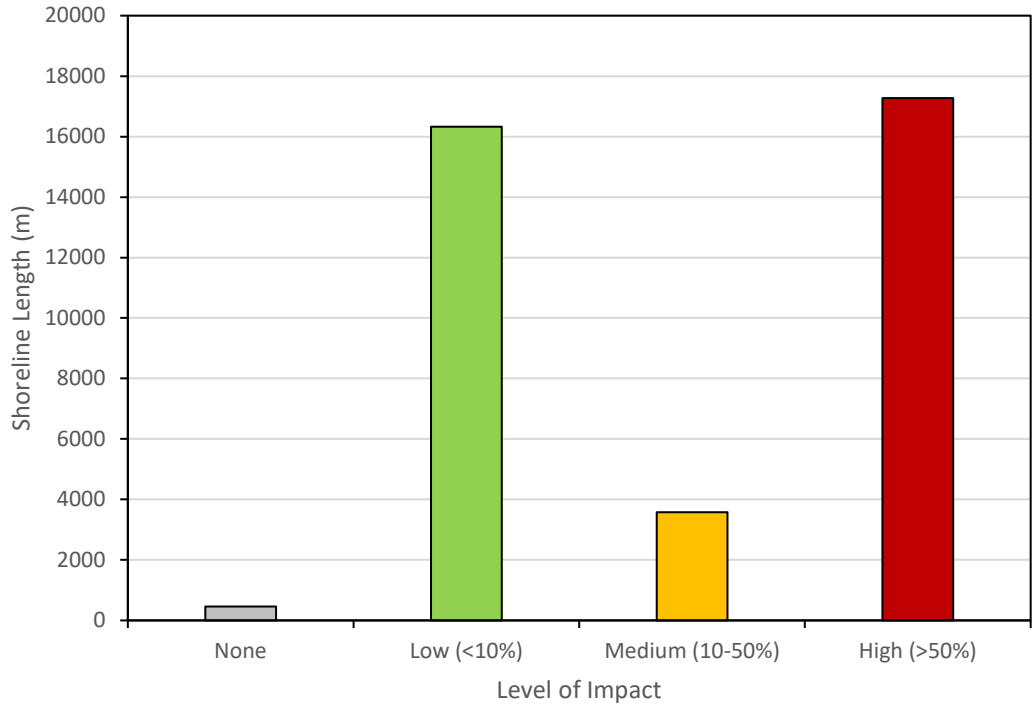


Figure 12: Level of Impact (None, Low, Medium or High) observed along the shoreline of Moyie Lake.

Figure 13: Examples of the different levels of impact assessed along the shoreline of Moyie Lake.

3.1.10 Comparison of 2008 FIM and 2020 re-FIM

3.1.10.1 Natural versus Disturbed Shoreline

The shoreline of Moyie Lake was divided into 31 segments in 2008 and 33 segments in 2020. The total length of disturbed shoreline increased slightly by 471 m (1.3% of the total shoreline) between 2008 and 2020 from 16,278 m (43.3%) to 16,749 m (44.5%), respectively (Figure 14). Therefore, the total length of natural shoreline also slightly decreased between 2008 and 2020 from 21,360 m (56.7%) to 20,889 m (55.5%), respectively (Figure 14). This suggests the amount of disturbance along the Moyie Lake shoreline is increasing by approximately 38 m (0.1%) per year.

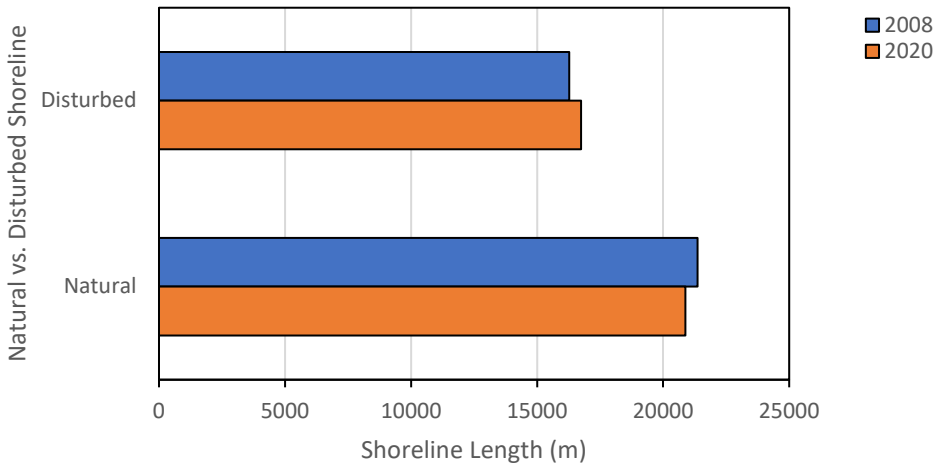


Figure 14: Comparison of the total shoreline length (m) classified as disturbed or natural for Moyie Lake, 2008 and 2020.

The level of disturbance increased between 2008 and 2020 at the following locations:

- West side of the north basin (Segment 4.2) – New shoreline modifications included one dock and development associated with a cabin within 5 m of the HWM. The level of disturbance increased by 10% (from 30% to 40%) between 2008 and 2020 resulting in approximately 17 m of recently disturbed shoreline. This suggests the amount of disturbance in Segment 4.2 is increasing by approximately 1.5 m (0.8%) per year.
- West side of the south basin adjacent to Moyie Shore Estates Road (Segment 10) – New shoreline modifications included additional docks (n=11) and a higher proportion of docks per kilometer (10.4 docks/km in 2008 compared to 15.5 docks/km in 2020), additional retaining walls (n=24), though the percentage of the segment with retaining walls was unchanged (70%), and two new boat launches. The level of disturbance increased by 10% (from 60% to 70%) between 2008 and 2020 resulting in approximately 213 m of recently disturbed shoreline. This suggests the amount of disturbance is increasing by approximately 18 m (0.8%) per year.
- Southwest side of the south basin and Moyie River outflow adjacent to Braunagel Road and West Side Road (Segment 12) – New shoreline modifications included additional docks (n=40) and a higher proportion of docks per kilometer (15.1 docks/km in 2008 compared to 31.0 docks/km in 2020), additional retaining walls (n=14), though the percentage of the segment with retaining walls was unchanged (60%), and one new boat launch. The level of disturbance increased by 10% (from 80% to 90%) between 2008 and 2020 resulting in approximately 252 m of recently disturbed shoreline. This suggests the amount of disturbance is increasing by approximately 21 m (0.8%) per year.

Though increased disturbance resulted in small changes to the riparian area in the locations identified above, it did not result in changes to characteristic classifications (i.e., Vegetation Band 1 coverage and distribution rankings) which remained unchanged between 2008 and 2020. In both segments mentioned above the number of retaining walls increased but the percent of the segment with retaining walls remained the same; this may be due to the revised definition of enumerating retaining walls though it was observed in the field that new retaining walls had been added behind, above or in front of existing retaining walls which would not have impacted the percent of shoreline with retaining walls value.

The level of disturbance decreased in a small cliff/bluff segment (231 m) on the east shore of the north basin (Segment 25) from 5% in 2008 to 0% in 2020 resulting in an improvement of approximately 11 m of shoreline. No modifications were identified in the segment during the 2008 FIM survey and it is unclear why some level of disturbance was indicated. It is likely the difference is solely due to a data entry error in 2008 or variation in observers between years.

3.1.10.2 Aquatic Vegetation Mapping

Overall, the 2008 aquatic vegetation mapping fit closely with what was observed in UAV images. Small areas of additional floating vegetation were mapped based on the UAV images within Segments 1, 3, 5, 17, 18, 22, and 23, which was updated in the 2020 FIM dataset and mapping products.

3.1.10.3 Level of Impact

The level of impact classification for each segment did not change between the 2008 and 2020 surveys.

3.1.10.4 Shoreline Modifications

Counts of shoreline modifications that were comparable between survey years included the number of boat launches, docks, marinas, marine rail and retaining walls (Figure 15). Differences between 2008 and 2020 counts are as follows (Figure 15):

- Docks increased from 109 to 208.
- Retaining walls increased from 84 to 140.
- Boat launches increased from 10 to 15.
- Marine rail increased from 3 to 6, And,
- The number of marinas and floating boat houses remained the same.

As outlined in Section 2.1.6, it was not feasible to compare counts of groynes between the two datasets. A new baseline number for groynes established in 2020 (n=54; Section 3.1.8) is to be used in future comparisons.

The amount of the shoreline modified by retaining walls (593 m; 1.8%) and substrate modification (219 m; 0.7%) increased slightly between years, while shoreline modified by railways and roadways was unchanged (Figure 16). Recently constructed retaining walls were observed in Segments 3, 7 and 18 resulting in higher proportions of these segments containing retaining walls; the proportion of retaining wall also increased at the Moyie Lake Provincial Park beach (Segment 28) though this may have been due to differences in the methodology for defining retaining walls in 2008 as it's likely the retaining wall existed but this cannot be confirmed from photos taken during the survey.

Substrate modification increased from 15 to 30% in Segment 24 between survey years because recent beach grooming activities were observed during the re-FIM.

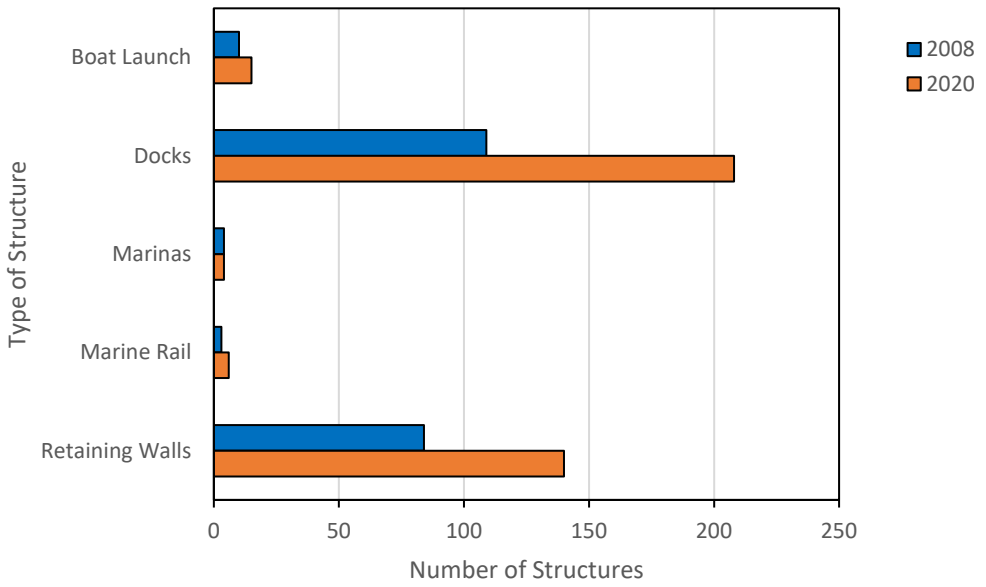


Figure 15: Comparison of the total number of selected modifications observed along the foreshore of Moyie Lake, 2008 and 2020.

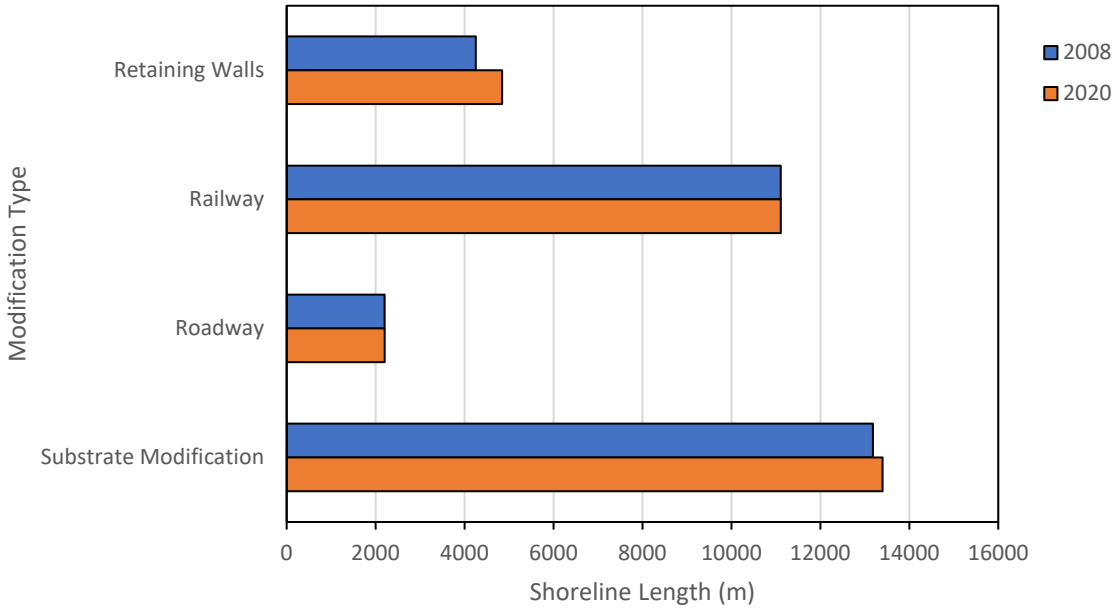


Figure 16: Comparison of total shoreline length that has been impacted by lineal modifications along the shoreline of Moyie Lake, 2008 and 2020. Data for Segment 4 was not included as outlined in the text.

3.2 FHSI

A summary of the 2020 FHSI values for Moyie Lake is provided in Table 3. Maps of shoreline segments with FHSI Ecological Ranking are provided in Appendix C. Calculations for each criterion and category as well as Ecological Rank breaks are provided in Appendix B.

Most of the shoreline of Moyie Lake was ranked as High (36.9%) ecological value followed by Moderate (36.9%), Very High (21.1%), Low (16.0%) and Very Low (1.4%) ecological value (Table 3). Most shoreline areas with Very High and High ecological value remained in natural condition (1.9% and 40.7% disturbed, respectively) while most shoreline areas with Moderate, Low and Very Low ecological value were disturbed (58.5%, 82.9% and 99% disturbed, respectively) (Figure 17).

Table 3: Moyie Lake FHSI Ecological Rankings.

FHSI Ecological Rank	# of Segments	Shoreline Length (m)	% of Shoreline
Very High	6	7,935	21.1
High	10	13,872	36.9
Moderate	12	9,252	24.6
Low	4	6,039	16.0
Very Low	1	539	1.4
Total	33	37,638	100

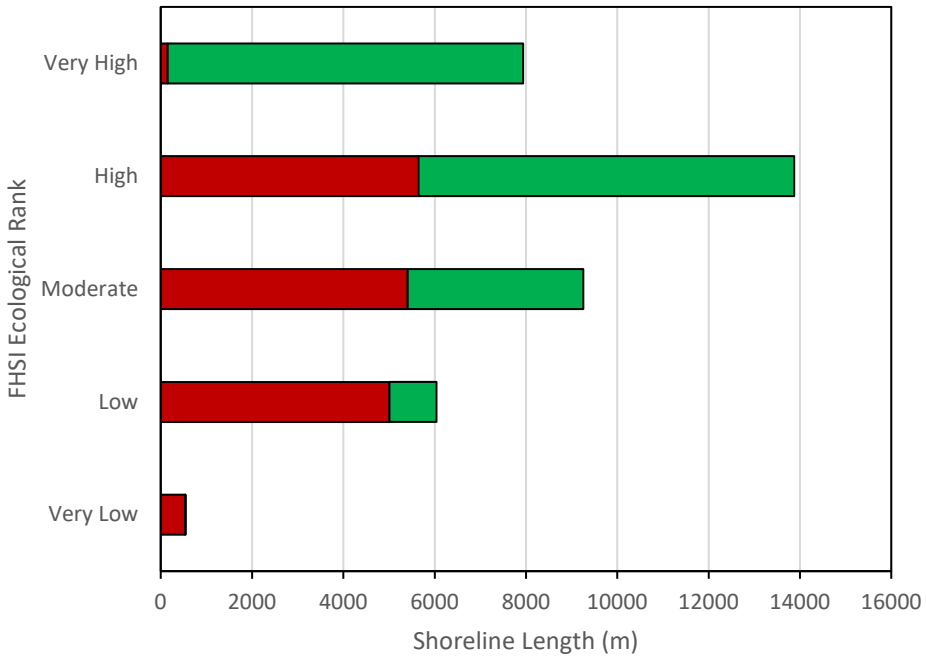


Figure 17: FHSI Ecological Rankings and length of natural (green) versus disturbed (red) shoreline for Moyie Lake.

All Very High ecological value segments had stream mouth or wetland shore types present while High ecological value segments had rocky shore, gravel or stream mouth shore types (Table 4). Moderate ecological value segments had a variety of shore types while Low value segments had gravel and rocky shore types and the one Very Low segment had a gravel shore (Table 4). Land uses observed in segments with Very High ecological value included natural areas, rural and single family residential while land uses were variable in segments with High and Moderate ecological value (Table 5). Single family residential and transportation land uses were observed in segments with Low ecological value and the one Very Low ecological value segment was entirely single family residential (Table 5).

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

FHSI Ecological Rank	Cliff/Bluff		Gravel		Rocky Shore		Stream Mouth		Wetland	
	Shoreline Length (m)	% of Shore Type Category	Shoreline Length (m)	% of Shore Type Category	Shoreline Length (m)	% of Shore Type Category	Shoreline Length (m)	% of Shore Type Category	Shoreline Length (m)	% of Shore Type Category
Very High	0	0	0	0	0	0	6,817	63	1,118	100
High	0	0	2,136	23	11,261	70	476	4	0	0
Moderate	438	100	3,050	33	2,252	14	3,512	33	0	0
Low	0	0	3,439	38	2,601	16	0	0	0	0
Very Low	0	0	539	6	0	0	0	0	0	0

Table 5: Moyie Lake FHSI Ecological Rankings by land use.

FHSI Ecological Rank	Natural Area		Park		Rural		Single Family		Transportation		Urban Park	
	Shoreline Length (m)	% of Shore Type Category	Shoreline Length (m)	% of Shore Type Category	Shoreline Length (m)	% of Shore Type Category	Shoreline Length (m)	% of Shore Type Category	Shoreline Length (m)	% of Shore Type Category	Shoreline Length (m)	% of Shore Type Category
Very High	1,143	17	0	0	6,548	65	244	2	0	0	0	0
High	5,744	83	0	0	1,633	16	860	9	5,404	55	231	100
Moderate	0	0	636	100	1,964	19	4,794	49	1,858	19	0	0
Low	0	0	0	0	0	0	3,439	35	2,601	26	0	0
Very Low	0	0	0	0	0	0	539	5	0	0	0	0

In general, Very High ecological value was identified where the shoreline consisted of wetlands and/or stream confluences that were in natural condition with no/very little shoreline modification or disturbance observed. These shoreline areas also had wide littoral areas, abundant aquatic vegetation and provide important juvenile rearing and staging habitat for fish. Conversely, Low and Very Low ecological value were identified where the shoreline was heavily disturbed by residential and transportation related shoreline modifications.

Overall, four segments had different Ecological Rankings in 2020 than they had in 2008 (Schleppe 2009). Some of the rank changes may have been due to increased disturbance and shoreline modification (e.g., Segments 10 decreased from Moderate to Low and Segment 24 decreased from Very High to High) while other rank changes were most likely due to additional criteria and adjusted weighting included in the 2020 FHSI that captured more aspects of shoreline habitat sensitivity than the 2008 AHI was able to detect (e.g., Segments 27 and 28 increased from Moderate to High ecological ranking).

3.2.1 Zones of Sensitivity (ZOS)

ZOS identified during the FIM field assessment and during the background data review are described below.

- Aquatic Vegetation – Aquatic vegetation contributes to the overall health of an ecosystem by providing an important source of nutrients, oxygenation and habitat for aquatic, terrestrial and avian species (Kennedy and Mayer 2002). Aquatic vegetation is an important component of wetlands, which provide habitat, flood control, water filtration and food resources (Mitsch and Gosselink 1993). Aquatic vegetation on Moyie Lake was originally mapped by Schleppe (2009) and updated during the 2020 re-FIM. All plant forms and communities occurring below the lake highwater level were considered aquatic plants due to their contribution to fish habitat under all water levels, including highwater (Schleppe 2009). Low flood benches delineated by Schleppe (2009) were therefore included within this overall classification of aquatic vegetation. Aquatic vegetation types that were mapped include marshes, low flood benches, emergent vegetation (e.g., sedges, horsetails and cattails) and floating vegetation (e.g., pondlilies and native pondweed that reaches the surface). On Moyie Lake, aquatic vegetation is relatively sparse and primarily associated with the few productive littoral regions that also include wetland and low flood bench habitat at the north end of the north basin (Segments 2 and 27), the narrows between the two basins (Segments 5, 21 and 22 as well sections of Segments 6, 20 and 23) and the northeast corner of the south basin (Segment 17). Aquatic vegetation in these productive littoral areas was, therefore, identified as a ZOS. Note that aquatic vegetation polygons overlaid wetland polygons delineated in the BC Freshwater Atlas; wetlands were not included as a unique ZOS because detailed wetland inventory and mapping has not been conducted and the available polygons from the BC Freshwater Atlas did not incorporate the full extent of wetland areas observed during FIM surveys and orthophoto and UAV image review. Therefore, aquatic vegetation polygons were selected as the best way to represent this ZOS with the data that is currently available. Also note that small pockets of emergent vegetation are present in other segments (see FIM maps in Appendix A), however, these areas were not included within the aquatic vegetation ZOS because these areas are not extensive or as critical to productivity in the lake as the large littoral regions identified by the aquatic vegetation ZOS.
- Tributary Mouths – Tributary mouth areas provide important habitat for fish rearing, migration and staging. Tributaries to Moyie 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). Tributaries to Moyie Lake with documented fish presence and no barriers to fish migration (FIDQ 2021) are summarized in Table 6. In addition to fisheries values, water quality parameters such as temperature, dissolved oxygen,

turbidity and nutrients of tributary inflows play an important role in the overall water quality of lake ecosystems (Rice et al. 2008). Therefore, the confluence areas of all tributaries to and from Moyie Lake delineated in the BC Freshwater Atlas dataset were identified as tributary mouth ZOS. The only exceptions were for tributaries that were confirmed to be ephemeral or abandoned by reviewing photos and UAV images taken during field surveys in Segments 7, 10 and 12. It is possible the alignment of these three tributaries has shifted to locations that are not clear from the imagery and photo documentation available (e.g., Etna Creek in Segment 10). Note that this was undertaken as a desktop exercise and ground truthing was not conducted to confirm tributary alignment and the presence of year-round flows.

Table 6: Tributaries to Moyie Lake with fish presence documented in FIDQ (2021).

Tributary Name	Watershed Code	Moyie Lake Segment
Cotton Creek	340-706800-71500	24
Peavine Creek	340-706800-72000	27
Moyie River	340-706800-72000	5, 20, 23, 27, 28
Mineral Lake Creek	340-706800-69800	4.3
Lamb Creek	340-706800-68200	5
Barkshanty Creek	340-706800-65900	17

ZOS were delineated as polygons on FHSI mapping products (Appendix A). Tributary mouth polygons were identified by an approximately 50 m radius semicircle polygon at the confluence of tributaries and Moyie Lake.

3.2.2 Potential Conservation Zones

It is recommended that the four productive littoral/wetland complex areas in Moyie Lake be considered for designation as conservation zones. These are located in two areas at the north end of the north basin (Segments 2 and 27), the narrows between the two basins (Segments 5, 21 and 22 as well sections of Segments 6, 20 and 23) and the northeast corner of the south basin (Segment 17). These areas have abundant aquatic vegetation, provide important habitat for fish and wildlife species and are also important components of the entire Moyie Lake ecosystem. The four areas include segments with Very High or High ecological rankings with one or two ZOS and currently remain in ≥90% natural condition. The highest priority for conservation is the Lamb Creek floodplain and wetland in Segment 5 adjacent to the narrows between the two lake basins. Designating these locations as conservation areas would protect unique and limited habitat features from habitat alteration and permanent development.

3.2.3 Comparison of 2008 and 2020 AHI Results

The AHI developed in 2008 by Schleppe (2009) was applied to the 2020 dataset to allow direct comparisons of shoreline sensitivity to be made using the same index. Table 7 summarizes the amount of shoreline area designated as Very High, High, Moderate, Low and Very Low habitat index ranking in 2008 and 2020. Detailed results by segment are provided in Schleppe (2009) for the 2008 dataset and in Appendix E for the 2020 dataset. The comparison suggested the amount of shoreline ranked Very High and High has decreased while the amount of shoreline ranked as Moderate, Low and Very Low has increased (Table 7). Reviewing the results on a segment-by-segment basis, the aquatic habitat ranking of nine segments decreased (Appendix E).

Table 7: Summary of the number of shoreline segments, shoreline length and percent of shoreline for the 2008 Aquatic Habitat Index categories for Moyie Lake. Data for 2008 is reproduced from Schleppe 2009.

Categories	2008			2020		
	# of Segments	Shoreline Length (m)	% of Shoreline	# of Segments	Shoreline Length (m)	% of Shoreline
Very High	7	8487.8	22.6	5	7691.2	20.4
High	5	12139.4	32.3	4	1614.2	4.3
Moderate	15	11350.9	30.2	17	18560.7	49.3
Low	2	2467.3	6.6	4	4506.7	12.0
Very Low	2	3139.8	8.4	3	5265.3	14.0
Total	31	37585.1	100	33	37638.0	100

Though there was a slight increase in the percent of shoreline classified as disturbed in 2020 compared with 2008 (e.g., Section 3.1.10.1), data collection, analysis and methodology changes may have influenced the aquatic habitat ranking changes more than foreshore modification between years in some segments. Segments where aquatic habitat rankings changed typically had AHI values very close to the rank breaks so though the ranking changed the actual numerical value difference was small (Appendix E). Examples of potential data/analysis discrepancies that might have affected the rankings included:

- Not all docks and groynes present in 2008 were correctly identified in the original FIM dataset (Section 4.0).
- Calculation errors were identified in the 2008 AHI analysis (e.g., some B2 values were calculated incorrectly).
- Survey timing was different, which might have led to systematic bias in select survey variables (e.g., Moyie Lake water level was very high during the June 2008 survey and percentage of overhanging vegetation may have been inflated and more aquatic vegetation may have been present in 2020 because surveys were conducted in August).
- Separation of Segment 4 into three segments (4.1, 4.2 and 4.3) in 2020 resulting in three rankings instead of one. In 2008, all 4,873 m of the segment was categorized as High aquatic habitat value whereas in 2020, when split into three segments, 310 m (one segment) were categorized as High value and 4,563 m (two segments) were categorized as Moderate habitat value.
- Revisions to the 2008 FIM dataset to correct data entry errors (e.g., missing percentages of shore types and substrates).
- Observer differences (e.g., differing evaluations of percent overhanging vegetation). And,
- Flooded terrestrial vegetation may have been inventoried as aquatic vegetation in some segments in 2008.

Examples of segments where these issues resulted in artificial changes in classification included Segment 2 (Decreased from Very High to High); Segment 6 (Decreased from High to Moderate); Segment 15 (Decreased from Moderate to Low); and Segment 18 (Decreased from Moderate to Low). Changes in shoreline modification and/or disturbance were not observed or very minor in these segments between the 2008 and 2020 FIM surveys and one or more of the data related issues mentioned above were identified during the comparison.

Examples of segments where an actual change in habitat quality between 2008 and 2020 may have influenced the change in habitat rank included:

- Segment 10 (Decreased from Low to Very Low) – new shoreline modifications including docks, retaining walls and boat launches as well as an increase percent of the segment disturbed. The rate of shoreline disturbance in this segment is estimated at approximately 18 m (0.8%) per year. See Section 3.1.10.1 for detailed description of changes observed in Segment 10.
- Segment 12 (Decreased from Moderate to Low) – new shoreline modifications including docks, retaining walls and boat launches as well as an increase percent of the segment disturbed. The rate of shoreline disturbance in this segment is estimated at approximately 21 m (0.8%) per year. See Section 3.1.10.1 for detailed description of changes observed in Segment 12.
- Segment 15 (Decreased from Moderate to Low) – new docks observed.
- Segment 18 (Decreased from Moderate to Low) – new shoreline modifications including docks and retaining walls. And,
- Segment 24 (Decreased from Very High to High) – increased substrate modification (from 15% to 30%) due to beach grooming activities.

3.3 FDG

The FDG for Moyie Lake is provided in Appendix F. The FDG is also provided under separate cover for distribution to landowners, regulators and other stakeholders.

4.0 Discussion

The initial Moyie Lake FIM survey was conducted during spring, on 3 June 2008, when water levels were at or near seasonal maximums due to spring runoff. In contrast, the more recent survey was conducted in mid-August when water levels were lower. It is possible that some shoreline characteristics were counted/inventoried differently or not observed at all due to high seasonal water levels during the 2008 survey. For example, counts of shoreline modifications might have been lower for some structures owing to them being either submerged (and hence not visible; e.g., groynes and retaining walls) or because they were not set out for the season (e.g., seasonally installed docks). Schleppe et al. (2020) suggest FIM surveys be conducted in different seasons to ensure accurate data is collected, regardless of seasonal influences. However, comparisons between FIM and re-FIM surveys need to consider the effect of season on the survey data.

The present comparison identified that the number of docks, retaining walls, boat launches and marine rails on Moyie Lake increased since 2008 as did the amount of shoreline that has been modified by beach grooming and erosion protection activities. The number of docks has nearly doubled over the past 12 years with 99 additional docks enumerated in 2020 compared to 2008. Some docks may not have been out for the season thus the counts during the 2008 FIM may have been lower than the actual number of docks that were put out in the summer. For example, docks enumerated on the southwest side of the south basin and Moyie River outflow adjacent to Braunagel Road and West Side Road (Segment 12) in 2008 (n=38) were lower than docks visible on the 2008 orthophoto imagery (n=60; Schleppe 2009). Even considering this, the number of docks has increased in the segment since 2008 as more docks were visible on 2016 orthophoto imagery (n=67) and during the 2020 re-FIM survey (n=78). Review of orthophotos and UAV images for a small section of Segment 12 within the right-of-way of Braunagel Road adjacent to the Moyie River outflow suggests the number of docks increased from 8 to 11 to 12 from 2008 to 2016 to 2020, respectively (Figure 18). Other shoreline modifications were documented within the Braunagel Road right-of-way in photos and UAV video taken during the re-FIM survey including stairs and substrate modification for pathways to access docks (Figure 18). Another area where significant shoreline development was observed over the past 12 years was a residential development on the west shore of the south basin (Segment 7) where docks observed in 2008 orthophotos (n=6) increased in 2016 orthophotos (n=14) and as inventoried during the 2020 re-FIM survey (n=16) (Figure 19). The number of retaining walls also increased between the 2008 (n=8) and 2020 (n=20) surveys but it is unknown how many retaining walls were submerged during the 2008 FIM survey.

The RDEK (2019) indicated that between 2008 and 2011 there were 14 new lots created and 61 new dwelling units constructed within the Moyie Lake area, 27 of which were adjacent to the west shoreline of the south basin (Figure 19).

Figure 18: UAV image of docks within the right-of-way of Braunagel Road (left side of image) along the Moyie River outflow (Segment 12).

Figure 19: Orthophotos of a residential development on the west shore of the south basin of Moyie Lake (Segment 7) in 2008 (left) and 2016 (right).

In general, segments of Moyie Lake that were in primarily natural condition during the 2008 survey remained in similar condition in 2020 and new shoreline modifications were observed in areas where shoreline modification had already occurred. For example, no changes were documented in the narrows between the two lakes where wetland and floodplain habitat important to a variety of fish and wildlife species resulted in the areas being ranked as Very High value habitat by the 2008 AHI (Schleppe 2008) and the same ranking was assigned by the 2020 FHSI. Other areas that were classified as being Very High value habitat by the 2008 AHI, mainly due to important stream confluences and wetland areas, remained in the same condition with no additional modification observed in 2020. One exception is that recent beach grooming activities resulted in increased substrate modification (from 15 to 30% between 2008 and 2020) along a Very High 2008 AHI value habitat shoreline on the east side of the north basin (Segment 24), and the increased disturbance resulted in the segment receiving a lower FHSI ecological value rank of High in 2020.

Overall, the FHSI Ecological Rankings changed for four segments between 2008 and 2020. The rest remained unchanged from the 2008 rank. Some of the rank changes may have been due to increased disturbance and shoreline modification observed (e.g., Segments 10 decreased from Moderate to Low and Segment 24 decreased from Very High to High) while the remaining two segment rank changes (e.g., Segments 27 and 28 increased from Moderate to High ecological ranking) were most likely due to additional criteria being included or slightly different weightings used. Differences in segment Ecological Ranks may have implications for the RDEK's existing Moyie & Area OCP Bylaw (No. 2912, 2019) that include the 2008 AHI Ecological Rankings (RDEK 2019). The Moyie & Area OCP identifies shoreline segments with Very High and High AHI rankings as Development Permit Area #2 – Moyie Lake & Monroe Lake Shoreline. The OCP provides guidance on activities that are and are not permitted in these shoreline areas and identifies where landowners are required to obtain a Development Permit prior to proceeding with any project that includes construction, addition or alteration of a building or structure, or, alteration of land, including removal of riparian or aquatic vegetation, site grading, deposition of fill, beach creation, or dredging. Updating the shoreline segment Ecological Rankings within the OCP to reflect the results of the 2020 FHSI is recommended.

Since the initial Moyie Lake FIM was conducted in 2008, natural shoreline areas have continued to be degraded. Though the overall rate at which natural shoreline areas are being converted to disturbed for the entire lake has been approximately 0.1% (38 m) per year, development pressure in the south and southwest areas of the south basin has resulted in some shoreline segments experience losses of nearly 1% of their natural area per year. This suggests that the current FDG, stewardship strategy, OCP and other government review, approval and enforcement programs do not appear to have prevented ongoing degradation of the natural condition of the lake. There also does not appear to have been any attempts to restore degraded habitat or reduce the impacts of development. Moving forward, a strategy to implement the policies and recommendations provided in the FDG and OCP should be implemented to encourage the restoration of natural features and ensure compliance with existing bylaws and guidelines.

5.0 Recommendations

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

1. **Complete shoreline surveys to document Kokanee spawning locations and tributaries.**
    a. Notes in the 2008 FIM dataset (Schleppe 2009, Appendix E, Summary of Wildlife and Vegetation Surveys) mention Kokanee spawning in Segment 24. This was the only mention of Kokanee spawning locations obtained during background literature review. Kokanee spawning locations were not included in the FHSI at this time because a comprehensive assessment was lacking, however, this information could be included in future versions of the index if data become available.
2. **Complete surveys to document additional Burbot spawning locations.**
    a. Recent spawning related studies have focused on gamete collection period and not on identifying other spawning locations. Additional spawning areas could be identified on mapping products and used to update the current dataset used in the FHSI analysis.
3. **Complete a detailed wetland inventory and classification.**
    a. Surveys are most warranted at the north end of the north basin (Segments 2 and 27), the narrows between the two basins (Segments 5, 21 and 22) and the northeast corner of the south basin (Segment 17). These productive habitat features are limited in Moyie Lake and the data available from provincial mapping resources does not appear to include the full extent of wetland habitats observed during field surveys. Wetland mapping was also recommended during the initial 2008 FIM (Schleppe 2009).
4. **Incorporate First Nations TEK.**
    a. As described in Section 2.3, this information was not available at the time of writing.
5. **Complete wildlife surveys and update the FHSI accordingly.**
    a. FHSI categories such as waterfowl, herptiles, ecosystem, etc. were not included in the current FHSI due to lack of existing and publicly available data.
6. **Update existing ZOS to reflect any new information.**
    a. Additional sensitive habitat features can be added as polygons, points or lines to the FIMP dataset and maps. A field-based tributary assessment could be conducted to update the current dataset of tributary mouth ZOS.
7. **Conduct a compliance audit of recent shoreline modification.**
    a. Determine if permits were obtained for new works documented since the 2008 surveys and evaluate if permit conditions were met. Follow-up with property owners if enforcement may be required.
8. **Update the Moyie & Area OCP Bylaw (No. 2912, 2019).**
    a. The existing OCP used the original FIMP report (specifically the Ecological Rankings assigned to shoreline segments) to guide development recommendations. Consequently, it should be updated to reflect the current ranks. For example, two segments at the north end of the north basin have been reclassified as High ecological rank and it is important to ensure sensitive habitats are protected from shoreline modification. ZOS should also be

incorporated into the bylaw and receive the same protections as red and orange shoreline segments (i.e., designation as Development Permit Area #2).

9. **Consider designating the four productive littoral/wetland complex areas in Moyie Lake as conservation zones.**

    a. Shoreline habitat in Segments 2, 5, 17, 20-23 and 27 have abundant aquatic vegetation, provide important habitat for fish and wildlife species and are also important components of the entire Moyie Lake ecosystem. The four areas are classified as Very High or High ecological rank with at least one ZOS and currently remain in ≥90% natural condition. Designating these locations as conservation areas would protect unique and limited habitat features from habitat alteration and permanent development.

10. **Develop a stewardship strategy for Moyie Lake.**

    a. The current FDG, stewardship strategy, OCP and other government review, approval and enforcement programs do not appear to have prevented ongoing degradation of the natural condition of the lake. A strategy is required to engage landowners to protect sensitive habitats, encourage the restoration of natural features and ensure compliance with existing bylaws and guidelines.

6.0 References

B.C. Conservation Data Centre (CDC). 2021. BC Species and Ecosystems Explorer. B.C. Ministry of Environment, Victoria B.C. Available: http://a100.gov.bc.ca/pub/eswp/ (January 11, 2021).

B.C. Conservation Data Centre (CDC). 2020. BC Species and Ecosystems Explorer. B.C. Ministry of Environment, Victoria B.C. Available: http://a100.gov.bc.ca/pub/eswp/ (13 December 2020).

B.C. Conservation Data Centre: CDC iMap [web application] (CDC iMap). 2020. Victoria, British Columbia, Canada. Available: http://maps.gov.bc.ca/ess/sv/cdc/ (27 November 2020).

B.C. Fisheries Inventory Data Queries (FIDQ). 2020. Single Waterbody Query. http://a100.gov.bc.ca/pub/fidq/viewSingleWaterbody.do (12 November 2020).

Caskenette, A.L., Durhack, T.C., and Enders, E.C. 2020. Review of information to guide the identification of Critical Habitat in the riparian zone for listed freshwater fishes and mussels. DFO Can. Sci. Advis. Sec. Res. Doc. 2020/049. vii + 67 p.

Chirico, A. 2019. Report: Moyie Lake Black Bullhead Capture – Public Reported. Available at: http://a100.gov.bc.ca/pub/acat/public/viewReport.do?reportId=57050.

Evans, V., S. Stephenson, and W. Warnock. 2019. 2017-2018 Lower Kootenay Burbot Summary: Moyie Lake and Kootenay Lake/River. Prepared by the B.C. Ministry of Forests, Lands, Natural Resource Operations and Rural Development, Nelson, BC. 46 p + 7 app.

Government of Canada. 2021. Species at Risk Public Registry. Environment and Climate Change Canada, Ottawa, ON. Available at: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html (January 11, 2021).

Kennedy, G. and T. Mayer. 2002. Natural And Constructed Wetlands In Canada: An Overview. Water Quality Research Journal: 295-325.

Lamson, H. and B. Phillips. 2012. Kootenay Fisheries – Field Report – Moyie Lake (South Basin). Prepared by B.C. Ministry of Forests, Lands and Natural Resource Operations. 17 p.

McPhail, J. D. 2007. The Freshwater Fishes of British Columbia. Published by the University of Alberta Press. 696 p.

Mitsch, W. J., and J.G. Gosselink. 1993. Wetlands. New York: Van Nostrand Reinhold.

National Research Council (NRC). 2002. Riparian areas: Functions and strategies for management. National Academies Press, Washington, D.C. doi:10.17226/10327.

Rice, S.P., P. Kiffney, C. Greene and G.R. Pess. 2008. River Confluences, Tributaries And The Fluvial Network. Chapter 11 - The Ecological Importance Of Tributaries And Confluences. West Sussex, England: John Wiley & Sons, Ltd. 465 pp.

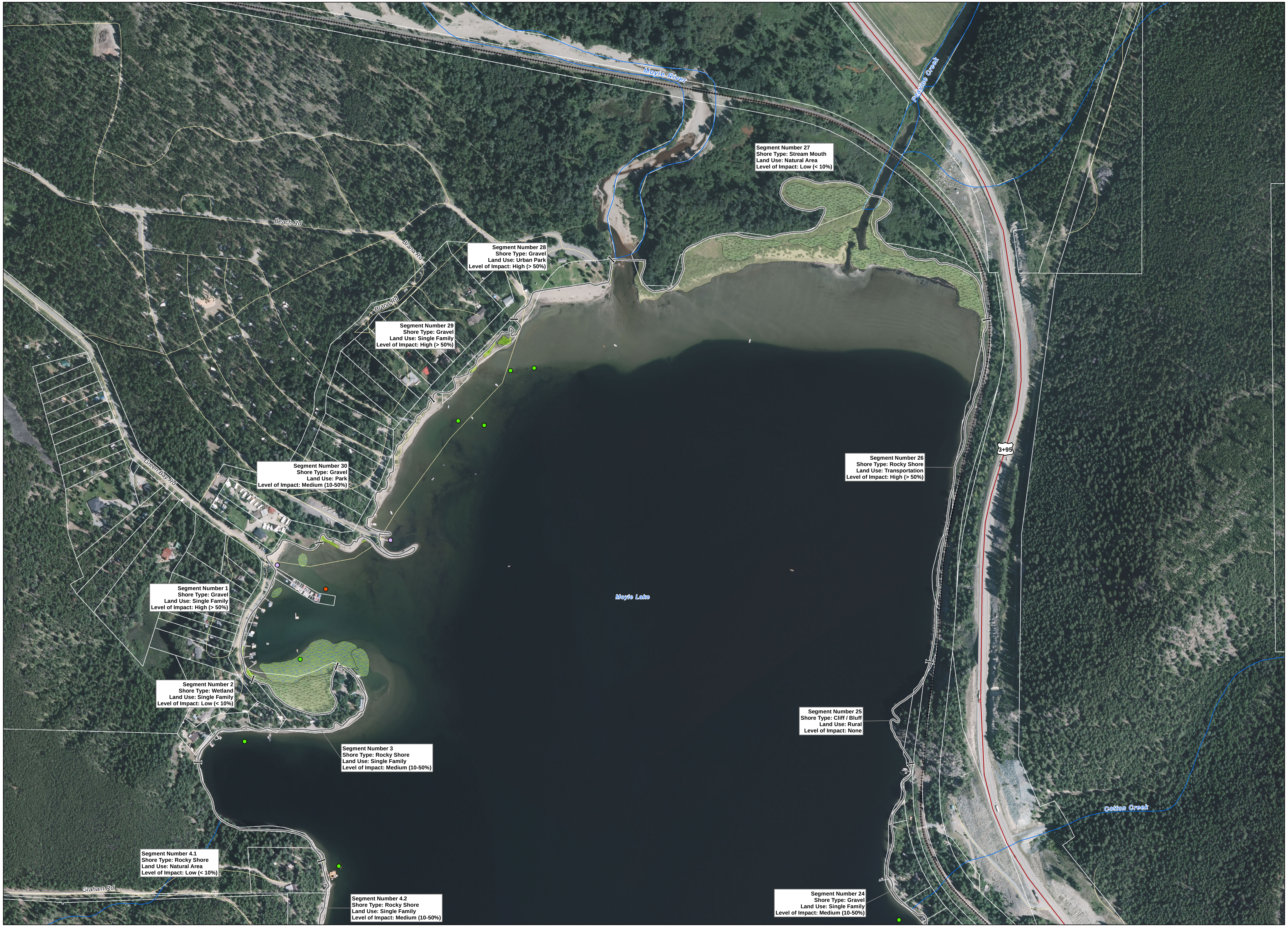
Regional District of East Kootenay (RDEK). 2019. Moyie & Area Official Community Plan Bylaw No. 2912, 2019. 49 pp. Available at: https://www.rdek.bc.ca/bylaws/ocp_zoning_landuse/ocp/moyie_area_ocp_bylaw_no_2912_2019/.

RDEK. 2020. Regional District of East Kootenay Department Mapping. Website accessed 15 December 2020: www.rdek.bc.ca/departments/mapping.

Schleppe, J. 2009. Moyie Lake Foreshore Inventory and Mapping. Ecoscape Environmental Consultants Lts. Project File: 09-371. July, 2009. Prepared for: East Kootenay Integrated Lake Management Partnership.

Schleppe, J., S. McPherson, L. Porto, and B. Mason. 2020. Draft Foreshore Integrated Management Plan Methods. Prepared for Living Lakes Canada. Prepared by: Ecoscape Environmental Consultants Ltd., Lotic Environmental Ltd., Wood Environment and Infrastructure Solutions, and BC Community Mapping Network. 52 pp. + 4 app.

Appendix A – Foreshore Inventory and Mapping (FIM) Segment Maps



CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Inventory Mapping

LEGEND:

- Shoreline Segment
- Segment Break
- Burbot Spawning Area

Modifications

- Boat Launch
- Marina
- Mooring Buoy
- Floodplain Assessment Area

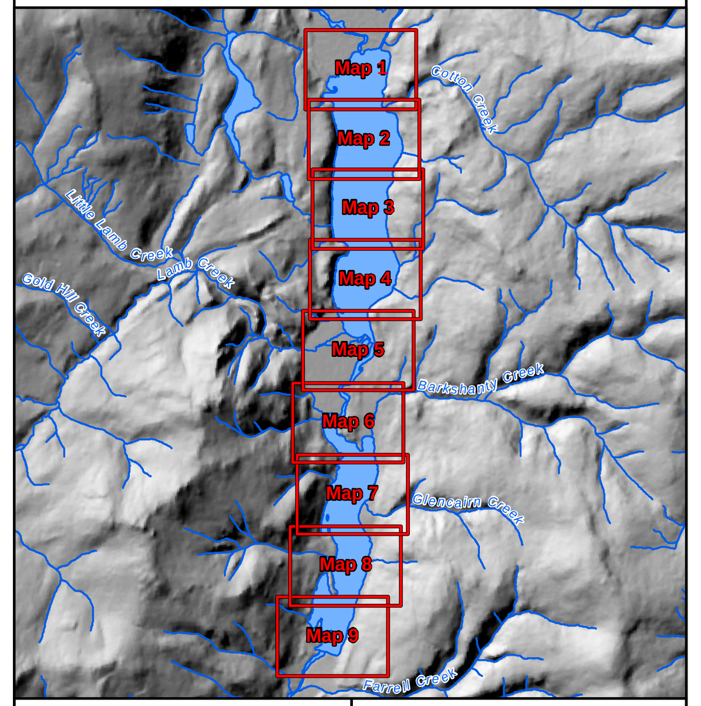
Vegetation Polygon

- Emergent Vegetation (EV)
- Flow Flood Bench (LFB)
- Floating Vegetation (FV)
- Marsh (M)
- Sparse Emergent Vegetation (SEV)

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50
Meters
Scale:1:3,000

N W E S

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

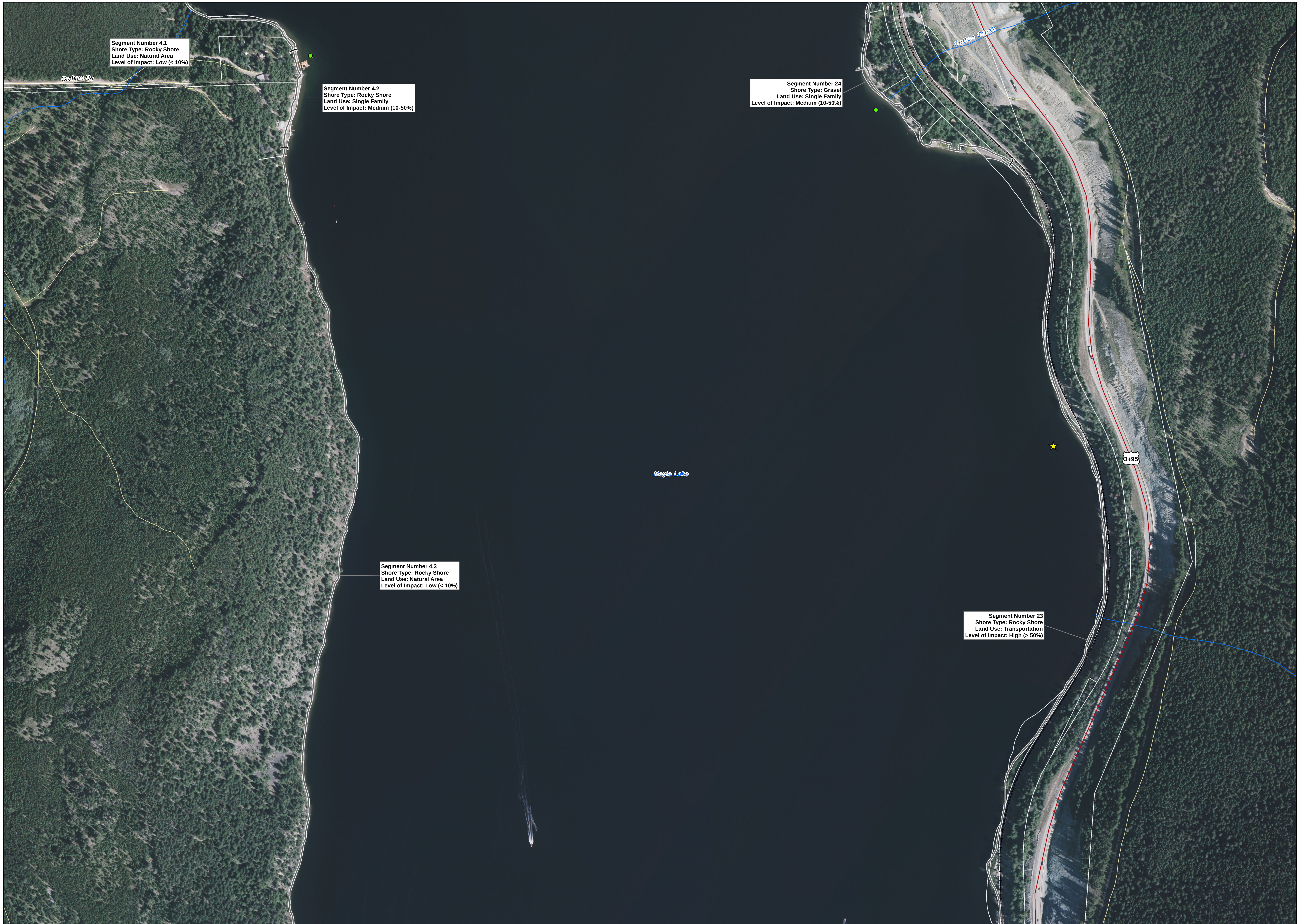
wood.

Wood PLC
4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO:	PAGE:
VE52823	1 of 9
COORDINATE SYSTEM:	DATE:
NAD 1983 UTM Zone 11N	March, 2021
ANALYST:	QA:
PK	CL

GIS FILE:
02-01-008_moyie_lake_segment_summary_maps.mxd

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-008_moyie_lake_segment_summary_maps.mxd



CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Inventory Mapping

LEGEND:

- Shoreline Segment
- Segment Break
- Burbot Spawning Area

Modifications

- Boat Launch
- Marina
- Mooring Buoy
- Floodplain Assessment Area

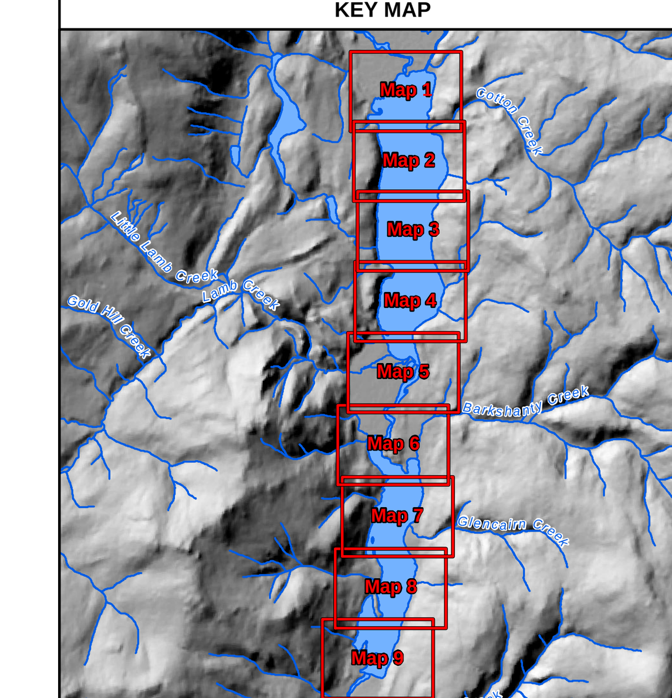
Vegetation Polygon

- Emergent Vegetation (EV)
- Flow Flood Bench (LFB)
- Floating Vegetation (FV)
- Marsh (M)
- Sparse Emergent Vegetation (SEV)

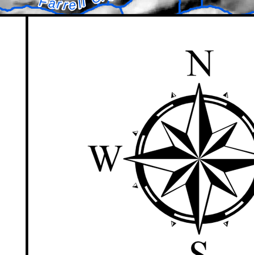
Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50
Meters
Scale:1:3,000



REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

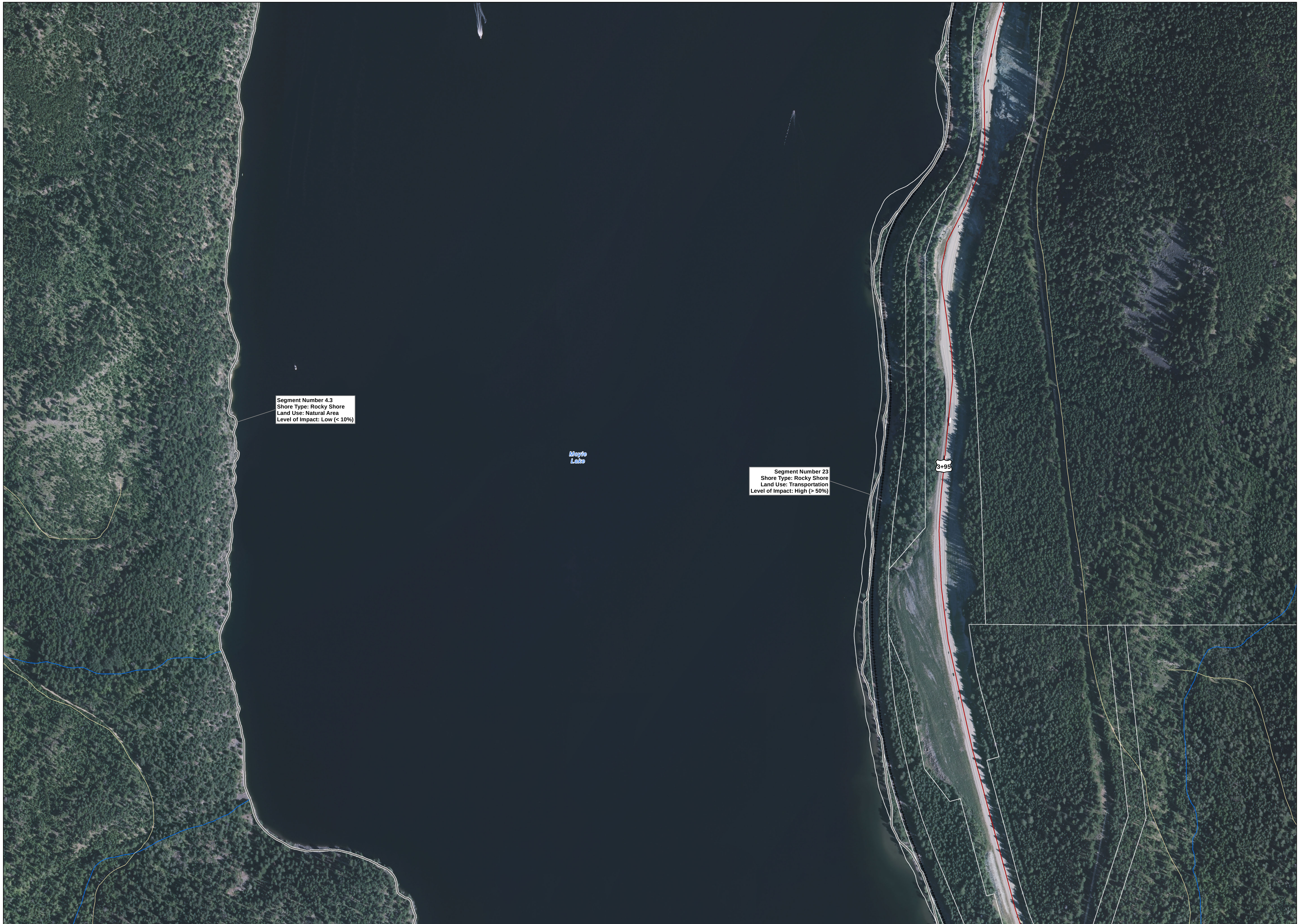
NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

Wood PLC
4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO: VE52823	PAGE: 2 of 9
COORDINATE SYSTEM: NAD 1983 UTM Zone 11N	DATE: March, 2021
ANALYST: PK	QA: CL
GIS FILE: 02-01-008_moyie_lake_segment_summary_maps.mxd	

...oyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-008_moyie_lake_segment_summary_maps.mxd



CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Inventory Mapping

LEGEND:

- Shoreline Segment
- Segment Break
- Burbot Spawning Area

Modifications

- Boat Launch
- Marina
- Mooring Buoy
- Floodplain Assessment Area

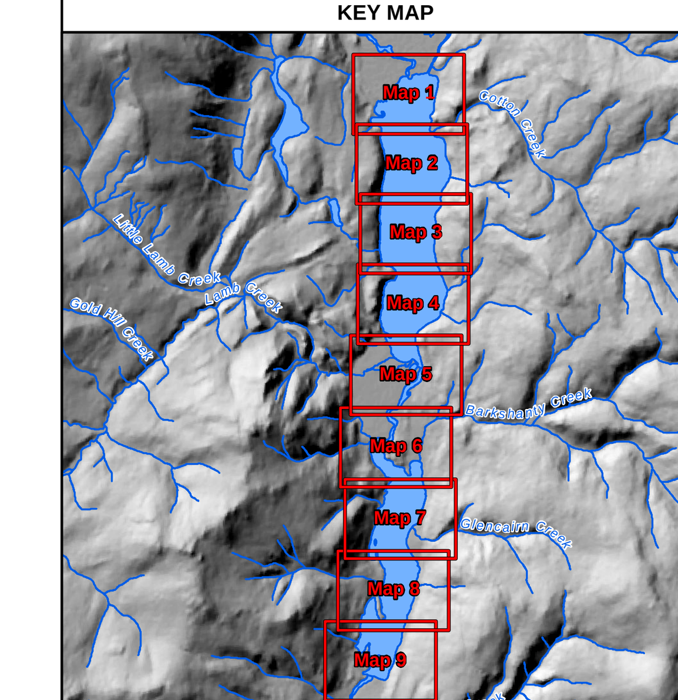
Vegetation Polygon

- Emergent Vegetation (EV)
- Flow Flood Bench (LFB)
- Floating Vegetation (FV)
- Marsh (M)
- Sparse Emergent Vegetation (SEV)

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50
Meters

Scale:1:3,000

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

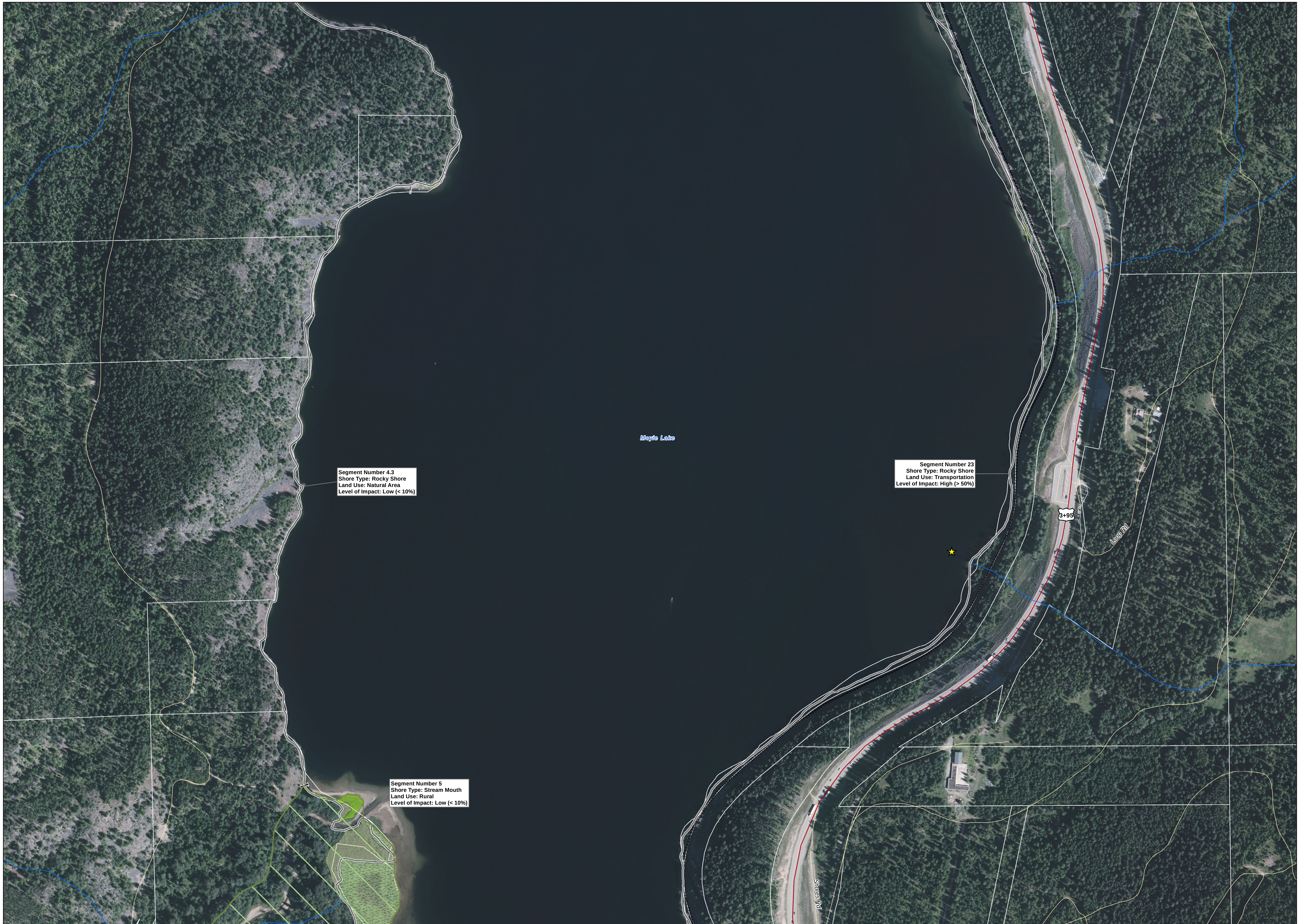
Wood PLC

4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO:	PAGE:
VE52823	3 of 9
COORDINATE SYSTEM: NAD 1983 UTM Zone 11N	DATE: March, 2021
ANALYST: PK	QA: CL

GIS FILE: 02-01-008_moyie_lake_segment_summary_maps.mxd

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-008_moyie_lake_segment_summary_maps.mxd



CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Inventory Mapping

LEGEND:

- Shoreline Segment
- Segment Break
- Burbot Spawning Area

Modifications

- Boat Launch
- Marina
- Mooring Buoy
- Floodplain Assessment Area

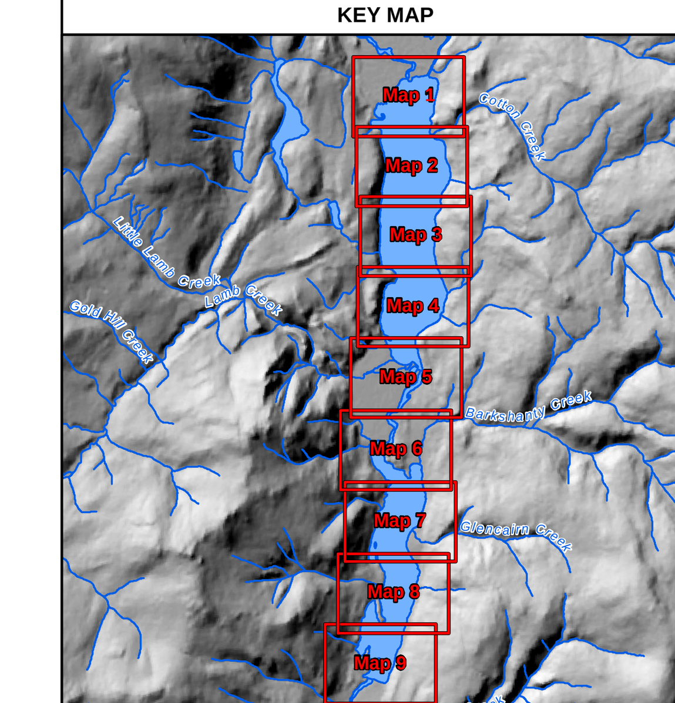
Vegetation Polygon

- Emergent Vegetation (EV)
- Flow Flood Bench (LFB)
- Floating Vegetation (FV)
- Marsh (M)
- Sparse Emergent Vegetation (SEV)

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50
Meters

Scale:1:3,000

N W E S

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

wood.

Wood PLC

4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO: VE52823	PAGE: 4 of 9
COORDINATE SYSTEM: NAD 1983 UTM Zone 11N	DATE: March, 2021
ANALYST: PK	QA: CL
GIS FILE: 02-01-008_moyie_lake_segment_summary_maps.mxd	

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-008_moyie_lake_segment_summary_maps.mxd

CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Inventory Mapping

LEGEND:

- Shoreline Segment
- Segment Break
- Burbot Spawning Area

Modifications

- Boat Launch
- Marina
- Mooring Buoy
- Floodplain Assessment Area

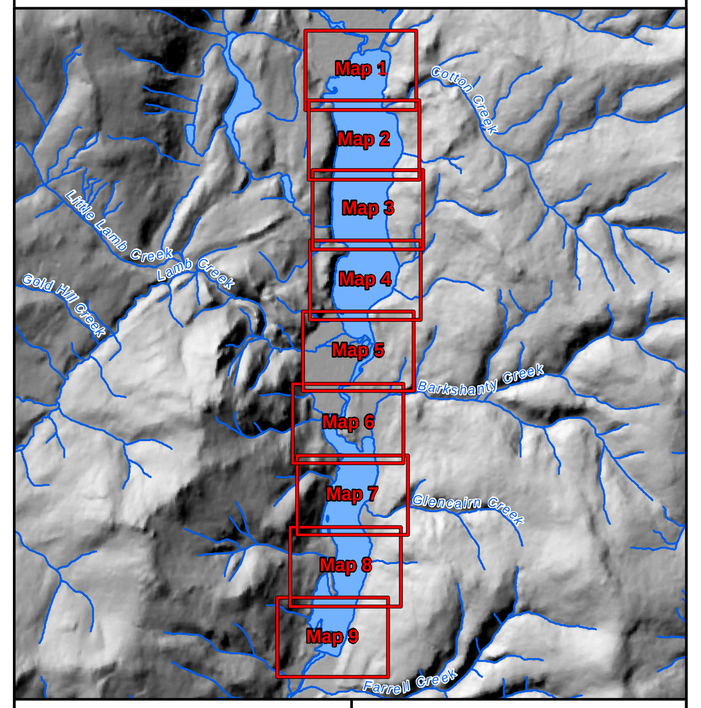
Vegetation Polygon

- Emergent Vegetation (EV)
- Flow Flood Bench (LFB)
- Floating Vegetation (FV)
- Marsh (M)
- Sparse Emergent Vegetation (SEV)

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50

Meters

Scale:1:3,000

N W E S

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

wood.

Wood PLC

4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO:	PAGE:
VE52823	5 of 9
COORDINATE SYSTEM:	DATE:
NAD 1983 UTM Zone 11N	March, 2021
ANALYST:	QA:
PK	CL

GIS FILE:

02-01-008_moyie_lake_segment_summary_maps.mxd

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-008_moyie_lake_segment_summary_maps.mxd

CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Inventory Mapping

LEGEND:

- Shoreline Segment
- Segment Break
- Burbot Spawning Area

Modifications

- Boat Launch
- Marina
- Mooring Buoy
- Floodplain Assessment Area

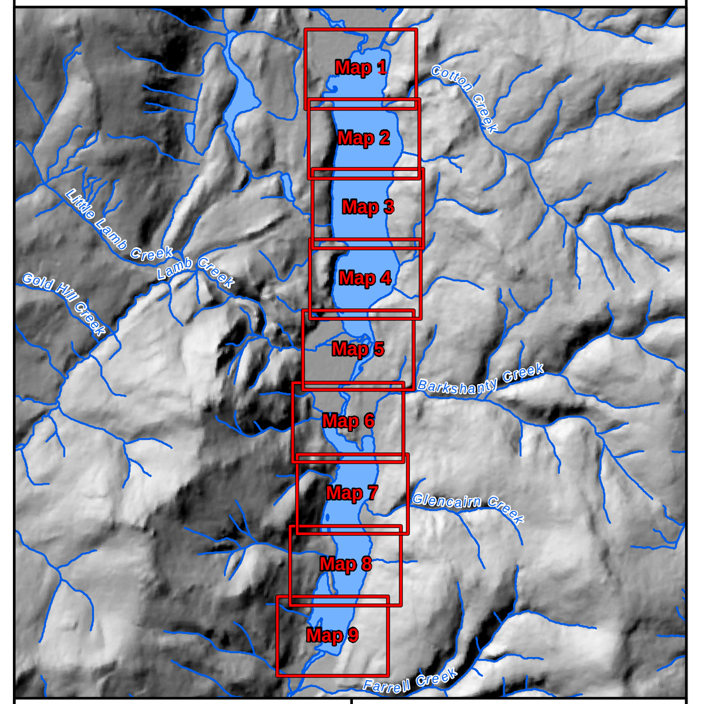
Vegetation Polygon

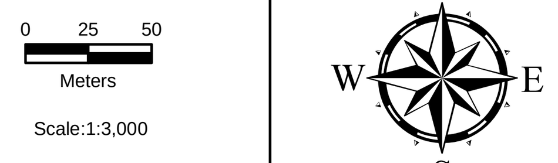
- Emergent Vegetation (EV)
- Flow Flood Bench (LFB)
- Floating Vegetation (FV)
- Marsh (M)
- Sparse Emergent Vegetation (SEV)

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP





REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

wood.

Wood PLC

4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO: VE52823	PAGE: 6 of 9
COORDINATE SYSTEM: NAD 1983 UTM Zone 11N	DATE: March, 2021
ANALYST: PK	QA: CL
GIS FILE: 02-01-008_moyie_lake_segment_summary_maps.mxd	

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-008_moyie_lake_segment_summary_maps.mxd

CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Inventory Mapping

LEGEND:

- Shoreline Segment
- Segment Break
- Burbot Spawning Area

Modifications

- Boat Launch
- Marina
- Mooring Buoy
- Floodplain Assessment Area

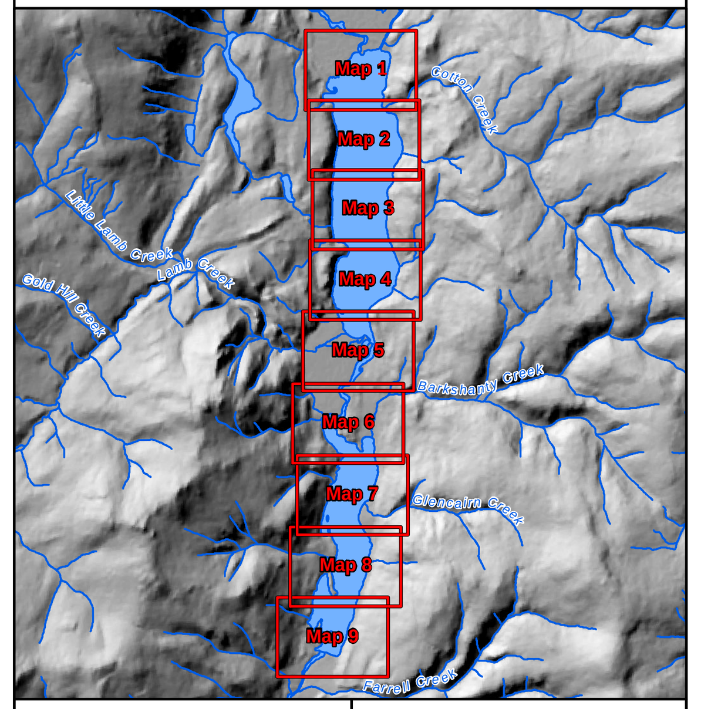
Vegetation Polygon

- Emergent Vegetation (EV)
- Flow Flood Bench (LFB)
- Floating Vegetation (FV)
- Marsh (M)
- Sparse Emergent Vegetation (SEV)

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50

Meters

Scale:1:3,000

N W E S

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

wood.

Wood PLC

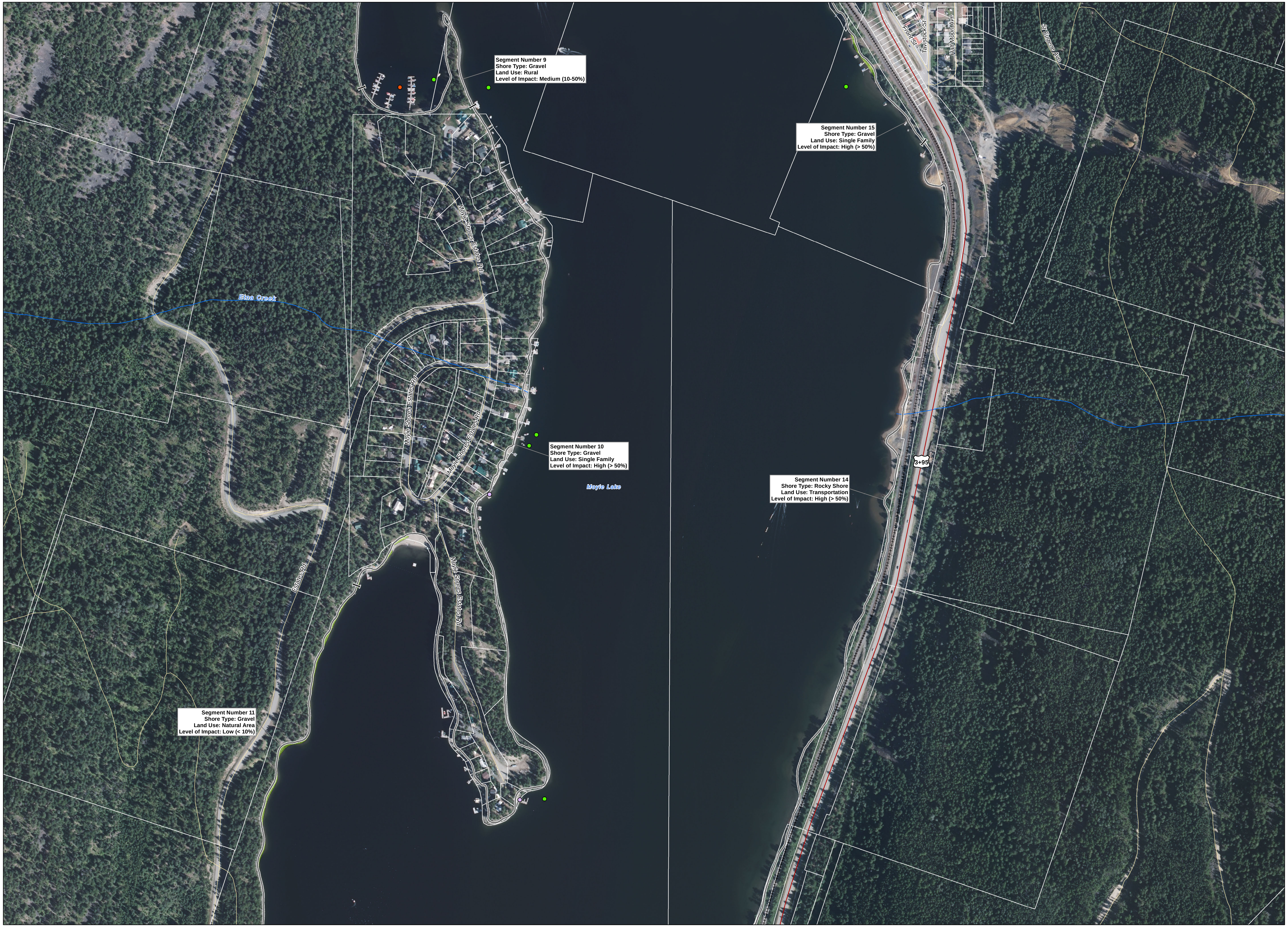
4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO:	PAGE:
VE52823	7 of 9
COORDINATE SYSTEM: NAD 1983 UTM Zone 11N	DATE: March, 2021
ANALYST: PK	QA: CL

GIS FILE:

02-01-008_moyie_lake_segment_summary_maps.mxd

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-008_moyie_lake_segment_summary_maps.mxd



CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Inventory Mapping

LEGEND:

- Shoreline Segment
- Segment Break
- Burbot Spawning Area

Modifications

- Boat Launch
- Marina
- Mooring Buoy
- Floodplain Assessment Area

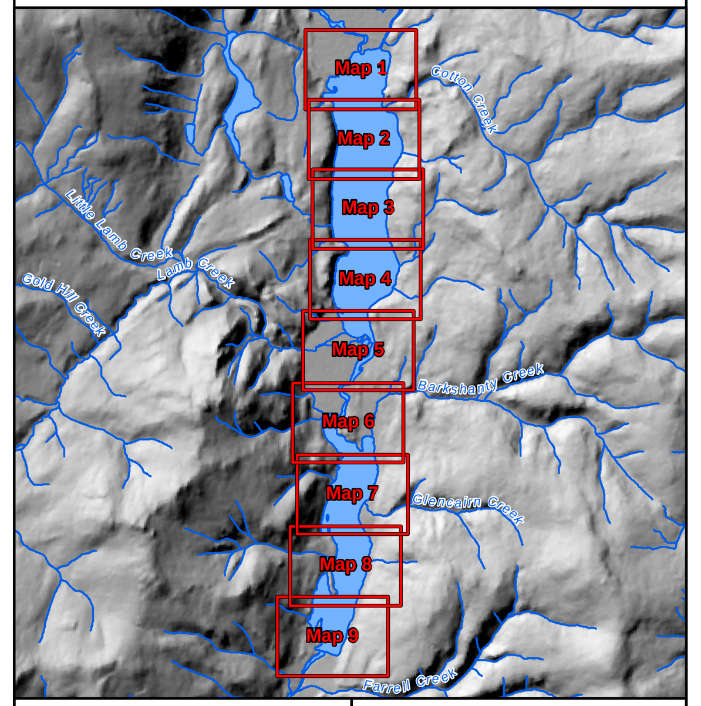
Vegetation Polygon

- Emergent Vegetation (EV)
- Flow Flood Bench (LFB)
- Floating Vegetation (FV)
- Marsh (M)
- Sparse Emergent Vegetation (SEV)

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50
Meters
Scale:1:3,000

N
W E
S

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

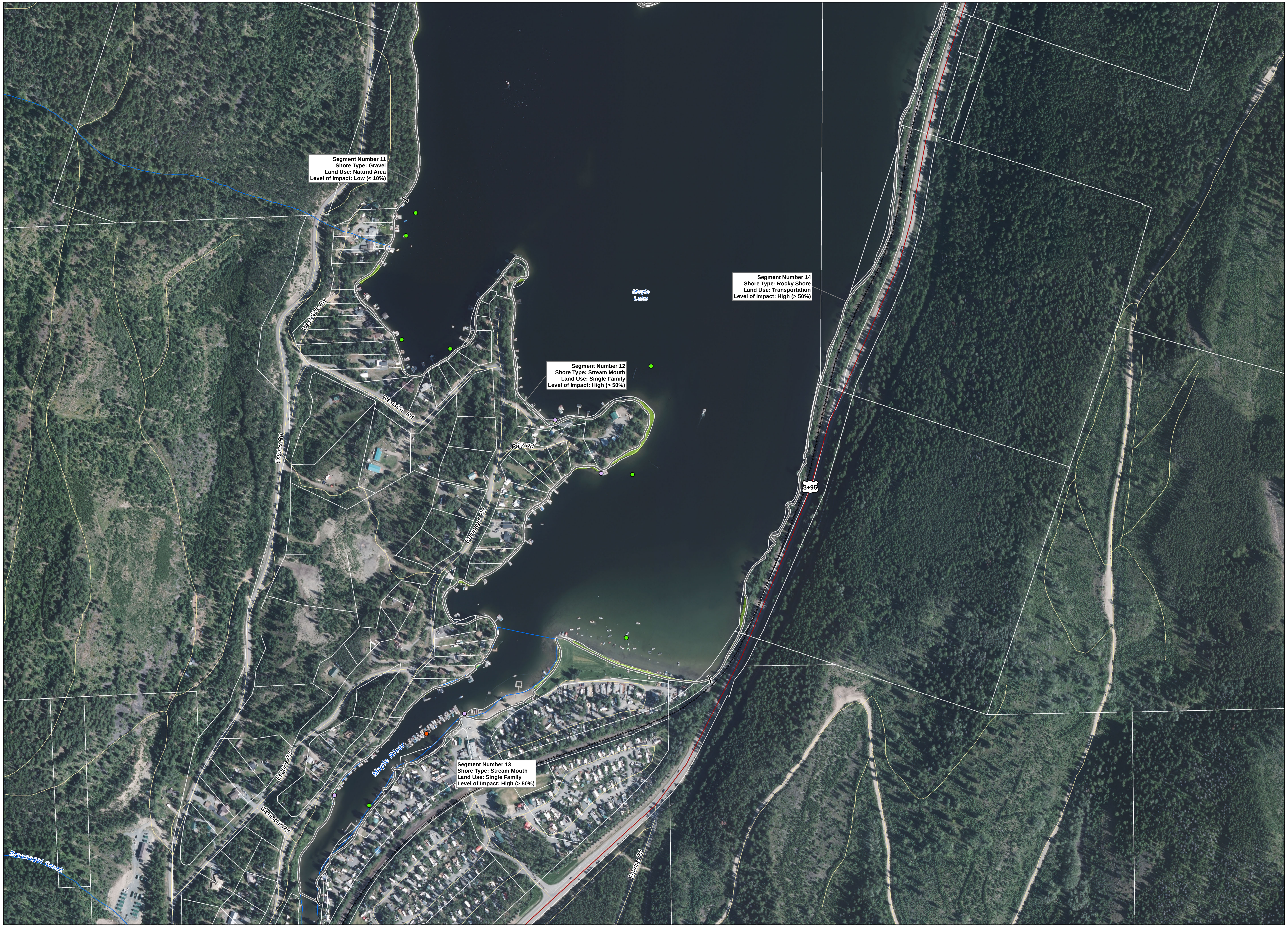
wood.

Wood PLC

4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO: VE52823	PAGE: 8 of 9
COORDINATE SYSTEM: NAD 1983 UTM Zone 11N	DATE: March, 2021
ANALYST: PK	QA: CL
GIS FILE: 02-01-008_moyie_lake_segment_summary_maps.mxd	

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-008_moyie_lake_segment_summary_maps.mxd



CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Inventory Mapping

LEGEND:

- Shoreline Segment
- Segment Break
- Burbot Spawning Area

Modifications

- Boat Launch
- Marina
- Mooring Buoy
- Floodplain Assessment Area

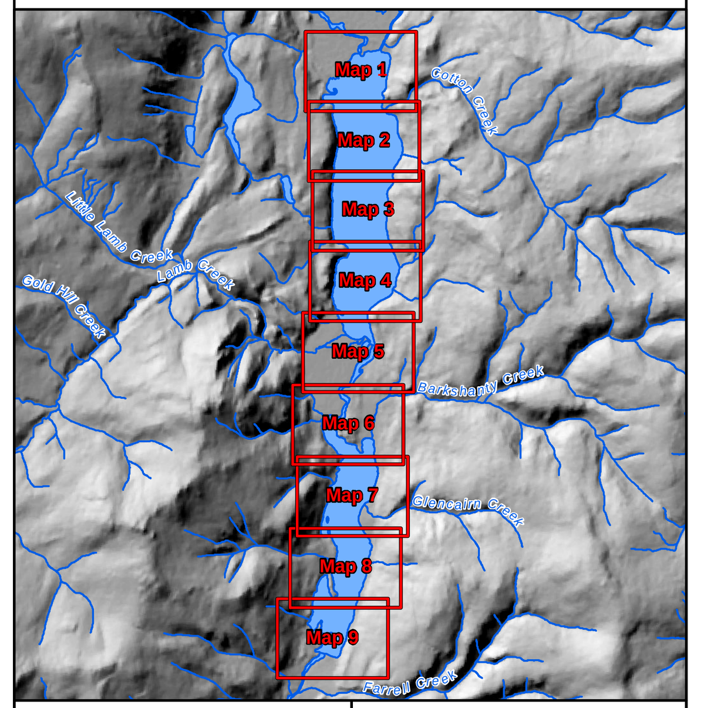
Vegetation Polygon

- Emergent Vegetation (EV)
- Flow Flood Bench (LFB)
- Floating Vegetation (FV)
- Marsh (M)
- Sparse Emergent Vegetation (SEV)

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50
Meters
Scale:1:3,000

N W E S

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

Wood PLC

4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO:	PAGE:
VE52823	9 of 9
COORDINATE SYSTEM: NAD 1983 UTM Zone 11N	DATE: March, 2021
ANALYST: PK	QA: CL
GIS FILE: 02-01-008_moyie_lake_segment_summary_maps.mxd	

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-008_moyie_lake_segment_summary_maps.mxd

Appendix B – Segment Summaries

Moyie Lake Segment 1



General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
352	Gravel	Large Marina (>20 Slips)	Low (> 5%)	Single Family	High (> 50%)	No	80%	20%	marina

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	0%	80%	20%	0%	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%	0%	0%	0%	0%	0%	0%	0%	100%	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%	60%	0%	0%	20%	0%	0%	0%	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
0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	Low (0 - 25%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Exposed Soil	Sparse	Sparse (< 10%)	Sparse (< 10%)	Patchy	20	10%	modified shoreline with road

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
Coniferous	Mature Forest	Medium (10 - 50%)	Abundant (> 50%)	Continuous	30	

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
15%	0%	0%	15%	

Large Woody Debris (LWD):

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

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Wide (> 50 m)	230	0	large littoral zone

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	Pond_Pool	Pilings	Pile Support Struct	Tram
3	5%	8	22.74	0	0	0	0	2	0	0	1	0	1	0	6	0	0	0	2	1	0	0	0	0	0

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
0%	100%	Yes	80%	5%	26 slip private marina beside Moyie Lake Provincial Park boat launch area. (South end of park); retaining wall material stonework

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
< 5 Trees	< 5 Trees	0	0	0	0	0	0	Deciduous riparian, conifers upland	

Moyie Lake Segment 2

General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
244	Wetland	None	Low (> 5%)	Single Family	Low (< 10%)	No	10%	90%	emergent sedge marsh

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%	0%	100%	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%	45%	0%	30%	15%	10%	0%	0%	0%	0%	0%	0%	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
0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	None (0%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Natural Wetland	Grass / Herb	Sparse (< 10%)	Sparse (< 10%)	Continuous	10	0%	Natural wetland section

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
Mixed Forest	Mature Forest	Medium (10 - 50%)	Abundant (> 50%)	Continuous	40	narrow emergent willow and riparian; mature cottonwoods

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
100%	25%	100%	100%	emergent sedges

Large Woody Debris (LWD):

LWD Range	Littoral LWD (#)	LWD Clusters	LWD Comment
< 5 Pieces	2	0	

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Wide (> 50 m)	230	3	large littoral zone

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	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

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
0%	100%	No	0%	0%	access road adjacent to shore

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
No	No	0	0	0	0	0	0	emergent willow and red osier dogwood in sedge marsh	

Moyie Lake Segment 3



General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
438	Rocky Shore	None	Low (> 5%)	Single Family	Medium (10-50%)	No	40%	60%	

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	80%	20%	0%	0%	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%	0%	0%	0%	0%	0%	0%	0%	100%	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%	5%	15%	0%	0%	45%	0%	0%	35%	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
0%	0%	0%	10%	30%	30%	0%	0%	30%	0%	0%	0%	0%	Low (0 - 25%)	Smooth

Vegetation Band 1:

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

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
Mixed Forest	Mature Forest	Medium (10 - 50%)	Abundant (> 50%)	Continuous	40	lodgepole pine with cottonwoods in moist areas

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
0%	0%	0%	0%	

Large Woody Debris (LWD):

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

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Medium (10 - 50 m)	20	0	

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	Pond_Pool	Pilings	Pile Support Struct	Tram
2	60%	6	13.69	0	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	60%	60%	

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
5 - 25 Trees	< 5 Trees	0	0	0	0	0	0		

Moyie Lake Segment 4.1

General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
310	Rocky Shore	None	Steep (20-60%)	Natural Area	Low (< 10%)	No	0%	100%	natural area but entire segment is private parcel

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	100%	0%	0%	0%	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%	0%	0%	0%	0%	100%	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
0%	0%	0%	0%	0%	20%	0%	0%	60%	0%	0%	20%	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
0%	0%	0%	20%	20%	20%	0%	0%	30%	0%	0%	10%	0%	Low (0 - 25%)	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	80%	

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
		N/A	Abundant (> 50%)	N/A	0	

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
0%	0%	0%	0%	

Large Woody Debris (LWD):

LWD Range	Littoral LWD (#)	LWD Clusters	LWD Comment
< 5 Pieces	2	0	

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Narrow (< 10 m)	9	0	narrow littoral zone

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	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	1	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	Flora Comments	Fauna Comments
> 25 Trees	< 5 Trees	0	0	0	0	0	0		3 merganzers

Moyie Lake Segment 4.2



General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
174	Rocky Shore	None	Steep (20-60%)	Single Family	Medium (10-50%)	No	40%	60%	2 houses; 1 on crown subdivision status; 1 on private parcel subdivision status

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	100%	0%	0%	0%	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%	0%	0%	0%	0%	0%	0%	0%	100%	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%	0%	15%	0%	0%	80%	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
0%	0%	0%	0%	10%	10%	0%	0%	80%	0%	0%	0%	0%	Low (0 - 25%)	Smooth

Vegetation Band 1:

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

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
		N/A	Abundant (> 50%)	N/A	0	

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
0%	0%	0%	0%	

Large Woody Debris (LWD):

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

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Medium (10 - 50 m)	23	0	narrow littoral zone

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	Pond_Pool	Pilings	Pile Support Struct	Tram
2	20%	3	17.22	1	0	0	0	0	7	40.17	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
0%	0%	Yes	30%	40%	All existent mods at first 2 houses at beginning of segment. retaining wall material wood

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
< 5 Trees	< 5 Trees	0	0	0	0	0	0		1 merganzer

Moyie Lake Segment 4.3



General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
4389	Rocky Shore	None	Steep (20-60%)	Natural Area	Low (< 10%)	No	2%	98%	fully natural; majority of segment is unknown parcel

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
90%	10%	0%	0%	0%	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%	0%	0%	0%	0%	100%	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
0%	0%	0%	0%	0%	0%	0%	0%	20%	0%	0%	40%	40%	Low (0 - 25%)	Angular

Littoral Substrates:

Marl	Mud	Organic	Fines	Sand	Gravel	Gravel Fine	Gravel Coarse	Cobble	Cobble Fine	Cobble Coarse	Boulder	Bedrock	Embeddedness	Shape
0%	0%	0%	0%	0%	0%	0%	0%	5%	0%	0%	50%	45%	Low (0 - 25%)	Angular

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	5%	

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
		N/A	Abundant (> 50%)	N/A	0	

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
0%	0%	0%	0%	

Large Woody Debris (LWD):

LWD Range	Littoral LWD (#)	LWD Clusters	LWD Comment
< 5 Pieces	3	0	

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Narrow (< 10 m)	8	0	narrow littoral zone

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	Pond_Pool	Pilings	Pile Support Struct	Tram
0	0%	1	0.23	0	0	0	0	0	2	0.46	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
0%	0%	Yes	2%	0%	1 additional dock beached that might have been blown to shore

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
> 25 Trees	> 25 Trees	0	0	0	0	0	0		1 osprey

Moyie Lake Segment 5



General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
4079	Stream Mouth	None	Low (> 5%)	Rural	Low (< 10%)	Yes	0%	100%	natural low flood bench in the narrows between lakes, flood plain of Lamb Creek

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	0%	0%	0%	100%	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
20%	0%	0%	0%	0%	0%	0%	0%	0%	80%	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%	40%	0%	0%	40%	15%	0%	0%	5%	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
0%	0%	50%	50%	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%)	Medium (10 - 50%)	Patchy	40	60%	emergent low flood bench riparian vegetation

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
Broadleaf	Mature Forest	Medium (10 - 50%)	Abundant (> 50%)	Patchy	10	

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
100%	20%	60%	20%	emergent sedges/grasses/willow along entire segment, patchy floating vegetation in areas

Large Woody Debris (LWD):

LWD Range	Littoral LWD (#)	LWD Clusters	LWD Comment
6 - 25 Pieces	10	0	

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Wide (> 50 m)	170	0	littoral zone spans the entire narrows

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	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

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
0%	0%	Yes	1%	1%	bridge over narrows is only mod, looks possibly not in use. Provides access to agriculture land

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
< 5 Trees	5 - 25 Trees	0	0	0	0	0	0	some cottonwood; mostly wetland	Kingfisher; mallards; Cooper’s hawk

Moyie Lake Segment 6

General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
1158	Rocky Shore	None	Medium (5-20%)	Rural	Low (< 10%)	No	3%	97%	coniferous forest, 1 house near beginning, mostly natural

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	60%	40%	0%	0%	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%	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%	15%	40%	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
0%	0%	0%	0%	0%	20%	0%	0%	75%	0%	0%	5%	0%	Low (0 - 25%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Shrubs	Tall Shrubs	Abundant (> 50%)	Medium (10 - 50%)	Continuous	5	45%	

Vegetation Band 2:

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

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
15%	0%	15%	0%	

Large Woody Debris (LWD):

LWD Range	Littoral LWD (#)	LWD Clusters	LWD Comment
6 - 25 Pieces	14	0	

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Narrow (< 10 m)	8	4	

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	Pond_Pool	Pilings	Pile Support Struct	Tram
1	0%	2	1.73	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%	Yes	1%	0%	1 dock was swim float; 2 abandoned docks on shore

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
5 - 25 Trees	> 25 Trees	0	0	0	0	0	0		

Moyie Lake Segment 7



General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
539	Gravel	Small Marina (6-20 Slips)	Medium (5-20%)	Single Family	High (> 50%)	No	99%	1%	houses/development with a few natural areas

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	40%	60%	0%	0%	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%	0%	0%	0%	0%	0%	0%	0%	100%	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%	10%	40%	0%	0%	40%	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
0%	0%	0%	0%	20%	40%	0%	0%	40%	0%	0%	0%	0%	Low (0 - 25%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Landscape / Lawn	Mature Forest	Sparse (< 10%)	Medium (10 - 50%)	Patchy	50	5%	patchy natural areas

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
		N/A	Abundant (> 50%)	N/A	0	

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
0%	0%	0%	0%	

Large Woody Debris (LWD):

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

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Medium (10 - 50 m)	10	0	

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	Pond_Pool	Pilings	Pile Support Struct	Tram
20	65%	16	29.68	0	0	0	2	0	6	11.13	7	4	1	0	14	3	0	0	7	0	0	0	0	0	0

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
0%	90%	Yes	95%	70%	retaining wall material stonework; small marina with 12 slips

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
< 5 Trees	No	0	0	0	0	0	0	patchy natural conifers left around houses	

Moyie Lake Segment 8



General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
1036	Rocky Shore	None	Medium (5-20%)	Rural	Low (< 10%)	No	5%	95%	old mine tailings at end of segment

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	40%	60%	0%	0%	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%	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%	5%	15%	0%	0%	75%	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
0%	0%	0%	0%	15%	20%	0%	0%	60%	0%	0%	5%	0%	Low (0 - 25%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Shrubs	Tall Shrubs	Medium (10 - 50%)	Medium (10 - 50%)	Continuous	5	45%	narrow riparian fringe

Vegetation Band 2:

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

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
0%	0%	0%	0%	

Large Woody Debris (LWD):

LWD Range	Littoral LWD (#)	LWD Clusters	LWD Comment
6 - 25 Pieces	13	0	

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Narrow (< 10 m)	5	8	narrow littoral zone

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	Pond_Pool	Pilings	Pile Support Struct	Tram
0	0%	1	0.97	0	0	0	0	0	0	0	0	0	0	1	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%	Yes	2%	0%	2 abandoned docks on shore; mine tailings at end of segment

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
5 - 25 Trees	> 25 Trees	0	0	0	0	0	0	Potentillia	Sandpiper; chickadee; dark eyed junco; sparrows

Moyie Lake Segment 9

General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
490	Gravel	Small Marina (6-20 Slips)	Low (> 5%)	Rural	Medium (10-50%)	No	30%	70%	mostly coniferous with intact riparian fringe and a marina

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	20%	70%	10%	0%	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%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	parcel description is Crown Provincial

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%	30%	60%	0%	0%	10%	0%	0%	0%	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
0%	0%	0%	0%	10%	20%	0%	0%	60%	0%	0%	10%	0%	Low (0 - 25%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Shrubs	Tall Shrubs	Medium (10 - 50%)	Abundant (> 50%)	Patchy	10	20%	patchy landscaped and coniferous forest areas

Vegetation Band 2:

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

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
40%	40%	0%	0%	

Large Woody Debris (LWD):

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

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Narrow (< 10 m)	10	2	

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	Pond_Pool	Pilings	Pile Support Struct	Tram
0	0%	0	0	0	0	0	0	0	0	0	0	0	1	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%	1%	Yes	40%	0%	Said 21 retain walls in old data but that is incorrect for Seg 9; large marina with 60 slips

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
< 5 Trees	5 - 25 Trees	0	0	0	0	0	0		

Moyie Lake Segment 10



General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
2126	Gravel	None	Low (> 5%)	Single Family	High (> 50%)	No	70%	30%	large houses/cottages with docks, mostly coniferous with a few deciduous trees along shore

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	20%	50%	30%	0%	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%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	All private land so removed %rural from 2008 entry

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%	50%	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
0%	0%	0%	0%	0%	50%	0%	0%	50%	0%	0%	0%	0%	Low (0 - 25%)	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%)	Patchy	50	10%	patchy landscaped and coniferous forest areas

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
		N/A	Abundant (> 50%)	N/A	0	

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
0%	0%	0%	0%	

Large Woody Debris (LWD):

LWD Range	Littoral LWD (#)	LWD Clusters	LWD Comment
< 5 Pieces	2	0	

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Narrow (< 10 m)	10	0	

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	Pond_Pool	Pilings	Pile Support Struct	Tram
45	70%	33	15.53	0	1	0	0	0	14	6.59	2	1	0	0	28	3	0	0	14	0	0	0	0	0	0

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
0%	1%	Yes	80%	80%	retaining wall material mixed

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
5 - 25 Trees	5 - 25 Trees	0	0	0	0	0	0		Muskrat observed when stopped at end of segment

Moyie Lake Segment 11

General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
816	Gravel	None	Low (> 5%)	Natural Area	Low (< 10%)	No	0%	100%	natural segment, moderate slope coniferous forest

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	40%	60%	0%	0%	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%	0%	0%	0%	0%	100%	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
0%	0%	0%	0%	10%	50%	0%	0%	40%	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
0%	0%	0%	0%	0%	50%	0%	0%	50%	0%	0%	0%	0%	Low (0 - 25%)	Smooth

Vegetation Band 1:

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

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
		N/A	Abundant (> 50%)	N/A	0	

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
0%	0%	0%	0%	

Large Woody Debris (LWD):

LWD Range	Littoral LWD (#)	LWD Clusters	LWD Comment
6 - 25 Pieces	20	0	

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Narrow (< 10 m)	8	10	

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	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

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
0%	1%	No	0%	0%	2009 had 2 marinas but likely not defined over 6 slips; 4 sheds counted were deck/platforms; 1 counted dock (new) was on shore

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
> 25 Trees	5 - 25 Trees	0	0	0	0	0	0		

Moyie Lake Segment 12



General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
2524	Stream Mouth	None	Low (> 5%)	Single Family	High (> 50%)	No	90%	10%	cottages w/ docks, coniferous forest

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	10%	10%	0%	80%	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%	0%	0%	0%	0%	0%	0%	10%	60%	30%	0%	0%	Did not update %land use and kept same as 2008 entry

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%	15%	20%	0%	0%	50%	0%	0%	15%	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
0%	0%	0%	0%	0%	40%	0%	0%	50%	0%	0%	10%	0%	Low (0 - 25%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Coniferous	Mature Forest	Sparse (< 10%)	Medium (10 - 50%)	Patchy	50	5%	

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
		N/A	Abundant (> 50%)	N/A	0	

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
10%	0%	10%	0%	

Large Woody Debris (LWD):

LWD Range	Littoral LWD (#)	LWD Clusters	LWD Comment
6 - 25 Pieces	10	0	

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Medium (10 - 50 m)	15	6	

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	Pond_Pool	Pilings	Pile Support Struct	Tram
33	60%	78	30.90	0	0	0	1	10	6	2.38	3	1	0	0	48	6	0	0	18	10	0	0	0	0	0

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
0%	5%	Yes	70%	60%	7 of total shed counts are decks/platforms; not all docks may have been out during 2009

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
< 5 Trees	< 5 Trees	0	0	0	0	0	0		1 unidentifiable duck

Moyie Lake Segment 13



General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
988	Stream Mouth	Large Marina (>20 Slips)	Bench	Single Family	High (> 50%)	No	90%	10%	trailer park on moyie river at south end of south moyie lake

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	0%	0%	0%	100%	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%	0%	0%	0%	0%	0%	0%	0%	70%	0%	30%	0%	

Foreshore Substrates:

Marl	Mud	Organic	Fines	Sand	Gravel	Gravel Fine	Gravel Coarse	Cobble	Cobble Fine	Cobble Coarse	Boulder	Bedrock	Embeddedness	Shape
0%	10%	0%	0%	15%	50%	0%	0%	25%	0%	0%	0%	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
0%	0%	0%	10%	0%	10%	0%	0%	80%	0%	0%	0%	0%	Low (0 - 25%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Coniferous	Mature Forest	Sparse (< 10%)	Medium (10 - 50%)	Patchy	50	2%	patchy remnant cottonwood / coniferous trees / riparian

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
		N/A	Abundant (> 50%)	N/A	0	

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
2%	0%	2%	0%	

Large Woody Debris (LWD):

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

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Medium (10 - 50 m)	30	10	

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	Pond_Pool	Pilings	Pile Support Struct	Tram
5	50%	3	3.04	0	1	0	0	0	0	0	1	0	1	0	5	39	0	0	0	0	0	0	0	0	0

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
0%	90%	Yes	100%	50%	retaining wall material stonework; piles of sand for beach; 2 docks are swim floats; large marina with 60 slips

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
< 5 Trees	No	1	0	0	0	0	0	inactive beaver lodge	

Moyie Lake Segment 14

General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
2601	Rocky Shore	Railway	Bench	Transportation	High (> 50%)	No	95%	5%	railroad and highway along shore

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	80%	20%	0%	0%	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%	0%	0%	0%	0%	0%	0%	0%	0%	100%	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%	0%	30%	0%	0%	20%	0%	0%	50%	0%	Medium (25 - 75%)	Blast Rock

Littoral Substrates:

Marl	Mud	Organic	Fines	Sand	Gravel	Gravel Fine	Gravel Coarse	Cobble	Cobble Fine	Cobble Coarse	Boulder	Bedrock	Embeddedness	Shape
0%	0%	0%	0%	0%	30%	0%	0%	50%	0%	0%	20%	0%	Unknown	Blast Rock

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Exposed Soil	Sparse	Medium (10 - 50%)	Sparse (< 10%)	Patchy	10	2%	mostly blast rock fill for railway, natural pockets where rail set back from lake

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
Exposed Soil	Sparse	Sparse (< 10%)	Abundant (> 50%)	Patchy	40	road and railway combined

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
0%	0%	0%	0%	

Large Woody Debris (LWD):

LWD Range	Littoral LWD (#)	LWD Clusters	LWD Comment
6 - 25 Pieces	8	0	

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Medium (10 - 50 m)	20	0	

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	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

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
100%	0%	Yes	90%	90%	immediately adjacent to shore is railway, just above that is highway

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
< 5 Trees	5 - 25 Trees	0	0	0	0	0	0		

Moyie Lake Segment 15



General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
961	Gravel	Railway	Bench	Single Family	High (> 50%)	No	80%	20%	Town of Moyie, docks along shore railroad behind

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	0%	80%	0%	20%	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%	0%	0%	0%	0%	0%	0%	0%	100%	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%	60%	0%	0%	20%	0%	0%	0%	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
0%	0%	0%	0%	0%	60%	0%	0%	40%	0%	0%	0%	0%	Low (0 - 25%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Shrubs	Tall Shrubs	Medium (10 - 50%)	Medium (10 - 50%)	Patchy	20	40%	some areas landscape, some areas tall riparian vegetation

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
Exposed Soil	Sparse	Sparse (< 10%)	Abundant (> 50%)	Patchy	30	railway

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
10%	10%	0%	0%	

Large Woody Debris (LWD):

LWD Range	Littoral LWD (#)	LWD Clusters	LWD Comment
< 5 Pieces	5	0	

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Medium (10 - 50 m)	10	0	

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	Pond_Pool	Pilings	Pile Support Struct	Tram
2	5%	35	36.40	0	0	0	1	0	7	7.28	0	0	0	0	11	2	0	0	8	0	0	0	3	0	0

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
100%	0%	Yes	40%	15%	retaining wall material wood; 3 sheds are decks/platforms

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
< 5 Trees	< 5 Trees	0	0	0	0	0	0		

Moyie Lake Segment 16

General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
1254	Gravel	Railway	Medium (5-20%)	Transportation	Medium (10-50%)	No	30%	70%	natural area with some railway at beginning and end

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	0%	100%	0%	0%	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%	0%	0%	0%	0%	0%	0%	0%	0%	100%	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%	0%	10%	0%	0%	80%	0%	0%	10%	0%	Low (0 - 25%)	Angular

Littoral Substrates:

Marl	Mud	Organic	Fines	Sand	Gravel	Gravel Fine	Gravel Coarse	Cobble	Cobble Fine	Cobble Coarse	Boulder	Bedrock	Embeddedness	Shape
0%	0%	0%	0%	0%	10%	0%	0%	80%	0%	0%	10%	0%	Low (0 - 25%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Shrubs	Tall Shrubs	Sparse (< 10%)	Abundant (> 50%)	Patchy	15	30%	low flood bench riparian community where railroad setback from lake

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
Coniferous	Young Forest	Sparse (< 10%)	Abundant (> 50%)	Continuous	35	

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
15%	15%	0%	0%	

Large Woody Debris (LWD):

LWD Range	Littoral LWD (#)	LWD Clusters	LWD Comment
< 5 Pieces	4	0	

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Medium (10 - 50 m)	15	1	

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	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

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
100%	0%	Yes	30%	30%	railway fill and impacts on first third of segment

Flora and Fauna:

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

Moyie Lake Segment 17

General:

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

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	0%	0%	0%	10%	90%	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%	50%	0%	0%	40%	10%	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
0%	50%	0%	0%	40%	10%	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%)	Abundant (> 50%)	Continuous	50	100%	well established low flood bench wetland

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
Herbs / Grasses	Grass / Herb	N/A	Abundant (> 50%)	Continuous	50	pasture or hayfield possibly

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
100%	50%	100%	30%	emergent sedges, willows, floating Potamogeton and lily, submergent Potamogeton

Large Woody Debris (LWD):

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

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Wide (> 50 m)	150	0	

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	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

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	Flora Comments	Fauna Comments
No	No	0	0	0	0	0	0		

Moyie Lake Segment 18



General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
669	Gravel	None	Medium (5-20%)	Single Family	High (> 50%)	No	75%	25%	developed area, houses in coniferous forest

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	40%	60%	0%	0%	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%	0%	0%	0%	0%	0%	0%	0%	100%	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%	10%	40%	0%	0%	50%	0%	0%	0%	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
0%	0%	0%	0%	0%	50%	0%	0%	50%	0%	0%	0%	0%	Low (0 - 25%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Coniferous	Mature Forest	Sparse (< 10%)	Abundant (> 50%)	Patchy	50	15%	imported pea gravel in front of some properties

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
		N/A	Abundant (> 50%)	N/A	0	

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
10%	10%	10%	0%	Just near wetland segment

Large Woody Debris (LWD):

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

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Medium (10 - 50 m)	20	0	

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	Pond_Pool	Pilings	Pile Support Struct	Tram
15	45%	15	22.41	0	1	0	0	0	7	10.46	0	0	0	0	6	4	2	0	8	0	0	0	0	0	0

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
0%	0%	Yes	40%	45%	retaining wall material concrete; 1 deck/platform included with a shed

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
5 - 25 Trees	< 5 Trees	0	0	0	0	0	0		

Moyie Lake Segment 19

General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
207	Cliff / Bluff	None	Steep (20-60%)	Rural	Low (< 10%)	No	1%	99%	

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
90%	10%	0%	0%	0%	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%	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%	0%	0%	0%	0%	10%	0%	0%	20%	70%	Low (0 - 25%)	Angular

Littoral Substrates:

Marl	Mud	Organic	Fines	Sand	Gravel	Gravel Fine	Gravel Coarse	Cobble	Cobble Fine	Cobble Coarse	Boulder	Bedrock	Embeddedness	Shape
0%	0%	0%	0%	0%	0%	0%	0%	30%	0%	0%	0%	70%	Low (0 - 25%)	Angular

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Coniferous	Mature Forest	Sparse (< 10%)	Medium (10 - 50%)	Continuous	50	0%	sparsly vegetated rock with coniferous pockets on deeper soils

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
		N/A	Abundant (> 50%)	N/A	0	

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
0%	0%	0%	0%	

Large Woody Debris (LWD):

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

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Narrow (< 10 m)	6	0	

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	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

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
0%	0%	No	0%	0%	very steep with little access

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
5 - 25 Trees	5 - 25 Trees	0	0	0	0	0	0		

Moyie Lake Segment 20

General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
476	Stream Mouth	None	Steep (20-60%)	Rural	Low (< 10%)	No	5%	95%	

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
50%	0%	0%	0%	50%	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%	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%	15%	45%	0%	0%	35%	0%	0%	5%	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
0%	0%	20%	0%	20%	0%	0%	0%	60%	0%	0%	0%	0%	Low (0 - 25%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Shrubs	Tall Shrubs	Medium (10 - 50%)	Abundant (> 50%)	Continuous	5	80%	narrow riparian fringe at base of coniferous bench

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
Coniferous	Mature Forest	Medium (10 - 50%)	Abundant (> 50%)	Continuous	45	

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
50%	20%	40%	0%	

Large Woody Debris (LWD):

LWD Range	Littoral LWD (#)	LWD Clusters	LWD Comment
6 - 25 Pieces	15	0	

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Medium (10 - 50 m)	20	15	

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	Pond_Pool	Pilings	Pile Support Struct	Tram
0	0%	1	2.10	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	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	Flora Comments	Fauna Comments
5 - 25 Trees	5 - 25 Trees	0	0	0	0	0	0		Sandpiper; unidentifiable duck

Moyie Lake Segment 21

General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
696	Stream Mouth	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%	100%	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%	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%	30%	40%	0%	0%	0%	30%	0%	0%	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
0%	0%	50%	50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	Medium (25 - 75%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Shrubs	Tall Shrubs	Medium (10 - 50%)	Abundant (> 50%)	Continuous	10	60%	

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
Coniferous	Mature Forest	Abundant (> 50%)	Abundant (> 50%)	Patchy	40	confierous forest

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
80%	0%	80%	10%	

Large Woody Debris (LWD):

LWD Range	Littoral LWD (#)	LWD Clusters	LWD Comment
6 - 25 Pieces	8	0	

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Medium (10 - 50 m)	30	12	

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	Pond_Pool	Pilings	Pile Support Struct	Tram
0	0%	2	2.87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	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	Flora Comments	Fauna Comments
< 5 Trees	5 - 25 Trees	0	0	0	0	0	0		

Moyie Lake Segment 22

General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
898	Stream Mouth	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%	100%	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%	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%	30%	40%	0%	0%	0%	30%	0%	0%	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
0%	0%	50%	50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	Medium (25 - 75%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Shrubs	Low Shrubs	Medium (10 - 50%)	Medium (10 - 50%)	Continuous	10	60%	narrow tall shrub riparian low flood bench

Vegetation Band 2:

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

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
90%	10%	80%	20%	emergent willows

Large Woody Debris (LWD):

LWD Range	Littoral LWD (#)	LWD Clusters	LWD Comment
6 - 25 Pieces	10	0	

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Wide (> 50 m)	55	13	littoral zone spans the entire narrows

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	Pond_Pool	Pilings	Pile Support Struct	Tram
0	0%	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	33	0	0

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
0%	1%	Yes	1%	1%	bridge across narrows

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
< 5 Trees	5 - 25 Trees	0	0	0	0	0	0		

Moyie Lake Segment 23

General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
5404	Rocky Shore	Railway	Steep (20-60%)	Transportation	High (> 50%)	No	90%	10%	railway fill slopes

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	90%	0%	0%	10%	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%	0%	0%	0%	0%	0%	0%	0%	0%	100%	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%	0%	20%	0%	0%	40%	0%	0%	40%	0%	Low (0 - 25%)	Angular

Littoral Substrates:

Marl	Mud	Organic	Fines	Sand	Gravel	Gravel Fine	Gravel Coarse	Cobble	Cobble Fine	Cobble Coarse	Boulder	Bedrock	Embeddedness	Shape
0%	0%	0%	0%	0%	20%	0%	0%	40%	0%	0%	40%	0%	Low (0 - 25%)	Angular

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Shrubs	Tall Shrubs	Medium (10 - 50%)	Sparse (< 10%)	Patchy	10	5%	patchy riparian areas with railway fill

Vegetation Band 2:

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

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
0%	0%	2%	0%	

Large Woody Debris (LWD):

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

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Medium (10 - 50 m)	10	0	

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	Pond_Pool	Pilings	Pile Support Struct	Tram
5	2%	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
100%	0%	Yes	50%	90%	retaining wall material concrete held back with rail

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
> 25 Trees	> 25 Trees	0	0	0	0	0	0		Osprey

Moyie Lake Segment 24



General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
584	Gravel	None	Low (> 5%)	Single Family	Medium (10-50%)	No	40%	60%	houses along east shoreline in front of railway

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	0%	90%	0%	10%	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%	0%	0%	0%	0%	0%	0%	0%	100%	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%	10%	40%	0%	0%	40%	0%	0%	10%	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
0%	0%	0%	0%	0%	40%	0%	0%	50%	0%	0%	10%	0%	Low (0 - 25%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Shrubs	Tall Shrubs	Abundant (> 50%)	Medium (10 - 50%)	Continuous	10	60%	

Vegetation Band 2:

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

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
0%	0%	0%	0%	

Large Woody Debris (LWD):

LWD Range	Littoral LWD (#)	LWD Clusters	LWD Comment
< 5 Pieces	5	0	

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Medium (10 - 50 m)	15	0	

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	Pond_Pool	Pilings	Pile Support Struct	Tram
0	0%	3	5.13	0	0	0	0	0	4	6.85	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
10%	0%	Yes	30%	15%	

Flora and Fauna:

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

Moyie Lake Segment 25

General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
231	Cliff / Bluff	None	Very Steep (> 60%)	Rural	None	No	0%	100%	

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
100%	0%	0%	0%	0%	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%	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%	0%	0%	0%	0%	5%	0%	0%	10%	85%	Low (0 - 25%)	Angular

Littoral Substrates:

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

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Coniferous	Sparse	Sparse (< 10%)	Medium (10 - 50%)	Patchy	50	0%	

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
		N/A	Abundant (> 50%)	N/A	0	

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
0%	0%	0%	0%	

Large Woody Debris (LWD):

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

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Narrow (< 10 m)	5	0	

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	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

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	Flora Comments	Fauna Comments
No	No	0	0	0	0	0	0		Sandpiper

Moyie Lake Segment 26

General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
603	Rocky Shore	Railway	Medium (5-20%)	Transportation	High (> 50%)	No	90%	10%	railway fill slopes

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	100%	0%	0%	0%	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%	0%	0%	0%	0%	0%	0%	0%	0%	100%	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%	10%	30%	0%	0%	10%	0%	0%	50%	0%	Low (0 - 25%)	Angular

Littoral Substrates:

Marl	Mud	Organic	Fines	Sand	Gravel	Gravel Fine	Gravel Coarse	Cobble	Cobble Fine	Cobble Coarse	Boulder	Bedrock	Embeddedness	Shape
0%	0%	0%	0%	0%	20%	0%	0%	30%	0%	0%	50%	0%	Low (0 - 25%)	Angular

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Shrubs	Low Shrubs	Abundant (> 50%)	Medium (10 - 50%)	Patchy	5	5%	railway fill slopes poorly vegetated

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
Coniferous	Young Forest	Sparse (< 10%)	Abundant (> 50%)	Continuous	45	above railway

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
5%	0%	0%	0%	

Large Woody Debris (LWD):

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

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Narrow (< 10 m)	10	0	

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	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

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
100%	0%	Yes	100%	100%	

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
No	5 - 25 Trees	0	0	0	0	0	0		

Moyie Lake Segment 27



General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
1143	Stream Mouth	None	Low (> 5%)	Natural Area	Low (< 10%)	No	0%	100%	stream confluence and flood bench wetland at north end of moyie lake

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	0%	0%	0%	60%	40%	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%	100%	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
0%	5%	0%	10%	50%	30%	0%	0%	5%	0%	0%	0%	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
0%	0%	10%	30%	50%	10%	0%	0%	0%	0%	0%	0%	0%	Low (0 - 25%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Natural Wetland	Tall Shrubs	Abundant (> 50%)	Abundant (> 50%)	Continuous	15	30%	low flood bench riparian community at stream confluence

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
Broadleaf	Mature Forest	Abundant (> 50%)	Abundant (> 50%)	Continuous	35	mature cottonwoods

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
100%	100%	0%	0%	Low water levels and no emergent veg as per 2009

Large Woody Debris (LWD):

LWD Range	Littoral LWD (#)	LWD Clusters	LWD Comment
6 - 25 Pieces	15	0	

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Wide (> 50 m)	210	5	large littoral zone

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	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

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
20%	0%	Yes	20%	0%	

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
No	5 - 25 Trees	0	0	0	0	0	0	large low flood bench wetland complex with well established riparian	

Moyie Lake Segment 28

General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
231	Gravel	None	Low (> 5%)	Urban Park	High (> 50%)	No	80%	20%	public park areas

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	0%	0%	0%	0%	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%	0%	0%	0%	0%	0%	100%	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
0%	0%	0%	0%	40%	30%	0%	0%	30%	0%	0%	0%	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
0%	0%	0%	50%	50%	0%	0%	0%	0%	0%	0%	0%	0%	Medium (25 - 75%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Landscape / Lawn	Grass / Herb	Sparse (< 10%)	Sparse (< 10%)	Patchy	50	0%	

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
		N/A	Abundant (> 50%)	N/A	0	

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
100%	100%	0%	0%	

Large Woody Debris (LWD):

LWD Range	Littoral LWD (#)	LWD Clusters	LWD Comment
< 5 Pieces	2	0	

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Wide (> 50 m)	210	0	

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	Pond_Pool	Pilings	Pile Support Struct	Tram
1	85%	0	0	0	1	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%	Yes	80%	85%	beach grooming; retaining wall material concrete; swim area delineated with float line

Flora and Fauna:

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

Moyie Lake Segment 29



General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
276	Gravel	None	Low (> 5%)	Single Family	High (> 50%)	No	80%	20%	single family development

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	0%	80%	20%	0%	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%	0%	0%	0%	0%	0%	0%	0%	100%	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%	40%	30%	0%	0%	30%	0%	0%	0%	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
0%	0%	0%	30%	35%	35%	0%	0%	0%	0%	0%	0%	0%	Low (0 - 25%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Broadleaf	Young Forest	Medium (10 - 50%)	Medium (10 - 50%)	Patchy	50	0%	patchy broadleaf forest with landscaped areas and understory

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
		N/A	Abundant (> 50%)	N/A	0	

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
100%	100%	0%	0%	

Large Woody Debris (LWD):

LWD Range	Littoral LWD (#)	LWD Clusters	LWD Comment
< 5 Pieces	2	0	

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Wide (> 50 m)	90	0	

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	Pond_Pool	Pilings	Pile Support Struct	Tram
1	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	0	0	0	0	0	0	0

Lineal Modifications:

% Rail	% Road	Substrate Mod	% Substrate Mod	% Erosion Protect	Modification Comment
0%	0%	Yes	10%	0%	

Flora and Fauna:

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

Moyie Lake Segment 30



General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
636	Gravel	None	Low (> 5%)	Park	Medium (10-50%)	No	60%	40%	moyie park and boat launch

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	0%	100%	0%	0%	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%	0%	0%	0%	0%	0%	100%	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
0%	0%	0%	0%	40%	30%	0%	0%	30%	0%	0%	0%	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
0%	0%	0%	0%	20%	20%	0%	0%	40%	0%	0%	20%	0%	Low (0 - 25%)	Smooth

Vegetation Band 1:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Overhanging Vegetation	Veg Band Comment
Shrubs	Tall Shrubs	Sparse (< 10%)	Medium (10 - 50%)	Patchy	5	0%	

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
Broadleaf	Mature Forest	Medium (10 - 50%)	Abundant (> 50%)	Continuous	45	

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
100%	100%	0%	0%	

Large Woody Debris (LWD):

LWD Range	Littoral LWD (#)	LWD Clusters	LWD Comment
< 5 Pieces	5	0	

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Wide (> 50 m)	100	1	

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	Pond_Pool	Pilings	Pile Support Struct	Tram
5	10%	1	1.57	0	0	0	0	0	1	1.57	1	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%	10%	Yes	50%	10%	retaining wall material stonework

Flora and Fauna:

Veteran Trees	Snags	Beaver Lodge	Wildlife Den	Wildlife Trail	Mineral Lick	Shellfish	Stick Nest	Flora Comments	Fauna Comments
< 5 Trees	< 5 Trees	0	0	0	0	0	0		

Moyie Lake Segment 31

General:

Segment Length (m)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
228	Gravel	None	Medium (5-20%)	Natural Area	None	No	0%	100%	small island

Shore Type:

Cliff/Bluff	Rocky	Gravel	Sand	Stream Mouth	Wetland	Other	Shore Type Comment
0%	40%	60%	0%	0%	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%	0%	0%	0%	0%	100%	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
0%	0%	0%	0%	10%	30%	0%	0%	50%	0%	0%	10%	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
0%	0%	0%	0%	0%	50%	0%	0%	50%	0%	0%	0%	0%	Low (0 - 25%)	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	10%	few scattered red osier dogwood/saskatoon/willow/rose on foreshore transitioning to mature pine / fir forest

Vegetation Band 2:

Class	Stage	Shrub Cover	Tree Cover	Distribution	Bandwidth (m)	Veg Band Comment
		N/A	Abundant (> 50%)	N/A	0	

Aquatic Vegetation:

Aquatic Vegetation	Submergent	Emergent	Floating	Aq Veg Comment
0%	0%	0%	0%	

Large Woody Debris (LWD):

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

Littoral Area:

Littoral Zone	Littoral Width	Littoral LWD (#)	Littoral Comment
Narrow (< 10 m)	6	0	

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	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

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	Flora Comments	Fauna Comments
< 5 Trees	> 25 Trees	0	0	0	0	0	0	Potentillia	

Appendix C – Foreshore Habitat Sensitivity Index (FHSI) Segment Maps


Moyie River
Pitcher Creek
Beach Rd
Green Bay Rd
Graham Rd
Moyie Lake
Cotton Creek
3+95
Segment Number 27
Shore Type: Stream Mouth
Land Use: Natural Area
Level of Impact: Low (< 10%)
FHSI Ecological Rank: Very High
Segment Number 28
Shore Type: Gravel
Land Use: Urban Park
Level of Impact: High (> 50%)
FHSI Ecological Rank: High
Segment Number 29
Shore Type: Gravel
Land Use: Single Family
Level of Impact: High (> 50%)
FHSI Ecological Rank: High
Segment Number 30
Shore Type: Gravel
Land Use: Park
Level of Impact: Medium (10-50%)
FHSI Ecological Rank: Moderate
Segment Number 26
Shore Type: Rocky Shore
Land Use: Transportation
Level of Impact: High (> 50%)
FHSI Ecological Rank: Moderate
Segment Number 1
Shore Type: Gravel
Land Use: Single Family
Level of Impact: High (> 50%)
FHSI Ecological Rank: Low
Segment Number 2
Shore Type: Wetland
Land Use: Single Family
Level of Impact: Low (< 10%)
FHSI Ecological Rank: Very High
Segment Number 3
Shore Type: Rocky Shore
Land Use: Single Family
Level of Impact: Medium (10-50%)
FHSI Ecological Rank: Moderate
Segment Number 25
Shore Type: Cliff / Bluff
Land Use: Rural
Level of Impact: None
FHSI Ecological Rank: Moderate
Segment Number 4.1
Shore Type: Rocky Shore
Land Use: Natural Area
Level of Impact: Low (< 10%)
FHSI Ecological Rank: High
Segment Number 4.2
Shore Type: Rocky Shore
Land Use: Single Family
Level of Impact: Medium (10-50%)
FHSI Ecological Rank: Moderate
Segment Number 24
Shore Type: Gravel
Land Use: Single Family
Level of Impact: Medium (10-50%)
FHSI Ecological Rank: High

CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Habitat Sensitivity Index (FHSI) Mapping

LEGEND:

- Segment Break
- Burbot Spawning Area

FHSI Rank

- Very High
- High
- Moderate
- Low and Very Low
- Floodplain Assessment Area

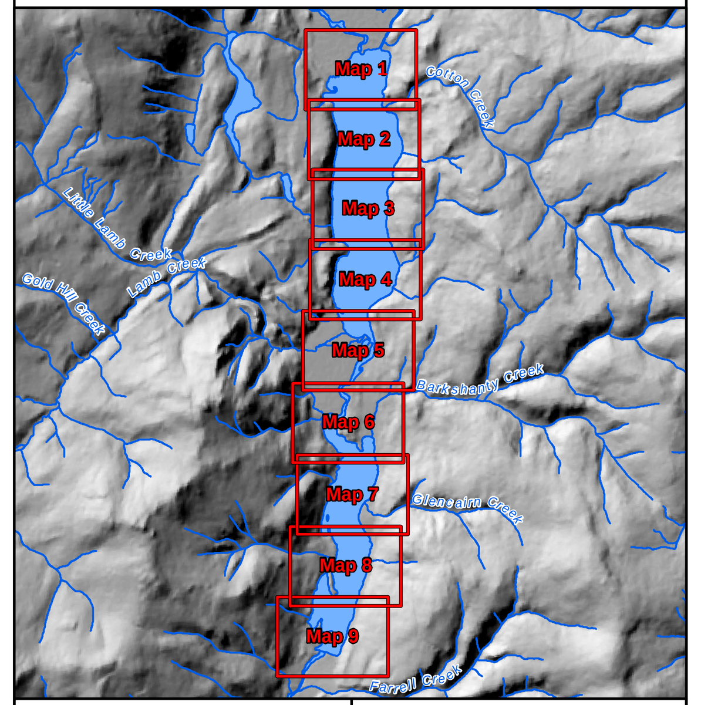
Zones of Sensitivity

- Emergent Vegetation (EV)
- Low Flood Bench (LFB)
- Floating Vegetation (FV)
- Marsh (M)
- Sparse Emergent Vegetation (SEV)
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50
Meters
Scale:1:3,000

N W E S

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

Wood PLC
4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO:	PAGE:
VE52823	1 of 9
COORDINATE SYSTEM:	DATE:
NAD 1983 UTM Zone 11N	March 2021
ANALYST:	QA:
PK	CL

GIS FILE:
02-01-012_moyie_lake_fhsi_maps.mxd

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-012_moyie_lake_fhsi_maps.mxd

CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Habitat Sensitivity Index (FHSI) Mapping

LEGEND:

- Segment Break
- Burbot Spawning Area

FHSI Rank

- Very High
- High
- Moderate
- Low and Very Low
- Floodplain Assessment Area

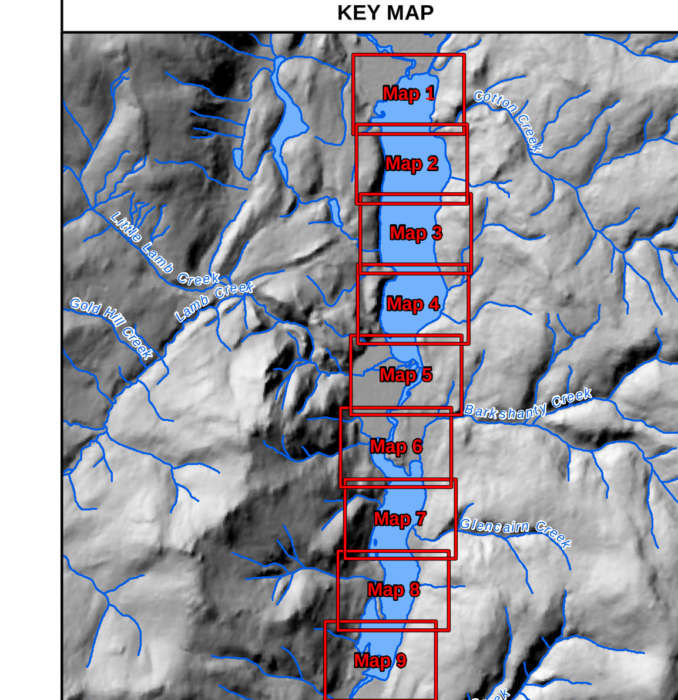
Zones of Sensitivity

- Emergent Vegetation (EV)
- Low Flood Bench (LFB)
- Floating Vegetation (FV)
- Marsh (M)
- Sparse Emergent Vegetation (SEV)
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50
Meters
Scale:1:3,000

N W E S

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

Wood PLC
4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO: VE52823	PAGE: 2 of 9
COORDINATE SYSTEM: NAD 1983 UTM Zone 11N	DATE: March 2021
ANALYST: PK	QA: CL
GIS FILE: 02-01-012_moyie_lake_fhsi_maps.mxd	

CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Habitat Sensitivity Index (FHSI) Mapping

LEGEND:

- Segment Break
- Burbot Spawning Area

FHSI Rank

- Very High
- High
- Moderate
- Low and Very Low
- Floodplain Assessment Area

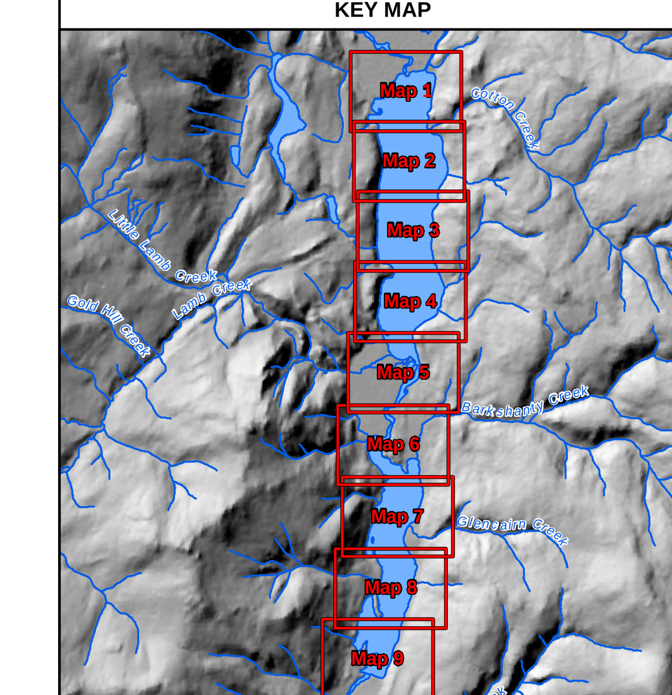
Zones of Sensitivity

- Emergent Vegetation (EV)
- Low Flood Bench (LFB)
- Floating Vegetation (FV)
- Marsh (M)
- Sparse Emergent Vegetation (SEV)
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50
Meters
Scale:1:3,000

N W E S

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

wood.

Wood PLC
4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO:	PAGE:
VE52823	3 of 9
COORDINATE SYSTEM: NAD 1983 UTM Zone 11N	DATE: March 2021
ANALYST: PK	QA: CL
GIS FILE: 02-01-012_moyie_lake_fhsi_maps.mxd	

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-012_moyie_lake_fhsi_maps.mxd

Moyie Lake

Segment Number 4.3
Shore Type: Rocky Shore
Land Use: Natural Area
Level of Impact: Low (< 10%)
FHSI Ecological Rank: High

Segment Number 23
Shore Type: Rocky Shore
Land Use: Transportation
Level of Impact: High (> 50%)
FHSI Ecological Rank: High

Segment Number 5
Shore Type: Stream Mouth
Land Use: Rural
Level of Impact: Low (< 10%)
FHSI Ecological Rank: Very High

3+95

Lagg Rd

Shore Rd

CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Habitat Sensitivity Index (FHSI) Mapping

LEGEND:

- Segment Break
- Burbot Spawning Area

FHSI Rank

- Very High
- High
- Moderate
- Low and Very Low
- Floodplain Assessment Area

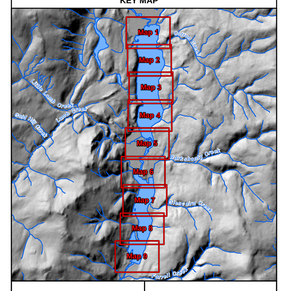
Zones of Sensitivity

- Emergent Vegetation (EV)
- Low Flood Bench (LFB)
- Floating Vegetation (FV)
- Marsh (M)
- Sparse Emergent Vegetation (SEV)
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50
Meters

Scale:1:3,000

N
W E
S

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082GG21 and 082GG31; Year: 2016

NOTE:

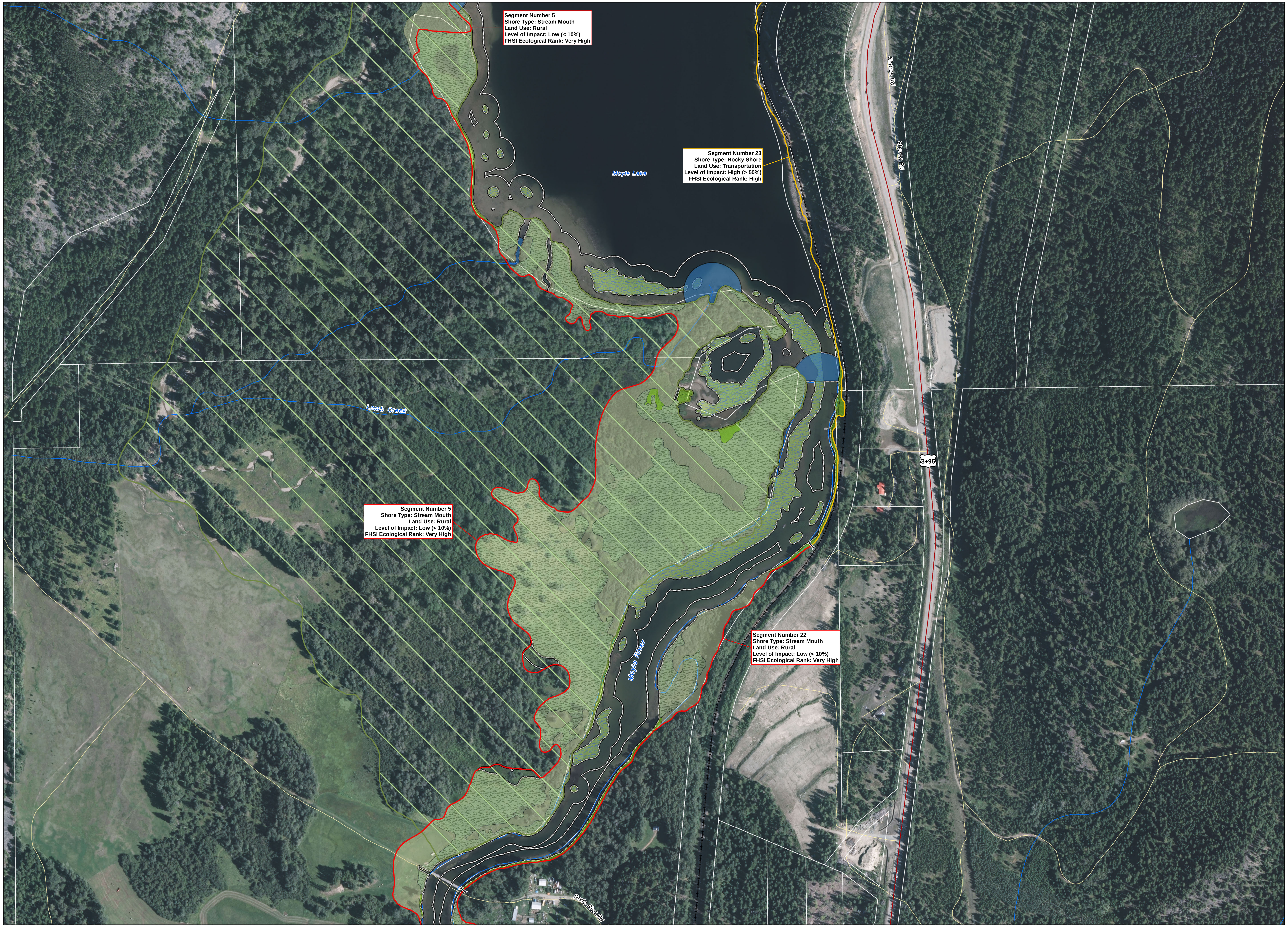
CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

wood.

Wood PLC
4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO:	PAGE:
VE52823	4 of 9
COORDINATE SYSTEM:	DATE:
NAD 1983 UTM Zone 11N	March 2021
ANALYST:	QA:
PK	CL
GIS FILE:	
02-01-012_moyie_lake_fhsi_maps.mxd	

F:\GIS\Projects\VE52823\02\01\012_moyie_lake_fhsi_maps\mxd\02-01-012_moyie_lake_fhsi_maps.mxd



CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Habitat Sensitivity Index (FHSI) Mapping

LEGEND:

- Segment Break
- Burbot Spawning Area

FHSI Rank

- Very High
- High
- Moderate
- Low and Very Low
- Floodplain Assessment Area

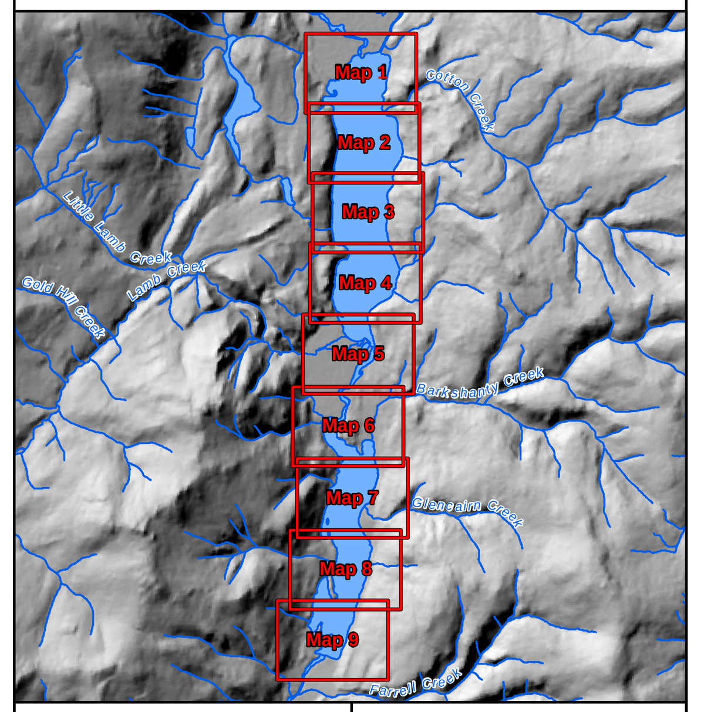
Zones of Sensitivity

- Emergent Vegetation (EV)
- Low Flood Bench (LFB)
- Floating Vegetation (FV)
- Marsh (M)
- Sparse Emergent Vegetation (SEV)
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50

Meters

Scale:1:3,000

W E S

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

wood.

Wood PLC

4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO: VE52823	PAGE: 5 of 9
COORDINATE SYSTEM: NAD 1983 UTM Zone 11N	DATE: March 2021
ANALYST: PK	QA: CL
GIS FILE: 02-01-012_moyie_lake_fhsi_maps.mxd	

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-012_moyie_lake_fhsi_maps.mxd

CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Habitat Sensitivity Index (FHSI) Mapping

LEGEND:

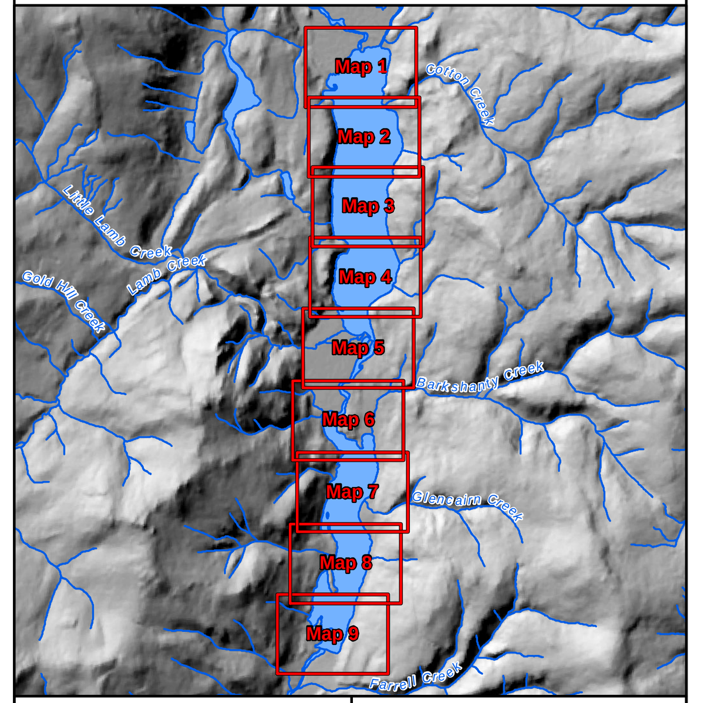
- Segment Break
- Burbot Spawning Area

FHSI Rank
- Very High
- High
- Moderate
- Low and Very Low
- Floodplain Assessment Area

Zones of Sensitivity
- Emergent Vegetation (EV)
- Low Flood Bench (LFB)
- Floating Vegetation (FV)
- Marsh (M)
- Sparse Emergent Vegetation (SEV)
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

Base Data
- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50
Meters

Scale:1:3,000

N W E S

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

wood.

Wood PLC

4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO:	PAGE:
VE52823	6 of 9
COORDINATE SYSTEM: NAD 1983 UTM Zone 11N	DATE: March 2021
ANALYST: PK	QA: CL
GIS FILE: 02-01-012_moyie_lake_fhsi_maps.mxd	

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-012_moyie_lake_fhsi_maps.mxd

CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Habitat Sensitivity Index (FHSI) Mapping

LEGEND:

- Segment Break
- Burbot Spawning Area

FHSI Rank

- Very High
- High
- Moderate
- Low and Very Low
- Floodplain Assessment Area

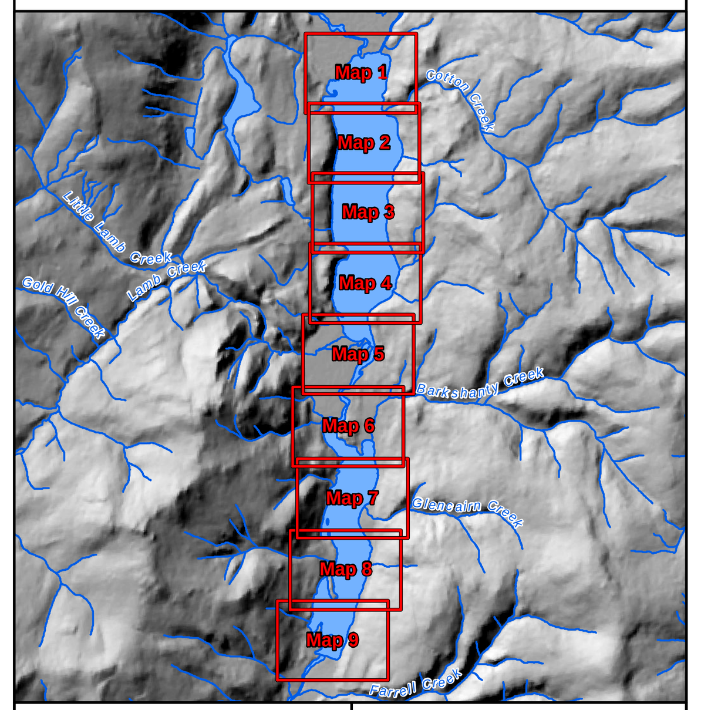
Zones of Sensitivity

- Emergent Vegetation (EV)
- Low Flood Bench (LFB)
- Floating Vegetation (FV)
- Marsh (M)
- Sparse Emergent Vegetation (SEV)
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50
Meters

Scale:1:3,000

N W E S

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

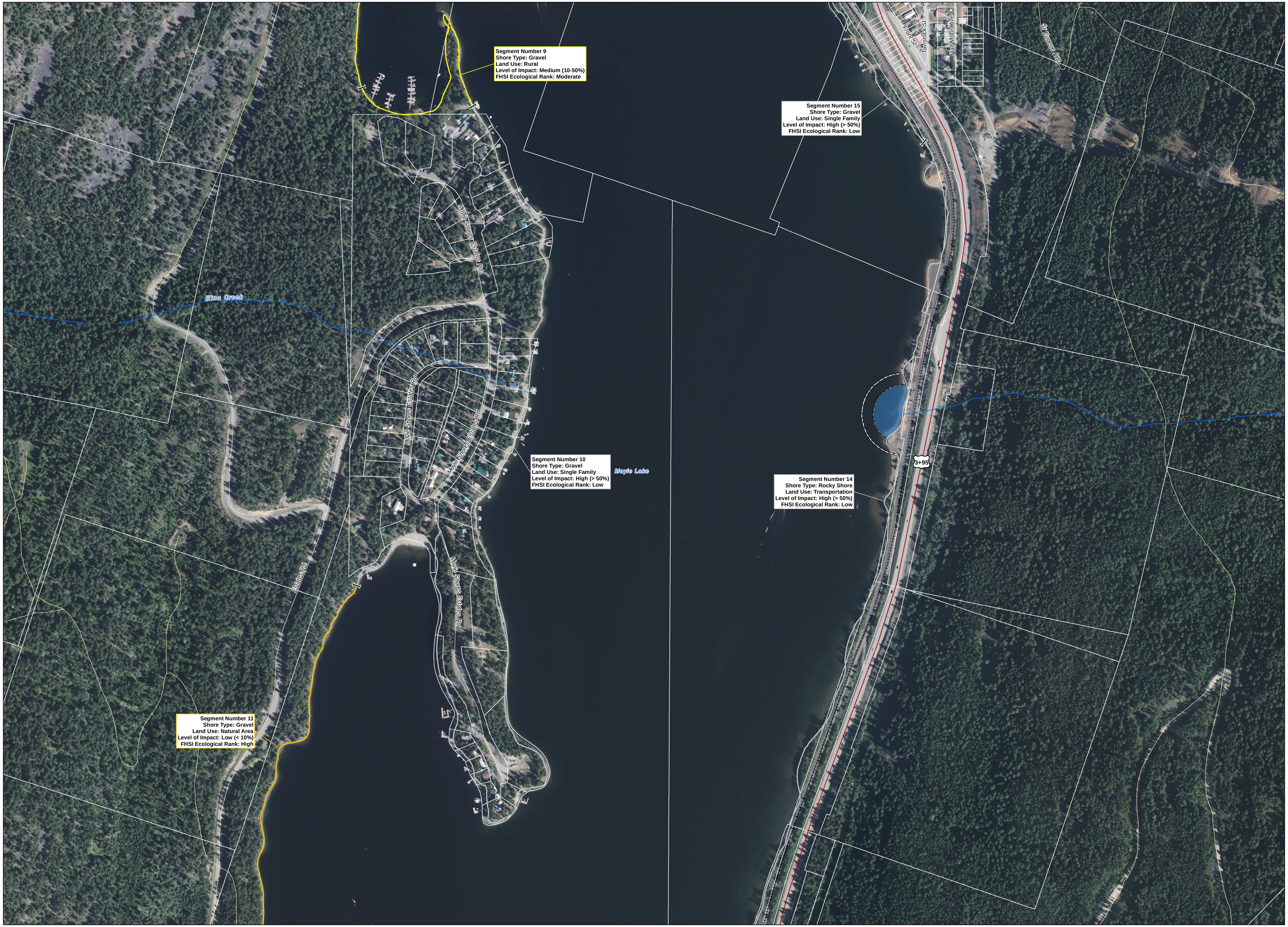
wood.

Wood PLC

4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO:	PAGE:
VE52823	7 of 9
COORDINATE SYSTEM: NAD 1983 UTM Zone 11N	DATE: March 2021
ANALYST: PK	QA: CL
GIS FILE: 02-01-012_moyie_lake_fhsi_maps.mxd	

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-012_moyie_lake_fhsi_maps.mxd



CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Habitat Sensitivity Index (FHSI) Mapping

LEGEND:

- Segment Break
- Burbot Spawning Area

FHSI Rank

- Very High
- High
- Moderate
- Low and Very Low
- Floodplain Assessment Area

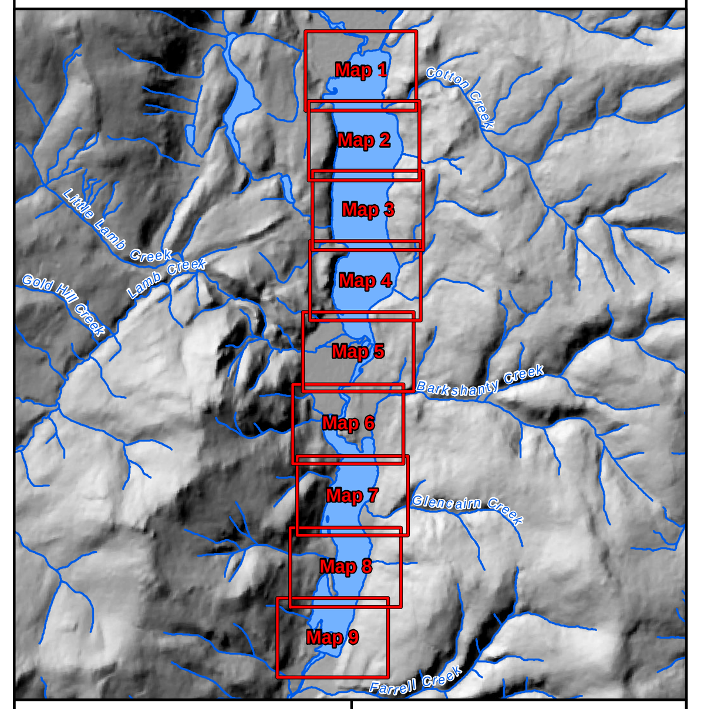
Zones of Sensitivity

- Emergent Vegetation (EV)
- Low Flood Bench (LFB)
- Floating Vegetation (FV)
- Marsh (M)
- Sparse Emergent Vegetation (SEV)
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50
Meters

Scale:1:3,000

N W E S

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

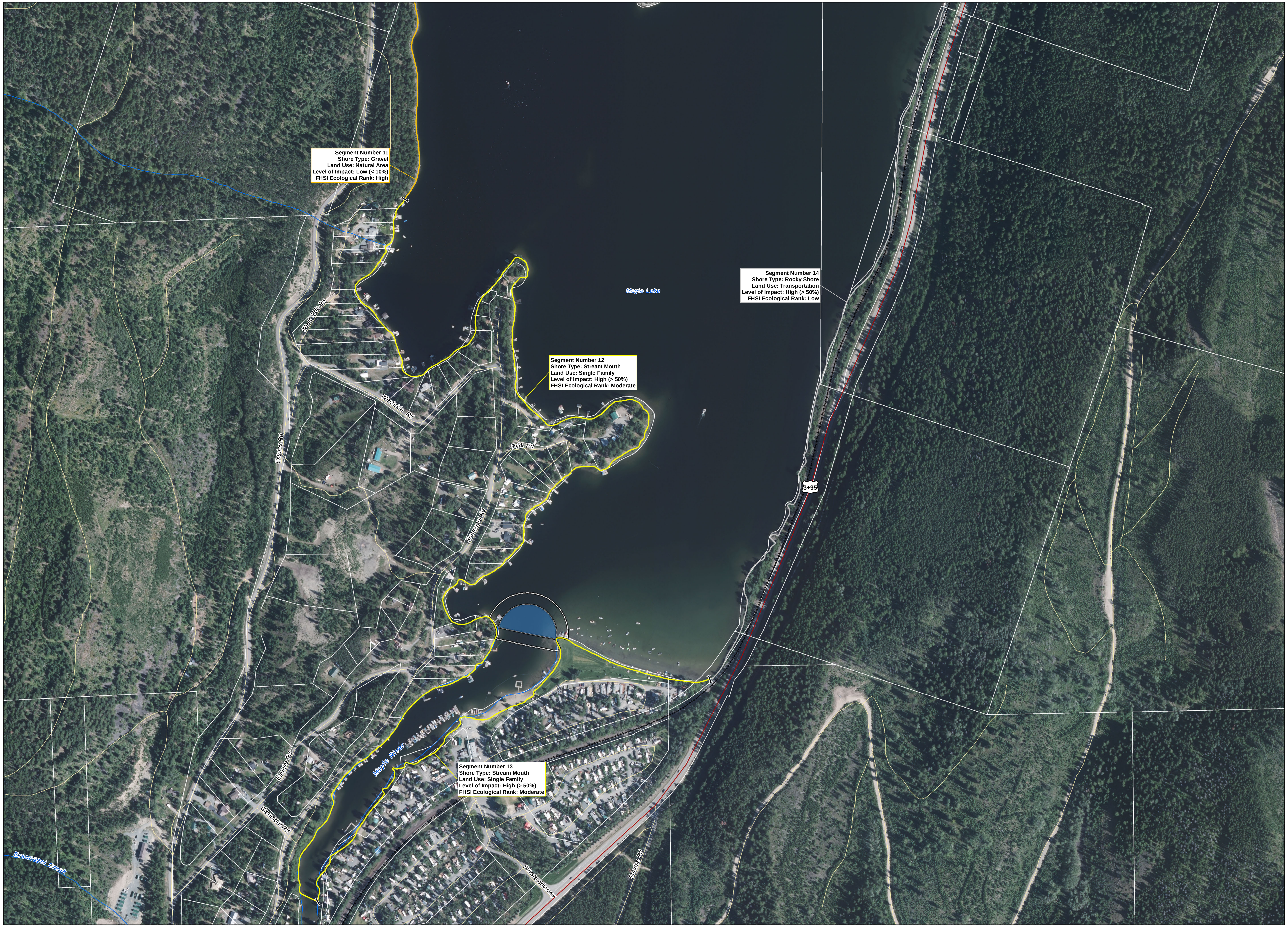
NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

Wood PLC
4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO: VE52823	PAGE: 8 of 9
COORDINATE SYSTEM: NAD 1983 UTM Zone 11N	DATE: March 2021
ANALYST: PK	QA: CL
GIS FILE: 02-01-012_moyie_lake_fhsi_maps.mxd	

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-012_moyie_lake_fhsi_maps.mxd



CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Habitat Sensitivity Index (FHSI) Mapping

LEGEND:

- Segment Break
- Burbot Spawning Area

FHSI Rank

- Very High
- High
- Moderate
- Low and Very Low
- Floodplain Assessment Area

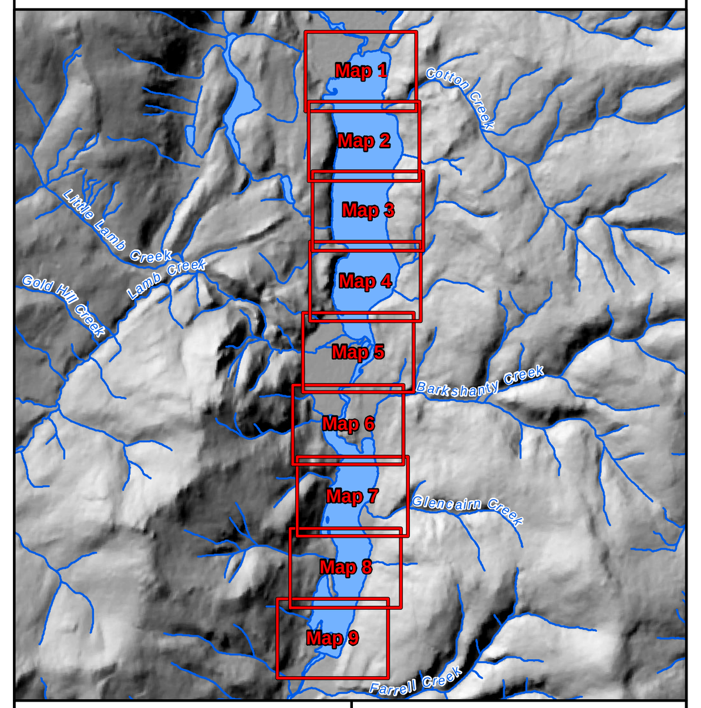
Zones of Sensitivity

- Emergent Vegetation (EV)
- Low Flood Bench (LFB)
- Floating Vegetation (FV)
- Marsh (M)
- Sparse Emergent Vegetation (SEV)
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50
Meters
Scale:1:3,000

N W E S

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

Wood PLC
4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO:	PAGE:
VE52823	9 of 9
COORDINATE SYSTEM:	DATE:
NAD 1983 UTM Zone 11N	March 2021
ANALYST:	QA:
PK	CL

GIS FILE:
02-01-012_moyie_lake_fhsi_maps.mxd

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-012_moyie_lake_fhsi_maps.mxd

Appendix D – Foreshore Habitat Sensitivity Index (FHSI) Calculations

Appendix Table D1. Moyie 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	Burbot Spawning	Staging	Juvenile Rearing	Badger Habitat	Ret Walls	Docks	Groynes	Boat Launches	Marinas
1	12.58	7.92	2.72	1.02	0.0612	0	0.328	4.32	0	0	1.9	2.5	-0.12	-3	0	-2.4	-2.4
2	17	6.028	12.24	6.8	0.408	5.4	3.28	4.32	0	0	3.8	2.5	0	0	0	0	0
3	13.6	7.964	8.16	0	0	0	3.28	4.32	0	0	1.9	2.5	-1.44	-3	0	0	0
4.1	13.6	8.448	13.6	0	0	3.24	6.56	4.32	0	0	3.8	2.5	0	0	0	0	0
4.2	13.6	8.712	8.16	0	0	0	6.56	4.32	0	0	1.9	2.5	-0.48	-3	-1.5	0	0
4.3	9.01	5.632	13.328	0	0	2.16	6.56	4.32	7.5	0	1.9	2.5	0	-1.5	-0.75	0	0
5	17	6.336	13.6	6.8	0.408	2.16	8.2	2.16	0	3.8	3.8	2.5	0	0	0	0	0
6	13.6	8.052	13.192	1.02	0.0612	4.32	1.64	4.32	0	3.8	0.38	0	0	-1.5	0	0	0
7	13.6	8.184	0.136	0	0	0	2.46	1.62	0	0	0.38	0	-1.56	-3	-1.5	-2.4	-2.4
8	13.6	8.492	12.92	0	0	5.4	1.64	4.32	0	0	0.38	0	0	-1.5	0	0	0
9	13.09	7.48	9.52	2.72	0.1632	2.16	3.28	4.32	0	0	1.9	0	0	0	0	0	-2.4
10	12.07	7.744	4.08	0	0	2.16	6.56	4.32	0	0	0.38	0	-1.68	-3	-1.125	-1.2	0
11	13.6	8.36	13.6	0	0	5.4	6.56	4.32	0	0	1.9	0	0	0	0	0	0
12	16.32	7.876	1.36	0.68	0.0408	3.24	6.56	4.32	0	3.8	3.8	0	-1.44	-3	-0.75	-1.8	0
13	17	7.964	1.36	0.136	0.00816	3.24	6.56	4.32	0	3.8	3.8	0	-1.2	-1.5	0	-1.8	-2.4
14	13.6	7.92	0.68	0	0	2.16	0.164	0.27	0	0	0.38	0	0	0	0	0	0
15	14.28	7.92	2.72	0.68	0.0408	2.16	6.56	0.27	0	0	1.9	0	-0.12	-3	-1.125	0	0
16	13.6	8.624	9.52	1.02	0.0612	2.16	4.92	4.32	0	0	0.38	0	0	0	0	0	0
17	17	6.16	12.92	6.8	0.408	0	8.2	3.24	0	3.8	3.8	0	0	0	0	0	0
18	13.6	8.36	3.4	0.68	0.0408	0	6.56	4.32	0	3.8	0.38	0	-1.08	-3	-1.5	0	0
19	9.01	4.136	13.464	0	0	0	6.56	4.32	0	3.8	0	0	0	0	0	0	0
20	12.75	8.052	12.92	3.4	0.204	5.4	1.64	4.32	0	3.8	3.8	0	0	-1.5	0	0	0
21	17	7.48	12.92	5.44	0.3264	5.4	3.28	4.32	0	3.8	3.8	0	0	-1.5	0	0	0
22	17	7.48	12.92	6.12	0.3672	5.4	3.28	5.4	0	3.8	3.8	2.5	0	0	0	0	0
23	13.94	8.096	1.36	0	0	0	3.28	4.32	7.5	3.8	1.9	5	-0.048	0	0	0	0
24	13.94	8.184	8.16	0	0	3.24	3.28	4.32	7.5	3.8	3.8	2.5	0	-2.25	-1.125	0	0
25	8.5	3.388	13.6	0	0	0	6.56	4.32	7.5	0	0	2.5	0	0	0	0	0
26	13.6	7.48	1.36	0.34	0.0204	0	1.64	4.32	7.5	3.8	1.9	5	0	0	0	0	0
27	17	6.072	13.6	6.8	0.408	5.4	4.92	5.4	0	3.8	3.8	2.5	0	0	0	0	0
28	17	7.04	2.72	6.8	0.408	3.24	2.46	1.62	0	3.8	3.8	2.5	-2.04	0	0	0	0
29	12.58	7.04	2.72	6.8	0.408	3.24	8.2	5.4	0	3.8	1.9	2.5	0	0	0	0	0
30	13.6	7.04	5.44	6.8	0.408	3.24	1.64	5.4	0	0	1.9	2.5	-0.24	-1.5	-0.75	-1.8	0
31	13.6	8.184	13.6	0	0	0	6.56	4.32	0	0	3.8	0	0	0	0	0	0

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

Segment Number	FIM	Fish	Wildlife	Modifications	FHSI Value	FHSI Rank
1	28.9492	1.9	2.5	-7.92	25.4292	Low
2	55.476	3.8	2.5	0	61.776	Very High
3	37.324	1.9	2.5	-4.44	37.284	Moderate
4.1	49.768	3.8	2.5	0	56.068	High
4.2	41.352	1.9	2.5	-4.98	40.772	Moderate
4.3	41.01	9.4	2.5	-2.25	50.66	High
5	56.664	7.6	2.5	0	66.764	Very High
6	46.2052	4.18	0	-1.5	48.8852	High
7	26	0.38	0	-10.86	15.52	Very Low
8	46.372	0.38	0	-1.5	45.252	Moderate
9	42.7332	1.9	0	-2.4	42.2332	Moderate
10	36.934	0.38	0	-7.005	30.309	Low
11	51.84	1.9	0	0	53.74	High
12	40.3968	7.6	0	-6.99	41.0068	Moderate
13	40.58816	7.6	0	-6.9	41.28816	Moderate
14	24.794	0.38	0	0	25.174	Low
15	34.6308	1.9	0	-4.245	32.2858	Low
16	44.2252	0.38	0	0	44.6052	Moderate
17	54.728	7.6	0	0	62.328	Very High
18	36.9608	4.18	0	-5.58	35.5608	Moderate
19	37.49	3.8	0	0	41.29	Moderate
20	48.686	7.6	0	-1.5	54.786	High
21	56.1664	7.6	0	-1.5	62.2664	Very High
22	57.9672	7.6	2.5	0	68.0672	Very High
23	30.996	13.2	5	-0.048	49.148	High
24	41.124	15.1	2.5	-3.375	55.349	High
25	36.368	7.5	2.5	0	46.368	Moderate
26	28.7604	13.2	5	0	46.9604	Moderate
27	59.6	7.6	2.5	0	69.7	Very High
28	41.288	7.6	2.5	-2.04	49.348	High
29	46.388	5.7	2.5	0	54.588	High
30	43.568	1.9	2.5	-4.29	43.678	Moderate
31	46.264	3.8	0	0	50.064	High

Appendix Table D3. Moyie Lake FHSI Ecological Rank Categories

FHSI Ecological Rank	FHSI Value Range
Very Low	≤21
Low	22-34
Moderate	35-47
High	48-60
Very High	≥61

Appendix E – 2008 Aquatic Habitat Index (AHI) Calculation using 2020 Data

Appendix Table E1. Moyie Lake 2020 AHI values by criteria using the 2008 AHI.

Segment Number	Biophysical					Riparian		Fisheries			Modifications				
	Shore Type	Foreshore Substrate	Percent Natural	Aquatic Vegetation	Overhanging Vegetation	Band 1	Band 2	Burbot	Staging	Rearing	RetWalls	Docks	Groynes	Boat Launch	Marinas
1	14.0	7.6	3	1.2	0.072	0.4	4.8	0	0	5	-0.25	-0.8	0	-1	-1
2	20.0	5.3	13.5	8	0.48	4	4.8	0	0	5	0	0	0	0	0
3	15.0	8.0	9	0	0	4	4.8	0	0	5	-3	-0.6	0	0	0
4.1	15.0	8.8	15	0	0	8	0	8	0	5	0.00	0	0	0	0
4.2	15.0	9.5	9	0	0	8	0	0	0	5	-1	-0.3	-0.25	0	0
4.3	10.5	5.2	14.7	0	0	8	0	0	0	5	0	-0.1	-0.25	0	0
5	20	5.7	15	8	0.48	10	2.4	0	5	5	0	0	0	0	0
6	15	8.1	14.55	1.2	0.072	2	4.8	0	5	0	0	-0.2	0	0	0
7	15	8.2	0.15	0	0	3	0	0	0	0	-3.25	-1.6	-0.25	-3	-1
8	15	9.2	14.25	0	0	2	4.8	0	0	0	0	-0.1	0	0	0
9	14.5	7	10.5	3.2	0.192	4	4.8	0	0	5	0	0	0	0	-1
10	13.5	7.4	4.5	0	0	8	0	0	0	0	-3.5	-3.3	-0.25	-2	0
11	15	8.4	15	0	0	8	0	0	0	0	0	0	0	0	0
12	19	8.1	1.5	0.8	0.048	8	0	0	5	5	-3	-4	-0.25	-3	0
13	20	7.7	1.5	0.16	0.0096	8	0	0	5	5	-2.5	-0.3	0	-1	-1
14	15	7.4	0.75	0	0	0.2	0.3	0	0	0	0	0	0	0	0
15	16	7.6	3	0.8	0.048	8	0.3	0	0	0	-0.25	-3.5	-0.25	0	0
16	15	9.4	10.5	1.2	0.072	6	4.8	0	0	0	0	0	0	0	0
17	20	5.4	14.25	8	0.48	10	3.6	0	0	5	0	0	0	0	0
18	15	8.6	3.75	0.8	0.048	8	0	0	5	0	-2.25	-1.5	-0.25	0	0
19	10.5	3.6	14.85	0	0	8	0	0	5	0	0	0	0	0	0
20	15	8	14.25	4	0.24	2	4.8	0	5	0	0	-0.1	0	0	0
21	20	7.4	14.25	6.4	0.384	4	4.8	0	5	5	0	-0.2	0	0	0
22	20	7.4	14.25	7.2	0.432	4	6	0	5	5	0	0	0	0	0
23	15.5	8	1.5	0	0	4	4.8	8	5	5	-0.1	0	0	0	0
24	15.5	8.2	9	0	0	4	4.8	8	5	5	0	-0.3	-0.25	0	0
25	10	2.8	15	0	0	8	0	8	0	0	0	0	0	0	0
26	15	6.8	1.5	0.4	0.024	2	4.8	8	5	5	0	0	0	0	0
27	20	5.6	15	8	0.48	6	6	0	5	5	0	0	0	0	0
28	20	7	3	8	0.48	3	0	0	5	5	-4.25	0	0	0	0
29	14	7	3	8	0.48	10	0	0	5	0	0	0	0	0	0
30	15	7	6	8	0.48	2	6	0	0	5	-0.5	-0.1	-0.25	-1	0
31	15	8.4	15	0	0	8	0	0	0	5	0	0	0	0	0

Note: Calculated values were higher than maximum possible in shaded cells; calculated value was replaced with maximum point possible.

Appendix Table E2. Moyie Lake 2020 AHI values by category and rank using the 2008 AHI.

Segment	Biophysical	Fish	Riparian	Modifications	2020 AHI Value	2020 AHI Rank
1	25.872	5	5.2	-3.05	33.022	Low
2	47.28	5	8.8	0	61.08	High
3	32	5	8.8	-3.6	42.2	Moderate
4.1	38.8	13	8	0	59.8	High
4.2	33.5	5	8	-1.55	44.95	Moderate
4.3	30.4	5	8	-0.35	43.05	Moderate
5	49.18	10	12.4	0	71.58	Very High
6	38.922	5	6.8	-0.2	50.522	Moderate
7	23.35	0	3	-9.1	17.25	Very Low
8	38.45	0	6.8	-0.1	45.15	Moderate
9	35.392	5	8.8	-1	48.192	Moderate
10	25.4	0	8	-9.05	24.35	Very Low
11	38.4	0	8	0	46.4	Moderate
12	29.448	10	8	-10.25	37.198	Low
13	29.3696	10	8	-4.8	42.5696	Moderate
14	23.15	0	0.5	0	23.65	Very Low
15	27.448	0	8.3	-4	31.748	Low
16	36.172	0	10.8	0	46.972	Moderate
17	48.13	5	13.6	0	66.73	Very High
18	28.198	5	8	-4	37.198	Low
19	28.95	5	8	0	41.95	Moderate
20	41.49	5	6.8	-0.1	53.19	High
21	48.434	10	8.8	-0.2	67.034	Very High
22	49.282	10	10	0	69.282	Very High
23	25	18	8.8	-0.1	51.7	Moderate
24	32.7	18	8.8	-0.55	58.95	High
25	27.8	8	8	0	43.8	Moderate
26	23.724	18	6.8	0	48.524	Moderate
27	49.08	10	12	0	71.08	Very High
28	38.48	10	3	-4.25	47.23	Moderate
29	32.48	5	10	0	47.48	Moderate
30	36.48	5	8	-1.85	47.63	Moderate
31	38.4	5	8	0	51.4	Moderate

Appendix E3. Moyie Lake 2008 AHI ranks presented in Schleppe (2009) and summary of rank changes between 2008 and 2020.

Segment	2008 AHI Rank	Rank Change from 2008 to 2020
1	Low	-
2	Very High	Down
3	Moderate	-
4	High	n/a
		n/a
		n/a
5	Very High	-
6	High	Down
7	Very Low	-
8	Moderate	-
9	Moderate	-
10	Low	Down
11	Moderate	-
12	Moderate	Down
13	Moderate	-
14	Very Low	-
15	Moderate	Down
16	Moderate	-
17	Very High	-
18	Moderate	Down
19	Moderate	-
20	High	-
21	Very High	-
22	Very High	-
23	High	Down
24	Very High	Down
25	Moderate	-
26	Moderate	-
27	Very High	-
28	Moderate	-
29	Moderate	-
30	Moderate	-
31	High	Down

Notes: "-" = no change; "n/a" = comparison not applicable

Appendix E4. Moyie Lake 2008 AHI rank breaks.

AHI Ecological Rank	AHI Value Range
Very Low	0-27
Low	28-39
Moderate	40-51
High	52-63
Very High	≥64

Appendix F – Foreshore Development Guidelines (FDG)

Foreshore Development Guide

Moyie Lake

Prepared For:

Living Lakes Canada

March 2021

Suggested Citation

McPherson, S.[1], J. Schleppe[2], C. Lawrence[3] and L. Porto[3]. 2021. Foreshore Development Guide – Moyie Lake. Prepared for Living Lakes Canada. Original template prepared by Lotic Environmental Ltd.[1] and Ecoscape Environmental Consultants Ltd.[2] Updated for Moyie Lake by Wood Environment & Infrastructure[3].

Acknowledgements

This project would not have been realized without the assistance and contributions from the following individuals:

- Heather Leschied, Operations Director, Living Lakes Canada
- Ryan Cloutier, Acting Project Manager, Living Lakes Canada
- Bruce MacDonald, Project Director, Living Lakes Canada

This project was completed in coordination with:

- Fisheries and Oceans Canada
- 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

TABLE OF CONTENTS

Figures

Tables

Appendices

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)
Email: info@rdek.bc.ca

First Nations - The following should be contacted for any works that require First Nation engagement.

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

Shuswap Indian Band
Phone: 1-250-341-3678
Email: reception@shuswapband.ca

2.1 First Nations Traditional Ecological Knowledge (TEK)

First Nations Traditional Ecological Knowledge (TEK) was not obtained for Moyie 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.

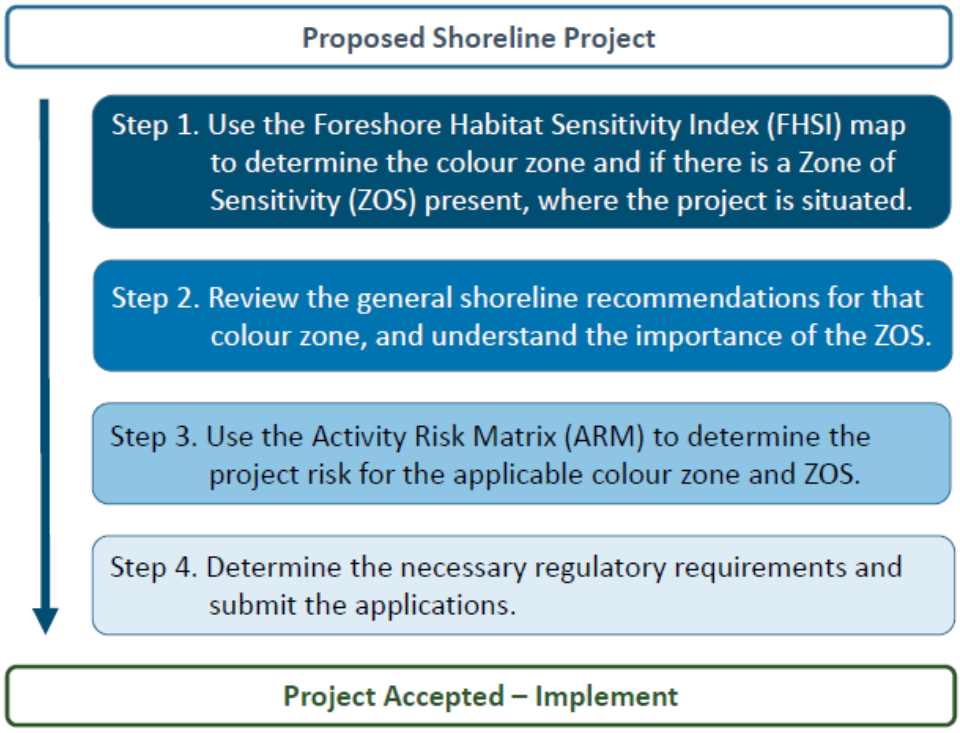


Figure 1. Four steps when planning to develop or modify foreshore habitat.

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.

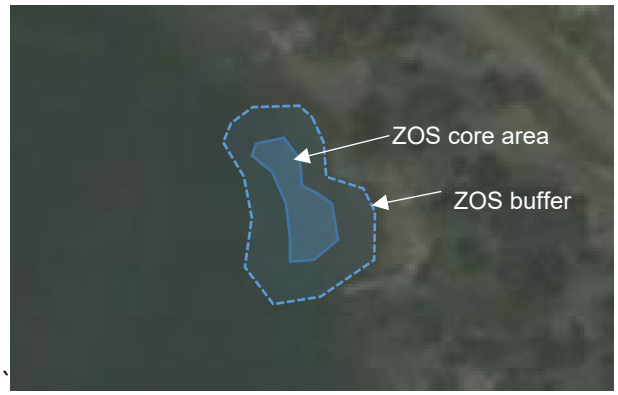


Figure 2. Zone of Sensitivity with an appropriate buffer.

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 21% of the total shoreline length of Moyie 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. consisted of wetlands and/or stream confluences that were in natural condition with no/very little shoreline modification or disturbance observed. These shoreline areas also had wide littoral areas, abundant aquatic vegetation and provide important juvenile rearing and staging habitat for fish. Shoreline disturbance is increasing at a rate of approximately 0.1% of the Moyie Lake shoreline per year and it is important to identify and protect sensitive areas from development pressure.
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 37% of the total shoreline length of Moyie 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 aquatic vegetation, large woody debris, and/or documented fish spawning areas and/or tributaries. These areas are sensitive to development, continue to provide important habitat functions, but may be at risk from adjacent development pressures. Shoreline disturbance is increasing at a rate of approximately 0.1% of the Moyie Lake shoreline per year and it is important to identify and protect sensitive areas from development pressure.
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 25% of the total shoreline length of Moyie Lake.
Sensitivity summary:	These areas have experienced a moderate amount of development disturbance and pressures. Shorelines have been modified by retaining walls, docks, railway lines, erosion control structures and other developments associated with residential, transportation and mining development. Important aquatic habitat features including aquatic vegetation and large woody debris are present. Some riparian areas remain intact though clearing has occurred near residential development. Although Yellow shoreline areas have been impacted to some degree, they still are largely intact. Shoreline disturbance is increasing at a rate of approximately 0.1% of the Moyie Lake shoreline per year and it is important to identify and protect sensitive areas from development pressure.

Yellow Shoreline	
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 17% of the total shoreline length of Moyie Lake.
Sensitivity summary:	Grey shorelines have a lower ecological ranking. Shorelines have been heavily disturbed by residential and transportation related shoreline modifications. 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. Shoreline disturbance is increasing at a rate of approximately 0.1% of the Moyie Lake shoreline per year and it is important to identify and protect sensitive areas from development pressure.
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 mouth ZOS are located at the confluence of Moyie Lake and inflow and outflow tributaries. Tributary mouth areas were mapped as polygons that capture the confluence of the two waterbodies and include both shallow areas used for migration and deeper areas used for staging. 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 Moyie Lake may provide spawning, egg incubation and juvenile rearing habitat for salmonids and can also provide a cool water refuge during summer when there are periods of higher water temperatures. In addition to fisheries values, water quality parameters such as temperature, dissolved oxygen, turbidity and nutrients of tributary inflows play an important role in the overall water quality of lake ecosystems.
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 20 m is recommended.

Vegetation – Aquatic Vegetation	
Lake summary:	Aquatic vegetation on Moyie Lake was originally mapped by Schleppe (2009) and updated during the 2020 re-FIM. All plant forms and communities occurring below the lake highwater level were considered aquatic plants due to their contribution to fish habitat under all water levels, including highwater (Schleppe 2009). Low flood benches delineated by Schleppe (2009) were therefore included within this overall classification of aquatic vegetation. Aquatic vegetation types that were mapped include marshes, low flood benches, emergent vegetation (e.g., sedges, horsetails and cattails) and floating vegetation (e.g., pondlilies and native pondweed that reaches the surface). On Moyie Lake, aquatic vegetation is relatively sparse and primarily associated with wetland and low flood bench habitat at the north end of the north basin (Segments 2 and 27), the narrows between the two basins (Segments 5, 21 and 22) and the northeast corner of the south basin (Segment 17). Note that small pockets of emergent vegetation are also present in other segments, however, only that in the few large productive littoral areas of the lake was included as a ZOS.
Sensitivity summary:	Aquatic vegetation contributes to the overall health of an ecosystem by providing an important source of nutrients, oxygenation and habitat for aquatic, terrestrial and avian species. Aquatic vegetation is an important component of wetlands, which provide habitat, flood control, water filtration and food resources.

Vegetation – Aquatic Vegetation	
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 20 m is recommended.

5.3 Shoreline Conservation Recommendations

It is recommended that the four productive littoral/wetland complex areas in Moyie Lake be considered for designation as conservation zones. These are located at the north end of the north basin (Segments 2 and 27), the narrows between the two basins (Segments 5, 21 and 22 as well sections of Segments 6, 20 and 23) and the northeast corner of the south basin (Segment 17). These areas have abundant aquatic vegetation, provide important habitat for fish and wildlife species and are also important components of the entire Moyie Lake ecosystem. The four areas include segments with Very High or High ecological rankings with one or two ZOS and currently remain in ≥90% natural condition. Designating these locations as conservation areas would protect unique and limited habitat features from habitat alteration and permanent development. The four areas are already identified as Development Permit Area #2 within the Moyie & Area OCP (see below), however, additional protections could include: a) establishment of protected areas (potentially through any level or government); b) Section 16 Land Act Reserves; or c) private land conservation agreements, such as tenure covenants or direct land sales to land conservancy organizations such as the Land Conservancy of Canada.

The Moyie & Area OCP identified shoreline segments with Very High (red) and High (orange) Ecological Rankings as Development Permit Area #2 – Moyie Lake & Monroe Lake Shoreline. The bylaw outlines a Development Permit Area that extends 30 m into the lake and 15 m upland from the natural boundary where the shoreline is designated as a red or orange shoreline zone. The OCP provides guidance on activities that are and are not permitted in these shoreline areas and where landowners are required to obtain a Development Permit prior to proceeding with any project that includes construction, addition or alteration of a building or structure, or, alteration of land, including removal of riparian or aquatic vegetation, site grading, deposition of fill, beach creation, or dredging.

The 2020 FHSI analysis found the Ecological Ranks for four segments requires updating: Segments 28 and 29 increased from Moderate to High while Segment 10 decreased from Moderate to Low and Segment 24 decreased from Very High to High. The updated results of the 2020 FIMP, including these FDG and associated maps, should be incorporated into the Moyie & Area OCP as an amendment to ensure sensitive shoreline areas are protected from future development. ZOS should also be incorporated into the bylaw and receive the same protections as red and orange shoreline segments (i.e., designation as Development Permit Area #2).

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.

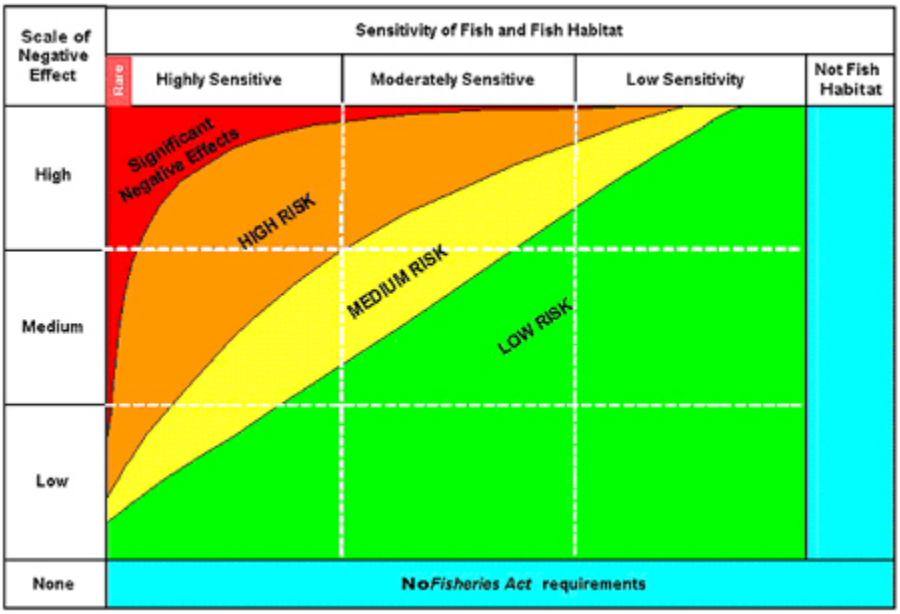


Figure 3. How the potential for negative effects relates to sensitivity and risk (DFO 2006).

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
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

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

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

[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 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.

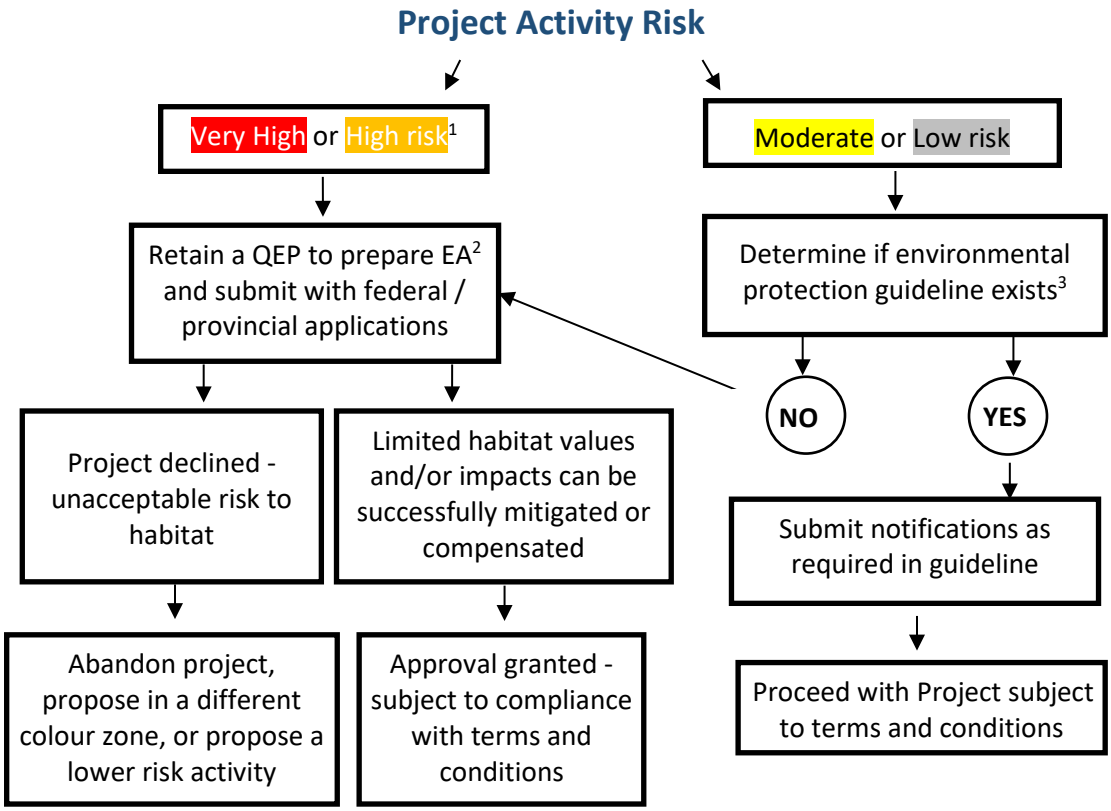
[1] DFO Projects Near Water website: https://dfo-mpo.gc.ca/pnw-ppe/index-eng.html

[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.

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

BC Ministry of Environment (BC MOE). 2008. High value habitat maps and Associated protocol for works along the foreshore of large lakes within the Okanagan, Region 8. Government memorandum.

BC MOE. 2019. *Natural Resource Best Management Practices.* Retrieved from https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/laws-policies-standards-guidance/best-management-practices

DFO. 2006. Habitat Management Program: Standard Operating Policies.

East Kootenay Integrated Lake Management Partnership (EKILMP), McPherson S. and Hlushak D. 2009. Windermere Lake Shoreline Management Guidelines for Fish and Wildlife Habitats. Combined agency and consultant (Interior Reforestation Co. Ltd) report.

Kootenay Lake Partnership. 2019. Kootenay Lake Shoreline Management Guidelines – A Living Document (Version 9). Prepared by: Ktunaxa Nation Council; Regional District of Central Kootenay; Ministry of Forests, Lands and Natural Resource Operations; Ecoscape Environmental Consultants Ltd.; Tipi Mountain Eco-Cultural Services Ltd.; The Firelight Group Ltd.; and, Wayne Choquette.

McPherson[1] S.M., D.G. Paton[2] and M.D. Robinson[1]. 2012. Tie Lake Shoreline Management Guidelines of Fish and Wildlife Habitats. Consultant report prepared for Ministry of Forests Lands and Natural Resource Operations, Nelson BC. Prepared by Lotic Environmental Ltd[1], Anatum Ecological Consulting Ltd[2].

Schleppe, J. 2009. Moyie Lake Foreshore Inventory and Mapping. Ecoscape Environmental Consultants Ltd. Prepared for: East Kootenay Integrated Lake Management Partnership.

Schleppe, J.[1], S. McPherson[2], L. Porto[3], and B. Mason[4]. 2020. Foreshore Integrated Management Plan Methods. Prepared for Living Lakes Canada. Prepared by: Ecoscape Environmental Consultants Ltd.[1], Lotic Environmental Ltd.[2], Wood Environment and Infrastructure Ltd.[3], and BC Community Mapping Network[4].

Wood. 2021. Moyie Lake Foreshore Integrated Management Planning – 2021. Report Prepared for Living Lakes Canada, Nelson, BC. Wood Project Number: VE52823-2020B. 35 pp. + 5 App.

Appendix A. Foreshore Guidance Document Map

CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Development Guidelines

LEGEND:

- Segment Break

FHSI Rank

- Very High
- High
- Moderate
- Low and Very Low

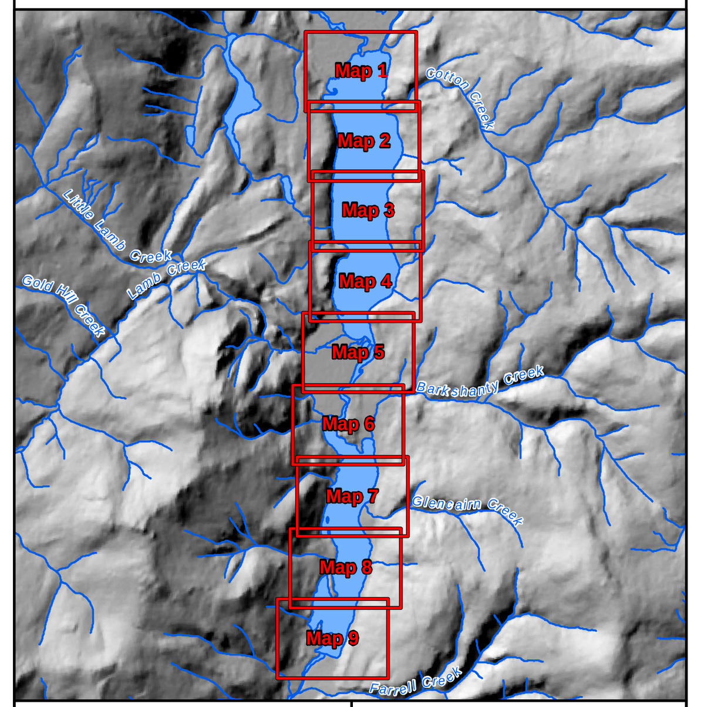
Zones of Sensitivity

- Vegetation - Aquatic Vegetation
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50

Meters

Scale:1:3,000

N W E S

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

Wood PLC

4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO:	PAGE:
VE52823	1 of 9
COORDINATE SYSTEM:	DATE:
NAD 1983 UTM Zone 11N	March 2021
ANALYST:	QA:
PK	CL

GIS FILE:

02-01-013_moyie_lake_fdg_maps.mxd

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-013_moyie_lake_fdg_maps.mxd

CLIENT:

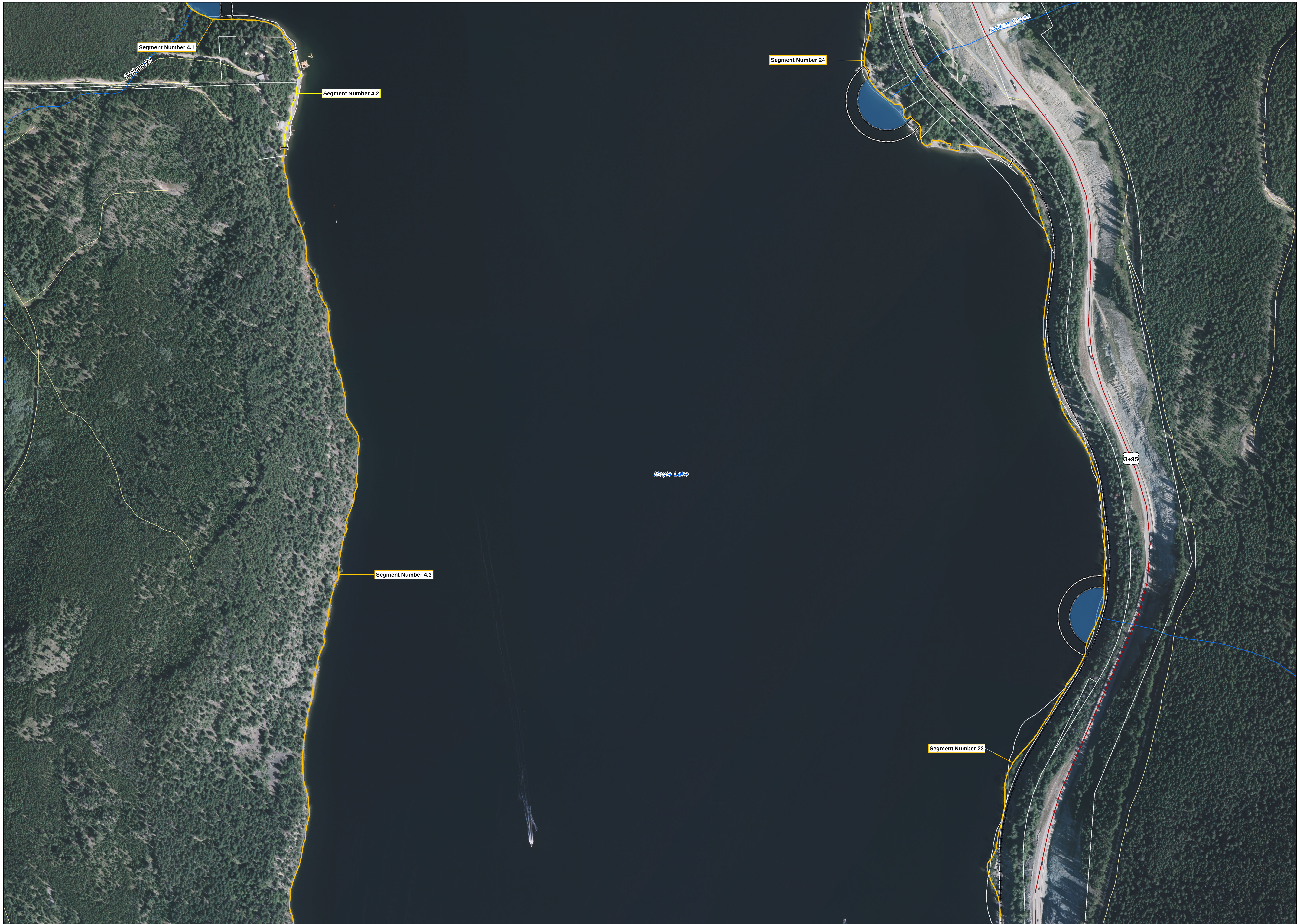
LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

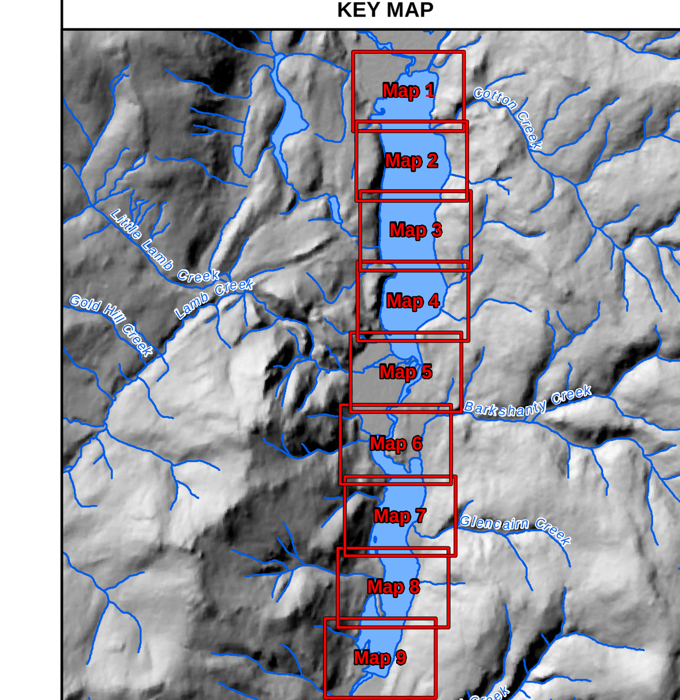
Moyie Lake Foreshore Development Guidelines



LEGEND:

- Segment Break
- **FHSI Rank**
  - Very High
  - High
  - Moderate
  - Low and Very Low
- **Zones of Sensitivity**
  - Vegetation - Aquatic Vegetation
  - Fisheries - Tributary Mouth
  - Zones of Sensitivity Buffer
- **Base Data**
  - Railway
  - Highway
  - Road
  - Watercourse
  - Parcel Boundary

KEY MAP



0 25 50

Meters

Scale:1:3,000

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

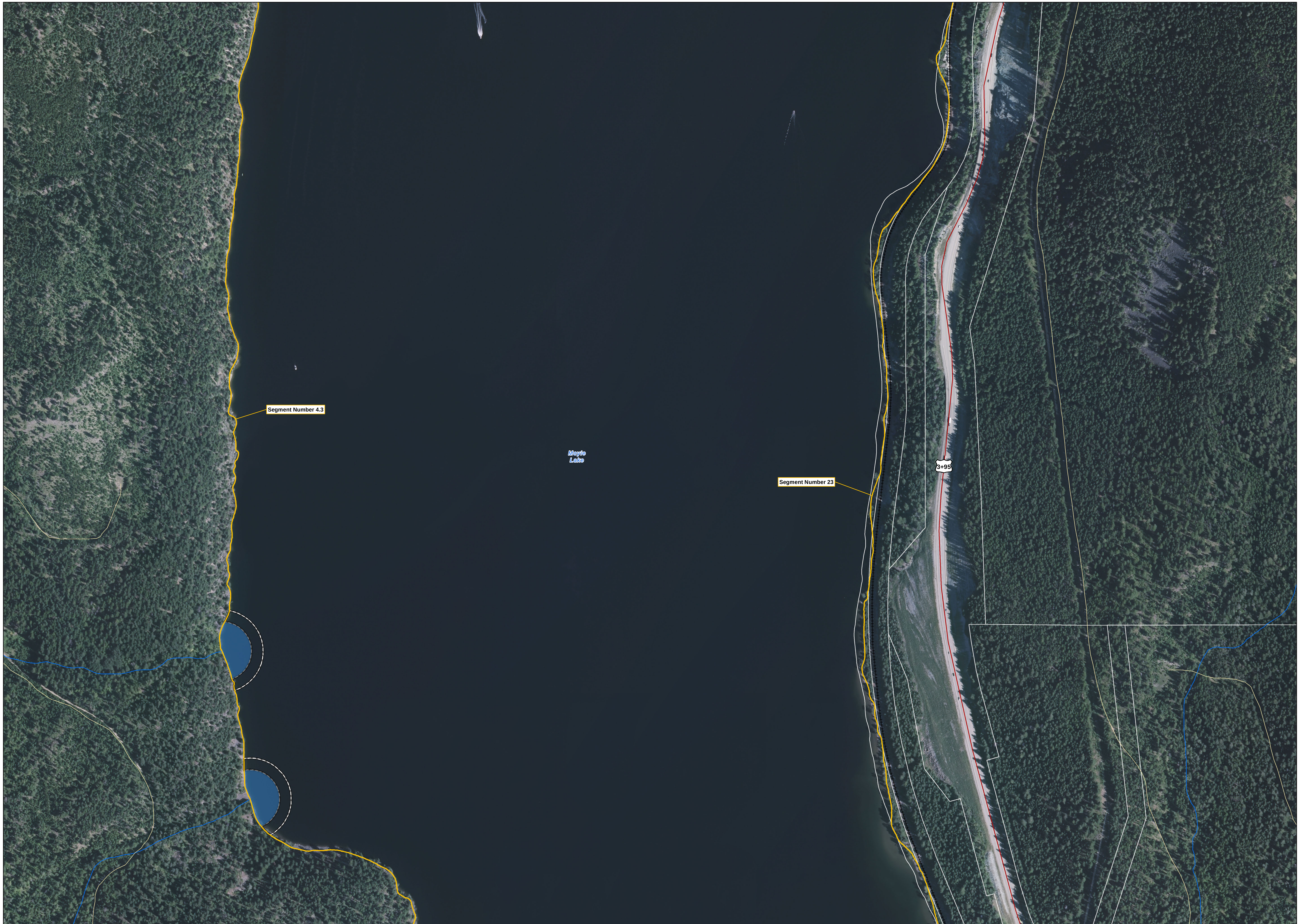
CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

Wood PLC

4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO:	PAGE:
VE52823	2 of 9
COORDINATE SYSTEM: NAD 1983 UTM Zone 11N	DATE: March 2021
ANALYST: PK	QA: CL
GIS FILE: 02-01-013_moyie_lake_fdg_maps.mxd	

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-013_moyie_lake_fdg_maps.mxd



CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Development Guidelines

LEGEND:

Segment Break

FHSI Rank

- Very High
- High
- Moderate
- Low and Very Low

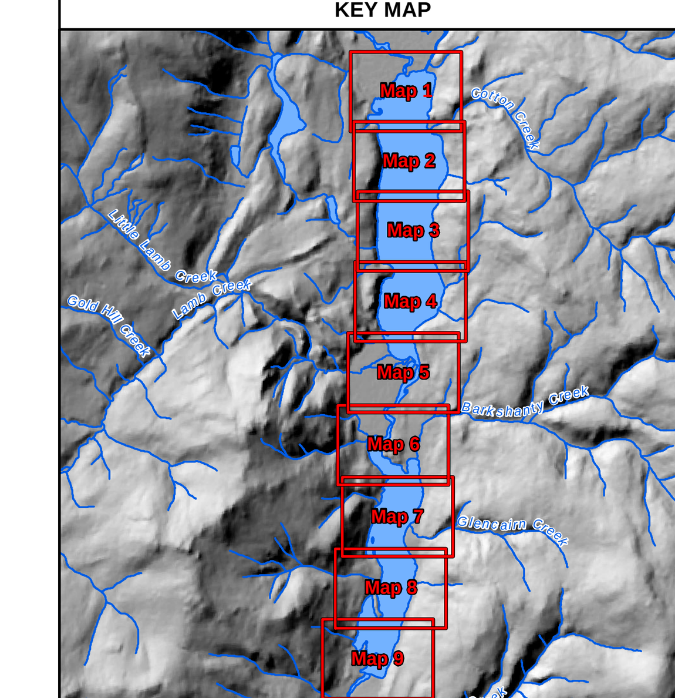
Zones of Sensitivity

- Vegetation - Aquatic Vegetation
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50
Meters
Scale:1:3,000

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

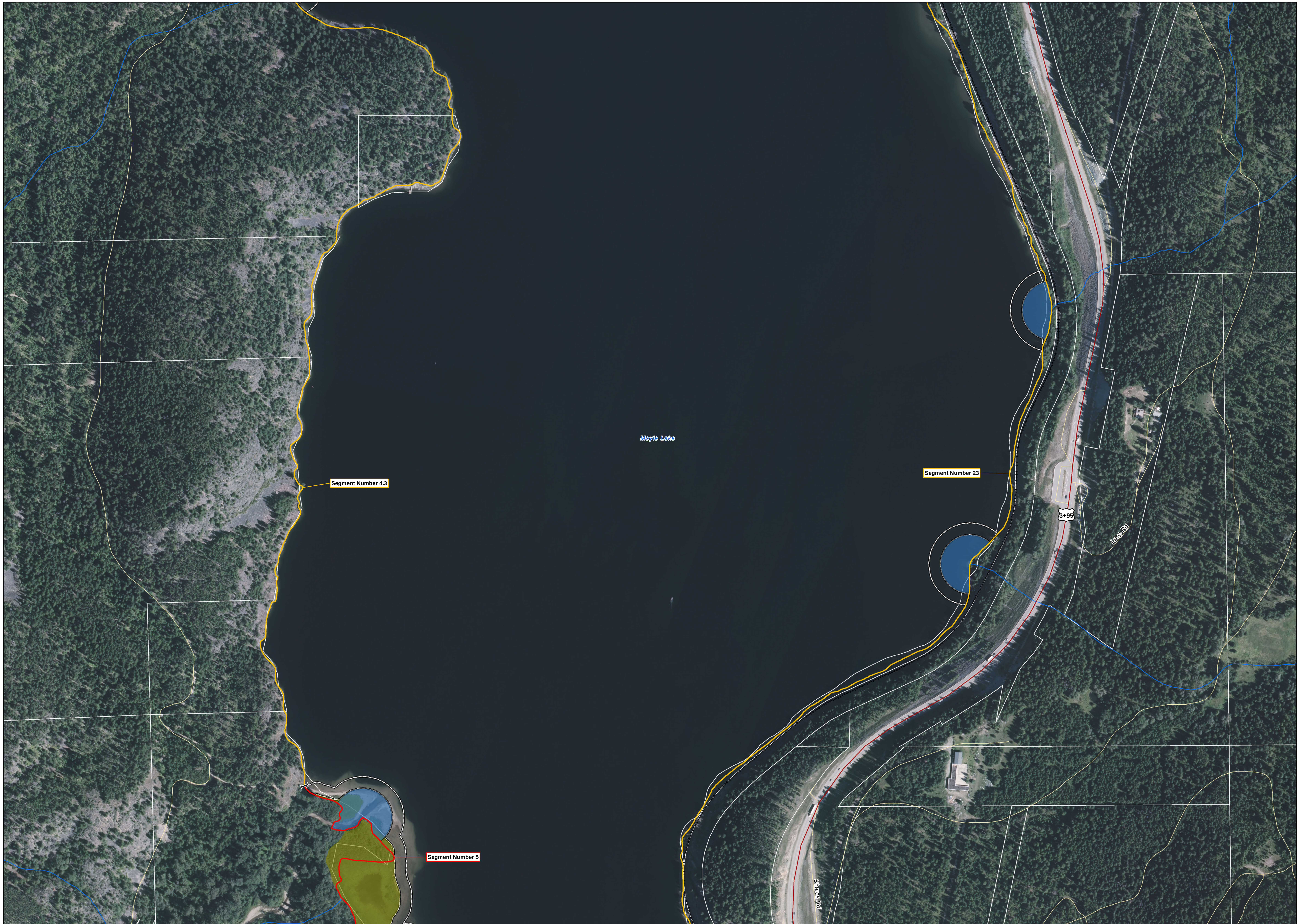
CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

Wood PLC

4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO: VE52823	PAGE: 3 of 9
COORDINATE SYSTEM: NAD 1983 UTM Zone 11N	DATE: March 2021
ANALYST: PK	QA: CL
GIS FILE: 02-01-013_moyie_lake_fdg_maps.mxd	

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-013_moyie_lake_fdg_maps.mxd



CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Development Guidelines

LEGEND:

- Segment Break

FHSI Rank

- Very High
- High
- Moderate
- Low and Very Low

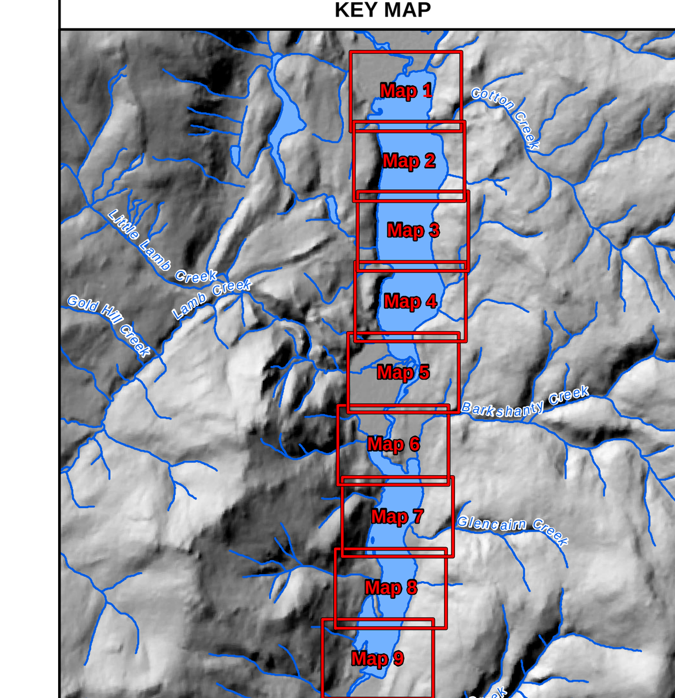
Zones of Sensitivity

- Vegetation - Aquatic Vegetation
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50
Meters

Scale:1:3,000

N W E S

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

wood.

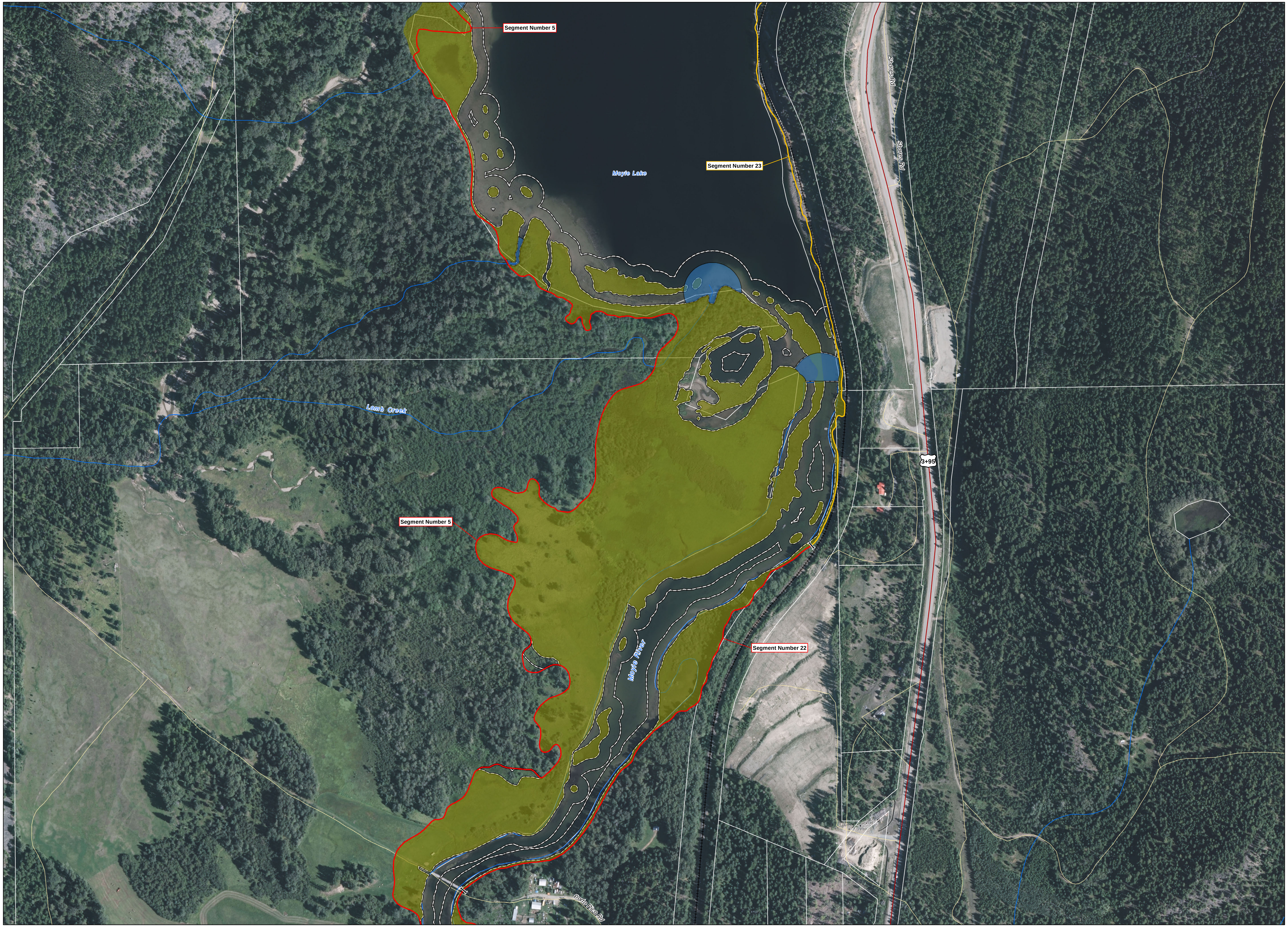
Wood PLC

4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO:	PAGE:
VE52823	4 of 9
COORDINATE SYSTEM: NAD 1983 UTM Zone 11N	DATE: March 2021
ANALYST: PK	QA: CL

GIS FILE: 02-01-013_moyie_lake_fdg_maps.mxd

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-013_moyie_lake_fdg_maps.mxd



CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Development Guidelines

LEGEND:

Segment Break

FHSI Rank

- Very High
- High
- Moderate
- Low and Very Low

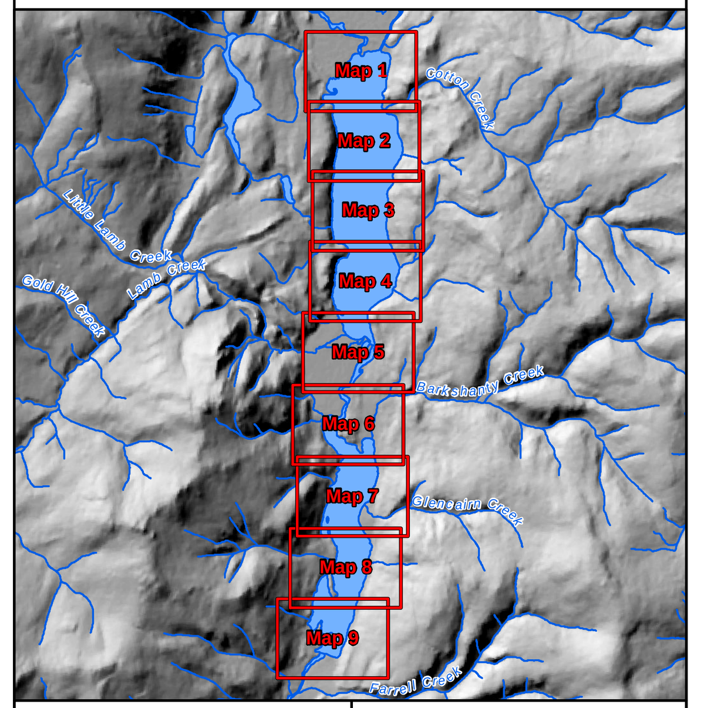
Zones of Sensitivity

- Vegetation - Aquatic Vegetation
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50

Meters

Scale:1:3,000

N W E S

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

wood.

Wood PLC

4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO:	PAGE:
VE52823	5 of 9
COORDINATE SYSTEM: NAD 1983 UTM Zone 11N	DATE: March 2021
ANALYST: PK	QA: CL

GIS FILE: 02-01-013_moyie_lake_fdg_maps.mxd

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-013_moyie_lake_fdg_maps.mxd

CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Development Guidelines

LEGEND:

- Segment Break

FHSI Rank

- Very High
- High
- Moderate
- Low and Very Low

Zones of Sensitivity

- Vegetation - Aquatic Vegetation
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP

0 25 50
Meters

Scale:1:3,000

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

Wood PLC

4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO: VE52823	PAGE: 6 of 9
COORDINATE SYSTEM: NAD 1983 UTM Zone 11N	DATE: March 2021
ANALYST: PK	QA: CL
GIS FILE: 02-01-013_moyie_lake_fdg_maps.mxd	

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-013_moyie_lake_fdg_maps.mxd

CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Development Guidelines

LEGEND:

- Segment Break

FHSI Rank

- Very High
- High
- Moderate
- Low and Very Low

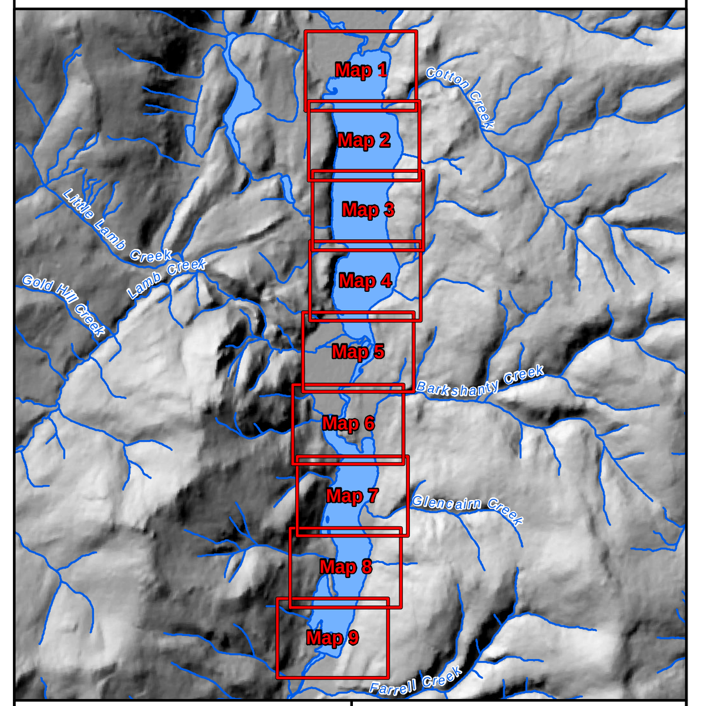
Zones of Sensitivity

- Vegetation - Aquatic Vegetation
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50
Meters
Scale:1:3,000

W E S N

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

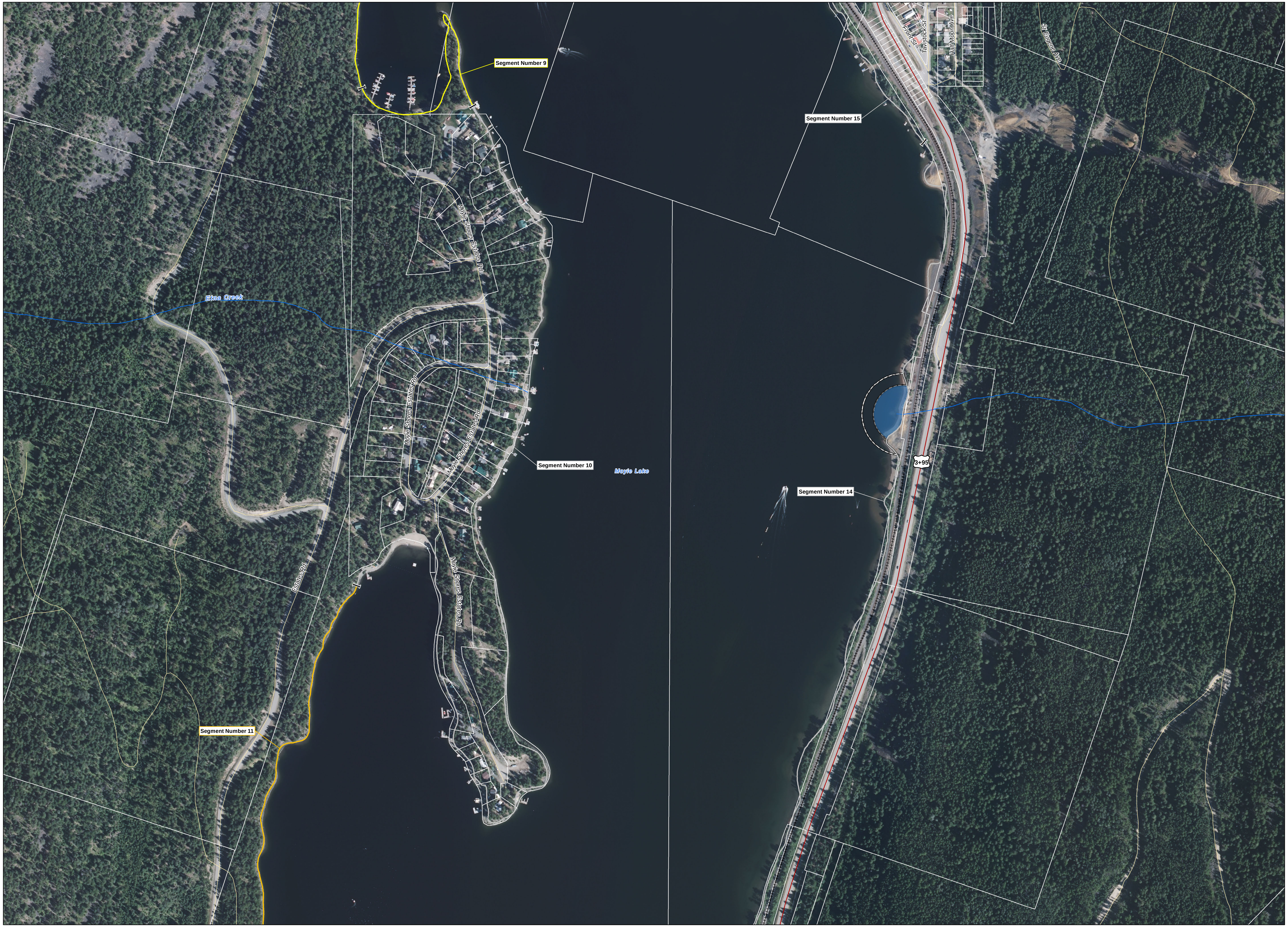
CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

Wood PLC

4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO:	PAGE:
VE52823	7 of 9
COORDINATE SYSTEM:	DATE:
NAD 1983 UTM Zone 11N	March 2021
ANALYST:	QA:
PK	CL
GIS FILE:	
02-01-013_moyie_lake_fdg_maps.mxd	

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-013_moyie_lake_fdg_maps.mxd



CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

TITLE:

Moyie Lake Foreshore Development Guidelines

LEGEND:

- Segment Break

FHSI Rank

- Very High
- High
- Moderate
- Low and Very Low

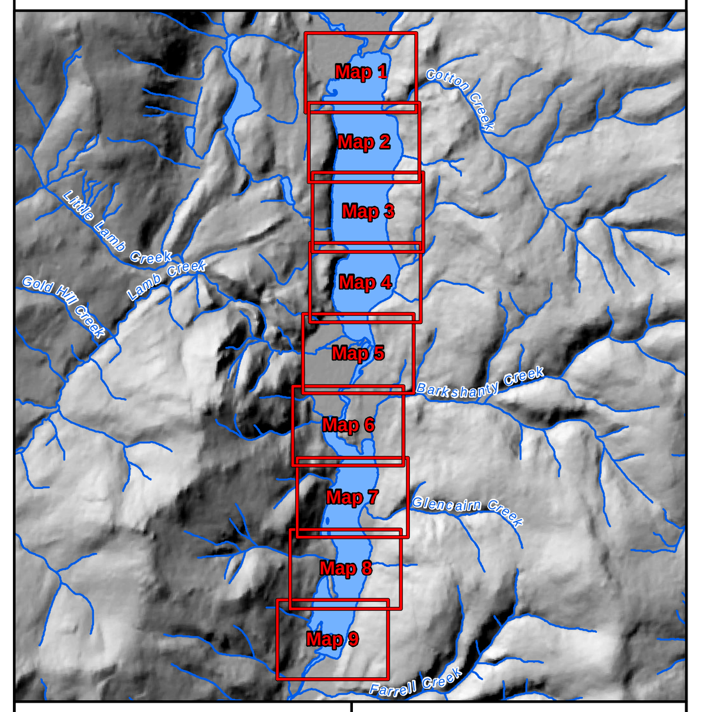
Zones of Sensitivity

- Vegetation - Aquatic Vegetation
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer

Base Data

- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50

Meters

Scale:1:3,000

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

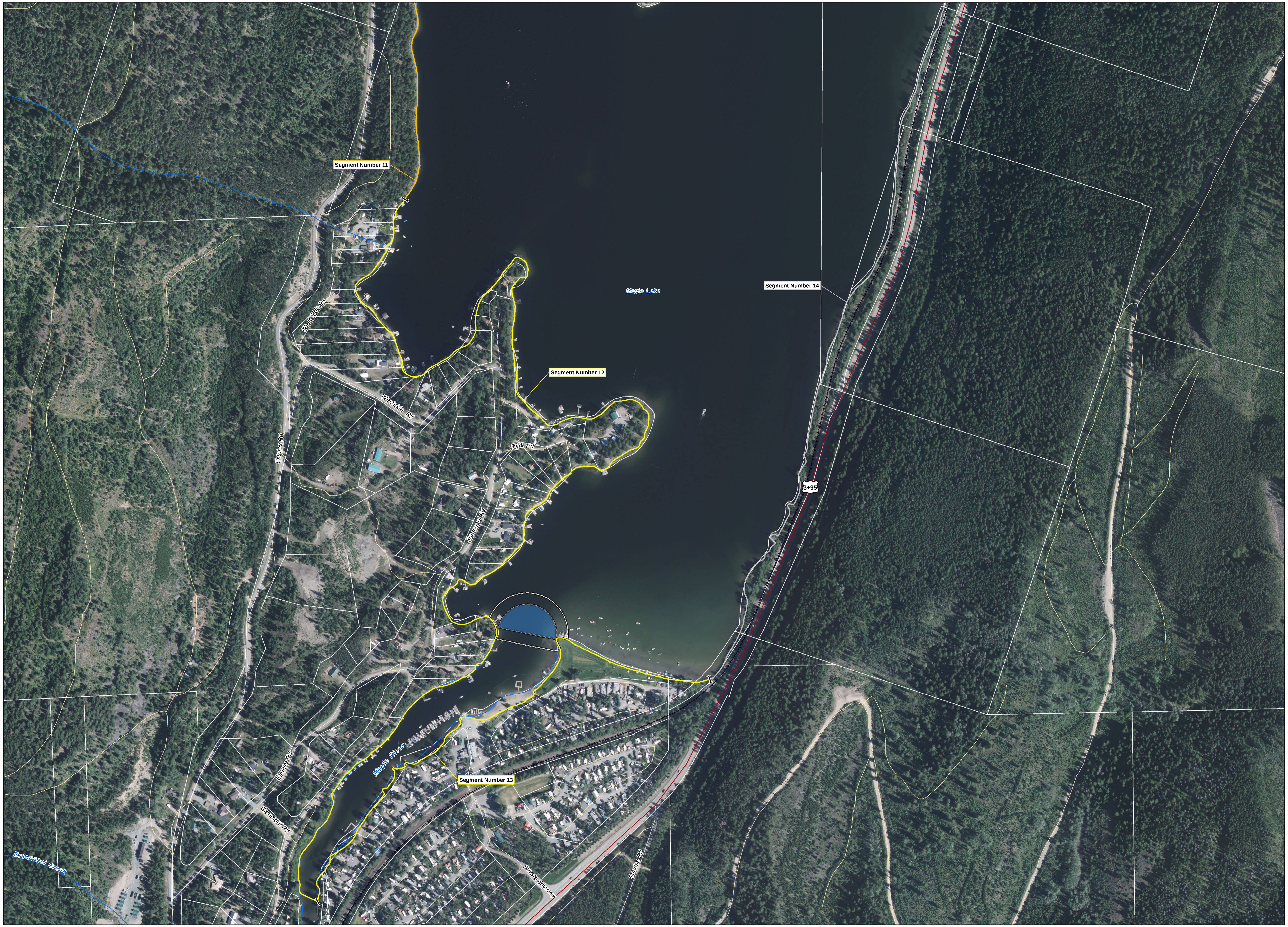
CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

Wood PLC

4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO:	PAGE:
VE52823	8 of 9
COORDINATE SYSTEM:	DATE:
NAD 1983 UTM Zone 11N	March 2021
ANALYST:	QA:
PK	CL
GIS FILE:	
02-01-013_moyie_lake_fdg_maps.mxd	

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-013_moyie_lake_fdg_maps.mxd



CLIENT:

LivingLakes

PROJECT:

Moyie Lake FIMP

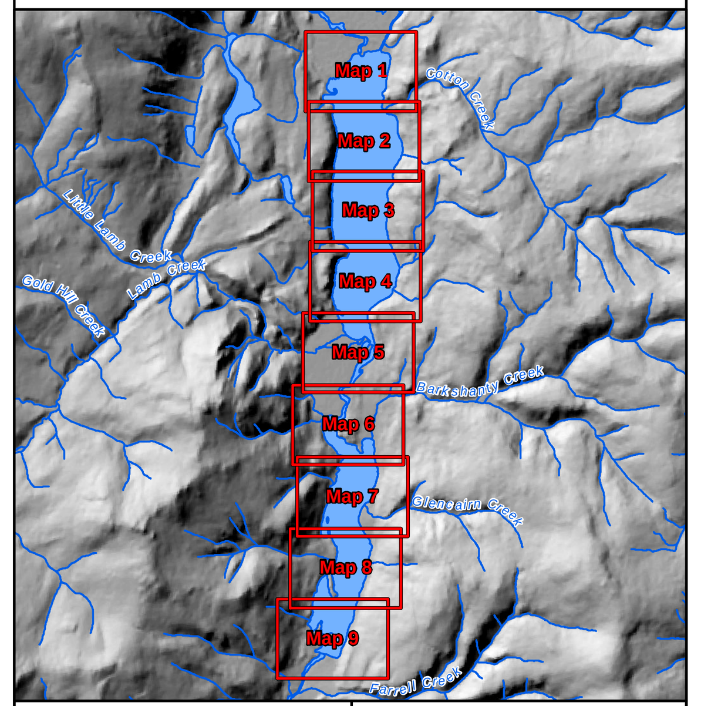
TITLE:

Moyie Lake Foreshore Development Guidelines

LEGEND:

- Segment Break
- **FHSI Rank**
- Very High
- High
- Moderate
- Low and Very Low
- **Zones of Sensitivity**
- Vegetation - Aquatic Vegetation
- Fisheries - Tributary Mouth
- Zones of Sensitivity Buffer
- **Base Data**
- Railway
- Highway
- Road
- Watercourse
- Parcel Boundary

KEY MAP



0 25 50
Meters

Scale:1:3,000

N W E S

REFERENCE:

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)

Orthophotos
Acquired from BC Basemap Online Store
Mapsheets: 082G021 and 082G031; Year: 2016

NOTE:

CAUTION:
DO NOT USE THIS MAP
FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions.
Uncharted hazards may exist

wood.

Wood PLC
4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

PROJECT NO:	PAGE:
VE52823	9 of 9
COORDINATE SYSTEM: NAD 1983 UTM Zone 11N	DATE: March 2021
ANALYST: PK	QA: CL
GIS FILE: 02-01-013_moyie_lake_fdg_maps.mxd	

Y:\GIS\Projects\VE\VE52800\VE52823_LivingLakes_Moyie_Whitetail_FIMP\Mapping\02_fisheries-aquatics\01_overview\02-01-013_moyie_lake_fdg_maps.mxd

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/