Douglas Lake Foreshore Integrated Management Planning Assessment

Presented To: **Upper Nicola Band and Living Lakes Canada Society**

Dated: March 2025

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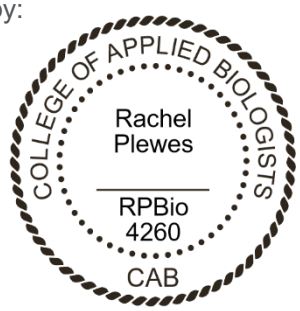

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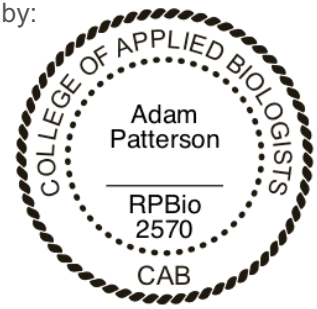

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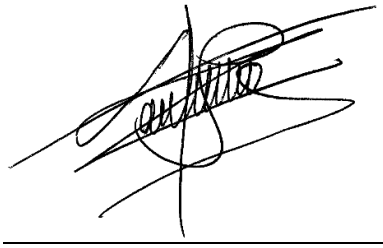

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Version	Date	Prepared By	Reviewed By	Notes/Revisions
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Executive Summary

Douglas Lake (Spaxmn) is a sacred and culturally significant place to the Upper Nicola Band (UNB). Located within the Upper Nicola watershed, Douglas Lake is a productive lake that provides important rearing and spawning habitat. The shoreline area provides migratory and breeding habitat for waterfowl, raptors, and shorebirds. About 55% of the Douglas Lake shoreline is adjacent to the largest UNB Reserve, Douglas Lake Indian Reserve #3.

The primary objective of this project was to conduct a baseline Foreshore Integrated Management Planning (FIMP) for Douglas Lake. This project used the updated FIMP methodology and the Local Indigenous Knowledge and Values Framework, that was developed as part of the Nicola Lake FIMP update in 2023 (Peck, Holmes, and Armstrong, 2023). The Syilx oral story (captikʷɬ) of the Four Food Chiefs and “How food was given” form the structure of the framework and their individual values provide guidance to a more holistic and inclusive FIMP process.

The values embodied by the Four Food Chiefs guided all aspects of the FIMP process. The greatest chief, Chief Skəmxist (Black Bear), challenged us to take a contemplative FIMP approach that focused on tradition and culture. The values of Chief Sp̓iƛ̓m̓ (Bitter Root) supported this process by making connections and including everyone. The creativity embodied by Chief Siyáʔ (Saskatoon Berry) helped to inform the FIMP analysis and presentation of the results. In the later stages of the FIMP process, the values of Chief N’tyxtix̌ (King Salmon) encouraged us to take action and persevere through challenges to protect the Douglas Lake shoreline.

The FIMP process is intended to guide foreshore management for Indigenous communities, government agencies, non-profit organizations, and landowners. FIMP summarizes the foreshore habitat values and quantifies the ecological risks posed by prospective shoreline-altering activities. The FIMP process follows three steps. First, qualified biologists conduct a field-based Foreshore Inventory Mapping (FIM) survey. Second, the Foreshore Habitat Sensitivity Index (FHSI) is calculated, and Zones of Sensitivity (ZOS) are delineated. The FHSI represents the relative ecological value and sensitivity of each shoreline segment. The ZOS represent important habitats or ecosystem functions. Third, the Foreshore Development Guide (FDG) is prepared, which provides planning guidelines aimed at protecting sensitive fish and wildlife habitats identified in the previous steps.

The 2024 Douglas Lake FIM survey showed that most of the Douglas Lake shoreline was natural with very few shoreline modifications and 84% of the shoreline was natural. The remaining 16% of the shoreline was associated with disturbance from cattle access, boat launches, roads, agricultural activities, and residences. Roads were the most prominent disturbance along the Douglas Lake shoreline, with 8% of the shoreline occurring beside a road. Substrate modification occurred along 1% of the shoreline. Shoreline modifications were limited to 6 fences, 3 boat launches, and 1 mooring buoy.

The Douglas Lake shoreline mainly consisted of a narrow riparian band of tall shrubs with rocky shore and gravel shore types. The predominant shore types observed along the Douglas Lake shoreline were rocky shore (57%) and gravel (20%). The remaining shore types of stream mouth (16%), wetland (4%), and sand (2%) were associated with the floodplains of the Upper Nicola River and Spahomin Creek. The rocky and gravel shore types were surrounded by a narrow riparian band of tall shrubs. The sand, stream mouth, and wetland shore types were associated with wider bands of tall shrubs and in some cases mature broadleaf forest.

This 2024 FIMP and the Cultural Overview Assessment (COA) identified abundant wildlife, fisheries, cultural, and spiritual values along the Douglas Lake shoreline. The COA found that 61% of the Douglas Lake shoreline overlaps with Culturally Sensitive Areas (CSA). The FHSI analysis showed 84.7% of the Douglas Lake shoreline had High ecological value. The remaining shoreline had 13.5% of Very High and 1.8% of Moderate ecological values. The shoreline with Very High ecological value was associated with Upper Nicola River inlet and Spahomin Creek mouth segments. Agricultural activities had historically disturbed the shoreline with Moderate ecological value.

Valuable fish and wildlife habitats along the Douglas Lake shoreline have been maintained due to minimal foreshore development over the past 50 years. To ensure the ongoing protection and stewardship of these habitats, four types of ZOS were identified. The ecosystem, fisheries, vegetation, and wildlife ZOS provide habitat for fish, amphibians, birds, moose and deer. ZOS were most abundant in the floodplain areas surrounding the Upper Nicola River inlet and Spahomin Creek. Fisheries, Ecosystem, and Wildlife ZOS in these areas were associated with stream mouths, wetlands, riparian cottonwood, and stream riparian areas. Wide littoral areas along Douglas Lake Road contained vegetation ZOS that were associated with emergent vegetation. The entire Douglas Lake Island was designated a wildlife ZOS due to a known deer and moose calving site.

Recommendations focus on protection and stewardship of ecological and cultural values at Douglas Lake and were guided by the values embodied by the Food Chiefs, as shown in Figure i below. Protecting the entire Douglas Lake shoreline requires a collaborative process guided by the Framework and supported by a Syilx-led decision-making process. The establishment of protection mechanisms requires collaboration among Upper Nicola Band, non-profit and non-governmental organizations (e.g., land trusts), and all levels of government. Priority areas and recommended protection mechanisms include:

- Conservation covenants for the foreshore area from Prince Phillips Point to the Upper Nicola River inlet;
- Conservation zones or land acquisitions from the Island to the Spahomin Creek mouth; and
- Conservation covenants from the Upper Nicola River outlet to the northern end of IR #3.

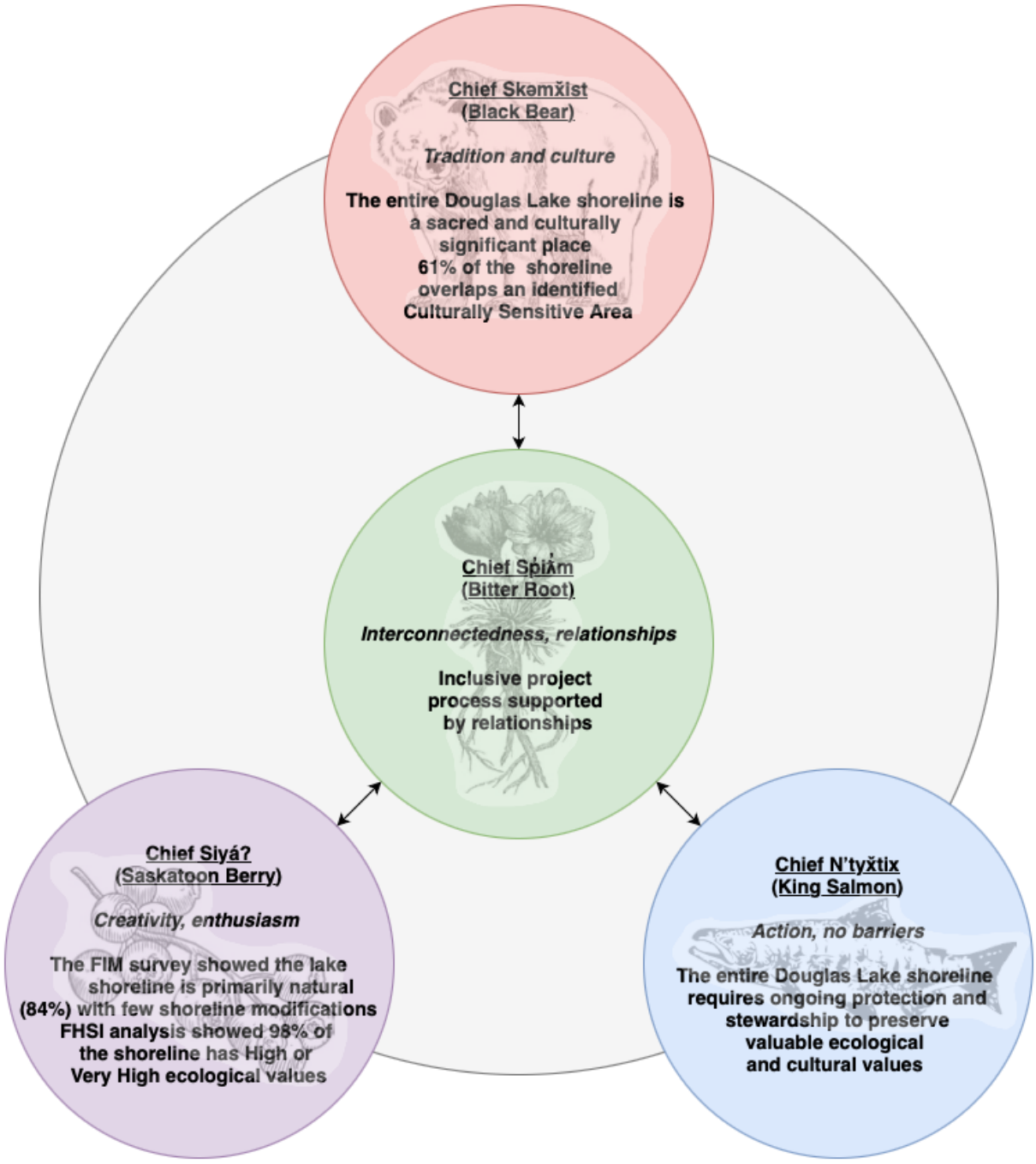

Figure i: Conceptual summary of the 2024 Douglas Lake FIMP following the Local Indigenous Knowledge and Values Framework. The values associated with each Food Chief as they relate to the FIMP finding are represented in italics

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Acknowledgements

We would like to acknowledge that this project occurred on the Traditional, Ancestral, and Unceded Territory of the Syilx people, both at Douglas Lake itself, as well as in the Okanagan home and office locations of the project team.

The Douglas Lake FIMP project team would like to thank Brian Holmes and Upper Nicola Band as well as Georgia Peck and LLC for providing cultural teachings, historic knowledge, and technical information sharing throughout the project. LLC 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. Their mandate is to help residents of Canada understand, adapt, and mitigate the impacts of climate change to water quality and quantity, biodiversity, and healthy human communities through diverse water stewardship activities. LLC bridges the gap between science and action to foster and normalize citizen-based water stewardship.

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Acronyms and Abbreviations

AHI	Aquatic Habitat Index
ALR	Agricultural Land Reserve
BC	British Columbia
BEC	Biogeoclimatic Ecosystem Classification
BG	Bunchgrass
CDC	BC Conservation Data Centre
CH	Critical Habitat
CSA	Culturally Sensitive Areas
ESA	Environmentally Significant Areas
FDG	Foreshore Development Guide
FHSI	Foreshore Habitat Sensitivity Index
FIDQ	Fish Inventories Data Queries
FIM	Foreshore Inventory and Mapping
FIMP	Foreshore Integrated Management Planning
FWA	Freshwater Atlas
GIS	Geographic Information System
GPS	Global Positioning System
HWL	High Water Level
HWM	High Water Mark
IBA	Important Bird Area
IR	Indian Reserve
LAC	Larratt Aquatic Consulting Ltd.
LDG	Lakeshore Development Guidelines
LiDAR	Light Detection and Ranging
LLC	Living Lakes Canada Society
masl	metres above sea level
OCP	Official Community Plan
ONA	Okanagan Nation Alliance
RAR/RAPR	Riparian Areas Regulation/Riparian Areas Protection Regulation
R.P.Bio	Registered Professional Biologist
SMG	Shoreline Management Guidelines

SOP	Standard Operating Procedures
TNRD	Thompson-Nicola Regional District
TOR	Terms of Reference
TUS	Traditional Use Study
UBC	University of British Columbia
UNB	Upper Nicola Band
WUMP	Water Use Management Plan
ZOS	Zone of Sensitivity

1. Introduction

The Ecora Engineering & Environmental Ltd. (Ecora) and Clear Viz Aquatic Consulting (Clear Viz) team was retained by Upper Nicola Band (UNB) and Living Lakes Canada Society (LLC) to complete a survey of Douglas Lake using the Foreshore Integrated Management Planning (FIMP) methodology. The FIMP methodology was updated by LLC in 2021 (Schleppe et al., 2021) and was subsequently applied to various Columbia Basin lakes from 2021 – 2023, and Fraser and Nicola lakes in 2023. Douglas Lake was identified as a high priority lake to apply the updated FIMP methodology and the Local Indigenous Knowledge and Values Framework (Peck, Holmes, and Armstrong, 2023). The Framework was previously developed to guide the FIMP assessment update for Nicola Lake in 2023 (Plewes et al., 2024). Douglas Lake was not previously assessed using the FIMP methodology.

The Douglas Lake FIMP assessment ('the Project') was completed in partnership with UNB and is consistent with the Local Indigenous Knowledge and Values Framework ('the Framework'). UNB represents the only Syilx community within the Thompson-Nicola region and the most northern extent of the Syilx language and culture (Upper Nicola Band Traditional Use Study, 2014). The Framework describes core principles embodied by the Syilx four Chiefs of the "How food was given" oral story (captikʷɬ) that explains how the Four Food Chiefs came together to plan how to feed St'elsqilxw (people) after the Kul'nchut'n (the Creator) told Tmixʷ (people, animals, plants, air, and water) that St'elsqilxw (people) were coming. The Four Food Chiefs represent the following:

- Chief Sp̓iʔm̓ (Bitter Root) represents the relationships between Tmixʷ (people, animals, plants, air, and water). This Chief is associated with connection and harmony between plants, animals, water, people, and the land (relationships, connections, inclusiveness).
- Chief Skəmx̌ist (Black Bear) represents culture and tradition. This Chief is associated with understanding the past and how that relates to the present and future (tradition, culture, knowledge keeping).
- Chief Siyáʔ (Saskatoon Berry) represents all things that grow above the ground. This Chief is associated with creativity and is associated with a youthful perspective (creativeness, vision, innovation).
- Chief N'tyx̌tix̌ (King Salmon) represents all creatures in the water. He is associated with action and male perspective (action, no barriers, efficient).

The establishment of respectful, meaningful, and productive relationships with the project team, UNB, and LLC were promoted in all Project stages through the application of the Framework. Traditional and cultural values were highlighted or addressed throughout the report, addressing both Indigenous and conventional FIMP perspectives as they relate to foreshore sensitivities and management considerations. The Syilx Nation siwɬkʷ Declaration, as summarized in the Syilx Strategy to Protect and Restore Siwɬkʷ states the Syilx Okanagan People "recognize water (siwɬkʷ) as a sacred entity that connects all life (tmixʷ)" (ONA, 2021). The Syilx Okanagan Worldview holds that there is a sacred and collective responsibility to care for water to ensure the health of tmixʷ for all future generations (ONA, 2021). In recognition of this and in keeping with the values of the Four Food Chiefs, this Project aims to adopt a 'Two-Eyed Seeing' approach that contributes both Indigenous and scientific knowledge to assess foreshore values.

1.1 Project Location

Douglas Lake is located at an elevation of 802 m within the Fraser River watershed. It occurs along the Upper Nicola River, approximately 15 km upstream from Nicola Lake and 35 km east of Merritt, BC (Figure 1). Douglas Lake has an approximate surface area of 680 ha and a maximum depth of 38.7 m (Table 1). The Project study area included the entire 17.9 km shoreline that was divided into 16 discrete segments. The spatial extents of the study area were based upon the High Water Level (HWL) of the lake, including a band that covers an area 50 m upland of the HWL. Moving into the lake from the HWL, the littoral zone ranged from approximately 10 to 200 m wide.

Table 1. Physical characteristics of Douglas Lake.

Metric	Douglas Lake
Elevation (m)	802
Surface Area (ha)	680*
Lake Shoreline (km)	17.9*
Max Depth (m)	38.7
Mean Depth (m)	18.3

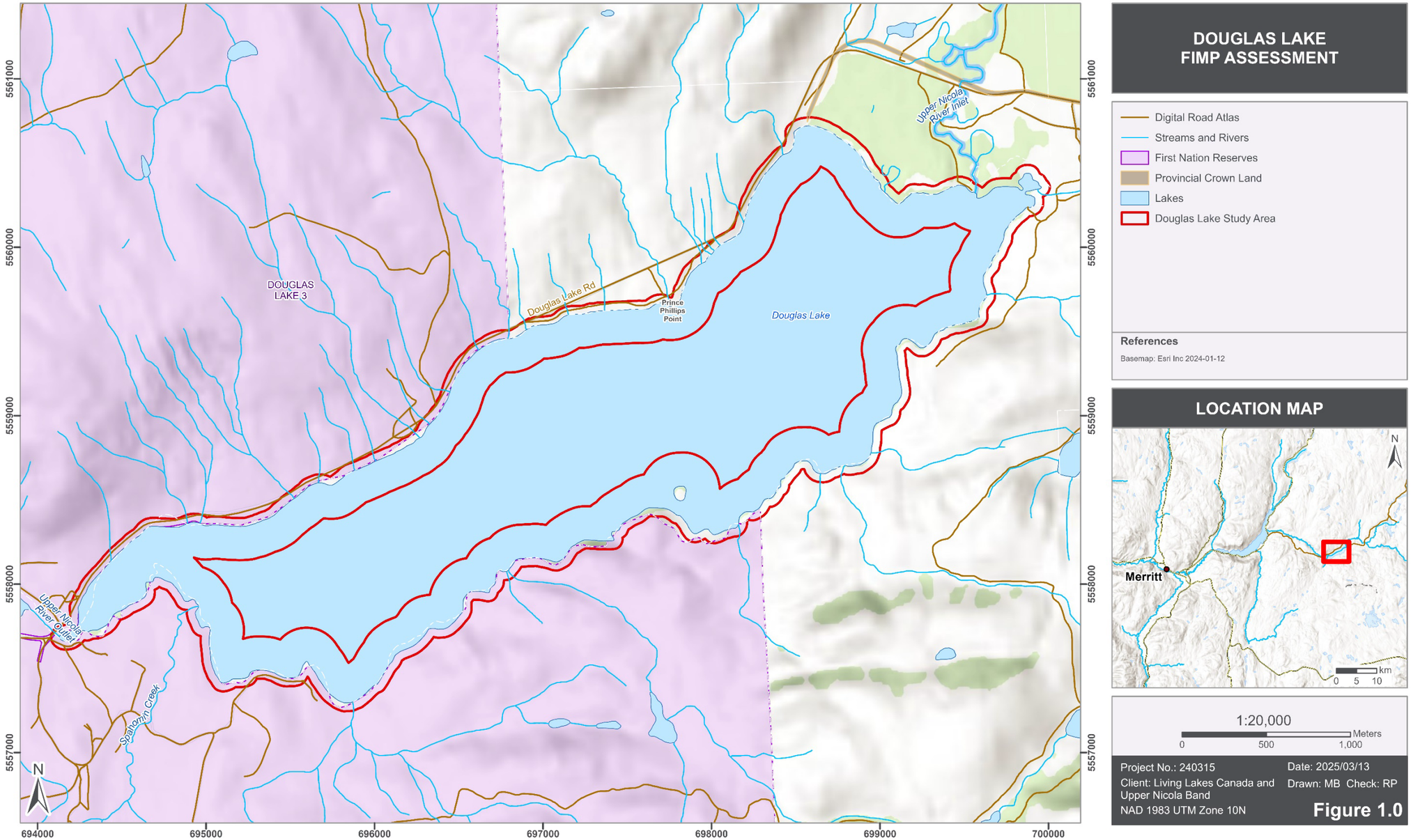
*calculated from 2024 FIM Segment Lines

The Douglas Lake shoreline occurs within both UNB Indian Reserve (IR) lands associated with Douglas Lake IR# 3 (55.3%) and the TNRD Electoral Area “M” (44.7%). Douglas Lake Road occurs along the north side of the lake, providing access from Highway 5A at Nicola Lake. The jurisdiction associated with each segment is described in Table 2.

Table 2. Segments and their corresponding location within the study area.

Jurisdiction	Land Use Area	Segment Number	Segment Description
UNB	Douglas Lake IR# 3	1	Upper Nicola River outlet (siʔaʷqən)
		2	Douglas Lake Road – South
		3	UNB Boat Launch; Lots 63 and 65
		4	Lot 65 - Northeast
		5	-
TNRD	Electoral Area “M”	6	Prince Philips Point
		7	Douglas Lake Road – North
		8	Douglas Lake Ranch – North End
		9	Upper Nicola River inlet
		10	-
		11	-
UNB	Douglas Lake IR# 3	12	Adjacent to Island
		13	Spahomin Creek Road
		14	Spahomin Creek inlet
		15	Spahomin wetlands
		16	Island

DOUGLAS LAKE STUDY AREA OVERVIEW



DOUGLAS LAKE FIMP ASSESSMENT

- Digital Road Atlas
- Streams and Rivers
- First Nation Reserves
- Provincial Crown Land
- Lakes
- Douglas Lake Study Area

References

Basemap: Esri Inc 2024-01-12

LOCATION MAP

1:20,000

0 500 1,000 Meters

Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/13
Drawn: MB Check: RP

Figure 1.0

Figure 1. Overview Map of Study Area

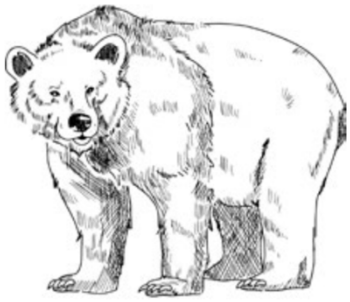
1.2 Project Planning and Objectives

The Project Team approached the planning phase with the values of Chief Sp̓iƛ̓m̓ (Bitter Root), which emphasizes inclusivity and relationship building. The planning phase of this Project began in the previous FIMP project at Nicola Lake in 2023. The Nicola FIMP included a place-based meeting and Food Chiefs teachings by B. Holmes, as well as an introduction of the Framework. The Project objectives employ FIMP methodology to collect FIM field data and derive a Foreshore Habitat Sensitivity Index (FHSI) for the first time at Douglas Lake.

The FIMP methodology includes identifying Zones of Sensitivity (ZOS) that contain high-value and sensitive habitats or other important features. The FIMP methodology was in harmonized with Indigenous Knowledge, consistent with the Framework. The FIMP methodology comprises three consecutive steps:

1. A field-based FIM survey is conducted that involves mapping land use (e.g., residential development), shoreline modifications (e.g., retaining walls, docks, marinas), and biophysical attributes (e.g., vegetation cover, substrates, large woody debris, and aquatic vegetation).
2. The field data and other data sources are used to calculate the Foreshore Habitat Sensitivity Index (FHSI) and delineate Zones of Sensitivity (ZOS). The FHSI represents the ecological value and sensitivity of each shoreline segment. ZOS are specific areas within segments that are important habitats for species or ecosystem functions.
3. The FDG is prepared, which provides development planning guidelines for protection of sensitive fish and wildlife and their habitats identified in the FIM and FHSI analyses. The FDG was not part of the Douglas Lake scope of work.

2. Information Sharing and History



A place-based planning meeting at Douglas Lake was a crucial component of the Project and consistent with the Chief Skəmx̌ist (Black Bear) values that include knowledge sharing, Traditional teaching, and contemplation.

2.1 Place-Based Meeting and Sharing

The Project Team met with UNB, LLC, and Kwusen for a place-based meeting at the UNB band office at Douglas Lake on May 7, 2024. During the meeting, roles and points of communication were confirmed, the schedule was reviewed, and important next steps were identified. UNB shared Douglas Lake history, important cultural areas, and wildlife observations and knowledge. Following the meeting, the Project Team conducted a field reconnaissance to review shoreline access and boat launch options.

An internal Project Team meeting was held on August 23, 2024, to review preliminary shoreline segment delineation, draft digital field forms, and to plan the field data collection. Another Project Team meeting was held online with UNB and LLC on November 14, 2024, to provide a project status update, review preliminary FHSI rankings, and seek feedback on the FHSI calibration process from UNB and LLC. Meetings focused on fostering trust, respect, and relationship-building between UNB, LLC, and the Project Team.

UNB and LLC provided important data, connections, and background material to facilitate a holistic approach to the FIMP process and address the concept of harmonizing Indigenous Knowledge with the highly structured and scientific approach typically followed for FIMP projects. The concept of ‘Two-Eyed Seeing’ refers to a balance between those two perspectives to provide an inclusive understanding of the important factors for management of foreshore environments.

2.2 Historical Context

The protection and stewardship of all water (siwɬkʷ) is part of a goal under Chief Skəmx̌ist (Black Bear) in the Upper Nicola Comprehensive Community Plan (CCP) 2021. Douglas Lake is a culturally and ecologically significant place to the Syilx Okanagan (Kwusen, 2025). Guided by Chief Skəmx̌ist, the project team completed a review of important events that have affected management or the conditions of ecological and cultural values. A review of the past 100+ years provided context and information that improved our understanding of change, including the following key milestone events:

- Inhabitation by the Syilx Okanagan and Secwépemc people dates to time immemorial (UNB, 2021).
- Permanent inhabitation of Douglas Lake area by Syilx Okanagan after the Fish Lake Accord in the late-1700s (UNB, 2021). The lake was an important fishing and trading place (Kwusen, 2025).
- Colonial settlement of the Nicola Valley began in the 1860s with a smallpox epidemic in 1862 (UNB, 2021).
- Land surveys were completed for Douglas Lake IR #3 and Spahomin Creek IR #8 in 1880 (Mohun, 1879). Increased agricultural and recreational activities began in the mid to late 1800s with the Quilchena Hotel at Nicola Lake opening in the early 1900s.
- Douglas Lake Cattle Company was established in 1886 (Douglas Lake Ranch, 2022)
- Heavy algae blooms and nutrient loading from ranching and agriculture activities were observed in the 1970s (Jones and Carmichael, 1979).
- In 1991, the TNRD classified Douglas Lake as a critical lake due to its eutrophic status and poor water quality (TNRD, 2004).
- The 2003 drought spurred water management initiatives within the Nicola Watershed, including the development of the Nicola Water Use Management Plan from 2004 to 2010 (Nicola WUMP, 2010).
- An increase in residential lakeside development in the 2000s led TNRD to the adoption of Lakeshore Development Guidelines in 2004 (TNRD, 2004) and the Nicola Valley Official Community Plan (OCP) in 2011.
- The invasive fish species, Yellow Perch was introduced to Nicola watershed lakes around 2007.
- The Upper Nicola Band Land Use Plans were developed in 2016, which includes guidelines for land use activities associated with Agricultural and Residential areas, as well as Environmentally Significant Areas (ESA) within Douglas Lake IR #3. (UNB, 2016)
- Flooding in 2017 and 2018, which resulted in impacts to foreshore and riparian vegetation (B. Holmes, personal communication, January 14, 2025).
- Algal monitoring conducted from 2022 to 2024 revealed extreme concentrations of cyanobacteria. In 2024, cyanotoxin analysis confirmed the presence of cyanobacterial toxin (H. Larratt, personal communication, March 17, 2025).

2.3 Project Setting

Douglas Lake has a mixed history of Indigenous inhabitation, colonial settlement, and anthropogenic disturbance. The extent of disturbance is relatively minor compared to nearby Nicola Lake. The ecological and regulatory settings associated with Douglas Lake are described below.

2.3.1 Ecological Setting

Douglas Lake occurs within the Nicola Basin Ecosection, which lies within the Southern Interior Ecoprovince. The lake occurs within a semi-arid setting, described by the BC Biogeoclimatic Ecosystem Classification (BEC) system as the Bunchgrass (BG) zone. This warm, dry region is relatively rare in BC, representing less than 1% of the provincial land base (Chourmouzis et al., 2009).

Grassland communities dominate the landscape around Douglas Lake, comprised of bunchgrass species that include bluebunch wheatgrass, rough fescue, and junegrass (Ryan et al., 2022). Forest stands are less common and patchy, including species such as ponderosa pine and Interior Douglas-fir. Riparian and floodplain communities along stream corridors and lakeshores include broadleaf trees and shrub species such as black cottonwood, trembling aspen, and willows. Wetland communities are scattered throughout and include a mix of saline meadows and marshes dominated by cattail and bulrush (Meidinger and Pojar 1991).

Grasslands are among the most at-risk communities in the province, largely due to historic livestock grazing and other agricultural activities over the past 100 to 150 years (Grasslands Conservation Council of BC, 2017). Impacts include soil disturbance, loss of bunchgrass cover, and introduction of invasive species such as cheatgrass and knapweed. Where grassland communities remain intact, they provide important habitats to a variety of provincially and federally designated species at risk. The Douglas Lake Plateau Important Bird Area (IBA) covers the entire Study Area and was designated to conserve important habitats for rare and sensitive species such as Sandhill Crane, Lewis's Woodpecker, and a variety of migratory raptors and waterfowl.

Upper Nicola River and Spahomin Creek are the two major tributaries of Douglas Lake. The Upper Nicola River inlet is located at the northeast end of Douglas Lake, beside Douglas Lake Ranch (Figure 1). The Spahomin Creek inlet is located at the southwest end of the Lake near the Upper Nicola River outlet. Rainbow Trout, Kokanee, and Mountain Whitefish are the most common salmonids in the Upper Nicola River and Spahomin Creek (FIDQ, 2024). However, Spahomin Creek was identified as an important salmon producing stream and spawning Chinook Salmon were observed in 1999 (Bailey et al., 2000; Millar et al., 1997).

Fish presence in Douglas Lake was determined by searching the Fish Inventories Data Queries (FIDQ) and verified by UNB. Species of management concern include Burbot, Kokanee, Rainbow Trout, and Mountain Whitefish. Invasive species of management concern within the lake include Yellow Perch. A summary of fish and wildlife species of management concern, including common, scientific, and Syilx names is provided in Table 3.

Table 3: Fish and wildlife species of management concern at Douglas Lake.

Type	Common Name	Scientific Name	Syilx Name[1]	Designation[2]		
				SARA	COSEWIC	BC List
Fish	Burbot	*Lota lota*	spqʷlic (ling cod)	-	-	-
	Chinook (Unit 15)[3]	*Oncorhynchus tshawytscha*	n'tyx̌tix̌ (king salmon)	-	E	-
	Coho (pop. 7)	*Oncorhynchus kisutch*	kisúʔ	-	T	-
	Kokanee	*Oncorhynchus nerka*	kəkni	-	-	-
	Rainbow Trout	*Oncorhynchus mykiss*	xʷəxʷmínaʔ (trout)	-	-	-
	Mountain Whitefish	*Prosopium williamsoni*	mimәlt	-	-	-
Mammal	American Badger	*Taxidea taxus*	yix̌wyəx̌wútxən	1-E	E	Red
	Little Brown Myotis	*Myotis lucifugus*	sɬnɬanwáya (bat)	1-E	E	Blue
Bird	American White Pelican	*Pelecanus erythrorhynchos*	-	-	NAR	Red
	Barn Swallow	*Hirundo rustica*	m̓am̓qʷcən̓	1-T	SC	-
	Burrowing Owl	*Athene cunicularia*	snínaʔ (owl)	1-E	E	Red
	Lewis's Woodpecker	*Melanerpes lewis*	-	1-T	T	Blue
	Sandhill Crane	*Antigone canadensis*	sʔitwn	-	NAR	-
Amphibian	Great Basin Spadefoot	*Spea intermontana*	sminap (toad)	1-T	T	Blue
Reptile	Great Basin Gophersnake	*Pituophis catenifer deserticola*	sx̌ʷyups (bull snake)	1-T	T	Blue

1. Source: https://www.firstvoices.com/syilx
2. SC: Special Concern; E: Endangered; T: Threatened; NAR: Not At Risk
   BC List: Blue – Of Special Concern, Red – Endangered or Threatened
3. Chinook Salmon - Designatable Unit 15: Lower Thompson, Stream, Spring population

2.3.2 Regulatory Setting

Douglas Lake is primarily surrounded by UNB IR lands and TNRD municipal lands. A substantial portion of the land is designated Agricultural Land Reserve (ALR).

The UNB Land Use Plans (2016) describe the regulatory process to develop on UNB IR lands, including Douglas Lake IR# 3. Land use categories were defined and mapped for each of the IR land parcels. According to the report, approximately 95% of IR# 3 is categorized as Agriculture/Range (AR) land use (UNB, 2016). Most of the remaining land is categorized as Environmentally Sensitive Area (ESA) and Residential (R-2). Areas designated ESA are intended primarily for Traditional uses, Gathering places, and/or conservation and environmental enhancement.

Douglas Lake occurs within the TNRD Electoral Area "M", also referred to as 'Beautiful Nicola Valley – North'. A review of the TNRD online mapping service (https://portal.tnrd.ca/MyRegionView/) indicates that currently, Development Permit Areas (DPA) are not designated around Douglas Lake. THE TNRD land surrounding Douglas Lake has rural zoning (RL-1). The TNRD zoning bylaw (No. 2400) provides riparian and lakeshore regulations (Part 4) that largely rely on the provincial Riparian Areas Protection Regulation (RAPR). Under this

regulation, setbacks to protect shoreline and riparian values are prescribed by a Qualified Environmental Professional (QEP) using the methodology provided by the RAPR.

The zoning bylaw refers to the Lakeshore Development Guidelines (LDG) established by TNRD in 2004 (TNRD, 2004). The LDG provides development guidelines and processes to 'protect the environmental quality of lakes' among other guiding principles. Appendix B of the LDG defines Douglas Lake as a 'Critical Lake', based upon concerns related to water quality. The 2004 management guidelines for Critical Lakes state the following:

- *Lakes in the Critical classification should be subject to no further residential subdivision or development of shoreland to prevent the acceleration of deteriorating water quality or to avoid further development or overcrowding of surface water.*
- *Further development or residential subdivision which is in conformity with existing land use regulations may be considered wherein no additional nutrient input is allowed into the lake.*

The 2013 Regional Growth Strategy (RGS) addresses 'Environmental Protection' in Section 4.0 (TNRD, 2013), which includes:

- *Protect and enhance the environment through the adoption and co-operative use of stewardship principles.*
- *Protect and enhance the quality and quantity of the water of the region's lakes, rivers, streams and ground water sources.*
- *Promote conservation and sustainability of watershed ecosystems, wetlands and riparian areas.*
- *Develop policies and regulations to identify, conserve and protect the natural environment, including mapping of sensitive ecosystems and designating development permit areas.*
- *Collaborate in the implementation of invasive terrestrial and aquatic plant management plans and integrated pest management plans to maintain natural biodiversity in the region.*

The subsequent RGS annual monitoring reports, including up to 2024, only address the 'Environment' as it pertains to the protection of air quality (TNRD, 2024).

Other municipal triggers to assess private lands for environmental values at the time of proposed development include:

- The provincial *Water Act* was replaced by the *Water Sustainability Act* in 2016, which also provides a mechanism to assess and approve 'changes in and about a stream', pursuant to Section 11 of the act.
- Federal conservation changes include the establishment of designated and mapped Critical Habitat for species at risk such as Great Basin Spadefoot (2017) and American Badger (proposed in 2021).

The Nicola Lake Water Use Management Plan (WUMP, 2010) provided 37 recommendations or 'policy instruments' related to water quantity and quality, environment, learning, and management. More recently, the Nicola Characterization Report (ESSA, 2019) provided prioritized recommendations including 'Improve the Use of Indigenous Knowledge in Decision Making' as the number one priority.

3. Assessment and Analysis Methods

The assessment and analysis phase of the Project aligns with the values of Chief Siyá? (Saskatoon Berry) that include creativity, innovation, and problem-solving. Although the FIMP process is highly structured and prescriptive, the Project Team undertook field surveys and data collection with a focus on place-based ecological and cultural values.

This project utilized the FIMP methods (with FHSI and ZOS) to identify the current condition of Douglas Lake, providing a baseline for future studies.

3.1 Data Review and Compilation

The Project includes a review of revised FIMP methods, previous foreshore inventory reports, spatial data, and analysis, and other relevant policies, guidelines, and management plans. Important information sources are listed below. Additional documents reviewed or cited in this report are summarized in the 'References' section.

- Local Indigenous Knowledge and Values Framework (Peck et al., 2023);
- Nicola Lake Foreshore Integrated Management Planning Assessment and Update (Plewes et al., 2024);
- Foreshore Integrated Management Planning for Aquatic Species at Risk in the Upper Columbia Basin 2019-2023 (Peck and Mac Donald, 2024);
- 2021 Living Lakes Canada Foreshore Integrated Management Planning Methods; Foreshore Inventory and Mapping Foreshore Habitat Sensitivity Index Foreshore Development Guide (Schleppe et al., 2021);
- Drone Video Standards for Foreshore Integrated Management Planning (LLC, 2023);
- Aerial photographs from the UBC Geographic Information Centre Collection (1948 to 2004); and
- Online sources including BC Conservation Data Centre (CDC), Habitat Wizard, Ecological Catalogue (EcoCat), and TNRD Open Data.

The pre-field assessment involved initial data gathering and map creation for the place-based meeting, followed by the refinement of maps and data dictionary for the FIM field survey. The digital maps were created using ArcGIS and published to ArcGIS Field Maps. The ArcGIS Survey123 form from the 2023 Nicola Lake FIM (Plewes et al., 2024) was used for Douglas Lake field collection. The FieldMaps schema were updated to accommodate the collection of overhanging vegetation.

We created a digital map for the Douglas Lake place-based meeting. The digital map included property boundaries, streams, critical habitat, CDC occurrence data, aerial imagery, and preliminary segment breaks. Most of the spatial data (Freshwater Atlas, cadastre, CDC occurrence) data was downloaded through the R bcdata package (Teucher et al., 2021). Additional spatial data sources were Canada Lands from Natural Resource Canada, grasslands from Grasslands Conservation Council of BC, and high-resolution Digital Elevation Model (DEM) provided by BGC Engineering.

Preliminary segment breaks were identified using property lines, land use, shore types, and slope. These segments were reviewed at the place-based meeting. Initially, there were 14 segments, but two segments were split in the field resulting in 16 segments.

3.2 FIM Field Surveys

The foreshore field survey was conducted from September 24 to 26, 2024. The survey occurred during a harmful algae bloom advisory that limited the visibility in the water column (Photo 1). The boat and drone surveys were conducted by a crew of qualified professionals including Adam Patterson, R.P.Bio and Rachel Plewes, R.P.Bio. A third biologist, Sara Knezevic, R.P.Bio operated the boat. Mikaela Bennet, A.Ag., conducted the drone survey using a combination of boat and ground access methods with Rachel Plewes and Sara Knezevic. Table 4 provides a summary of the weather conditions and Douglas Lake water levels, based on the hydrometric station 'Douglas Lake at Spaxomin (08LG069)', during each of the survey days.

Photo 1: Cyanobacteria algae bloom observed during FIM survey (September 24, 2024).

Table 4. Summary of field dates and conditions during the Nicola Lake FIM surveys.

Survey Date (2024)	Weather	Daily Mean Water Level (metres above sea level)*
September 24	Partly cloudy, light breeze, 13°C	797.469
September 25	Mostly cloudy, light breeze, 17°C	797.471
September 26	Mostly cloudy, gentle breeze, 11°C	797.473

* Daily mean water level measurement plus the vertical datum conversion of 795.941 m

The field crew used handheld tablets (iPad mini-6) with Survey123 digital data collection forms tailored to the FIMP methods and customized for the Project. One of the tablets was equipped with an external antenna (EOS Arrow GPS receiver) to improve the accuracy of spatial data collection. Drone surveys were completed using a DJI Mini2 drone. The drone was operated from a boat on September 24 and 25, and from publicly accessible lands on September 26. The Standard Operating Procedure (SOP) for drones provided by LLC was used to optimize drone elevation, speed, orientation, and viewing angle of the shoreline.

3.3 FIMP Analysis Methods

We used Survey123 to collect the FIM 2024 database and post-processed it with R Studio (R Core Team, 2024). First, the FIM segments were redrawn in ArcGIS Pro by interpolating the HWL of Douglas Lake from aerial imagery and 1 m contours. ArcGIS Pro was also used to proof spatial points and redraw spatial polygons collected during the FIM field survey.

We created segment polygons to delineate an approximate study area for post-processing of FIM data, FHSI, and ZOS analysis. First, we delineated a study area by buffering the segment line (Douglas Lake HWL) by 50 m on the upland side and 200 m on the lake side. Next, we derived segment splitting lines from perpendicular extensions of segment breaks and manual editing. We used the segment splitting lines to split the study area into segment polygons. Then, we split each segment polygon into two zones - the riparian zone and the littoral zone.

The littoral zone was approximate because lake bathymetry is needed to define the exact littoral zone for each segment.

We proofed all data collected as part of the 2024 FIM survey using air photos, drone imagery, field photos, and zoning. Aerial imagery was used to redraw FIM Vegetation Polygons that were collected in the field. We did not draw any polygons for submergent vegetation because the FIM survey was conducted during an algae bloom and visibility was reduced in the water column. The percent disturbed shoreline was adjusted post-processing based on calculating the percent disturbed area within the 50 m upland riparian area. The percent disturbed area was calculated by digitizing the disturbed extent from the aerial photo. The littoral area was assumed natural for all segments except Segment 1. For these segments, the percent of shoreline disturbed was calculated by dividing the percent riparian disturbance by 2.

We summarized the natural and anthropogenic shoreline characteristics by proportion and length of the shoreline. This included the calculation of the length of disturbed and natural shoreline by predominant land use and at the lake-wide scale. We calculated the length of shoreline for the FIM categories of shore type, littoral widths, aquatic vegetation, foreshore substrates, slope, shoreline modifier type, and land use.

3.3.1 Foreshore Habitat Sensitivity Index

The Foreshore Habitat Sensitivity Index (FHSI) is a ranking index designed to quantify the ecological value of each of shoreline segment and their sensitivity to development. Segments with a higher FHSI score are considered more sensitive to development activities because they provide valuable habitats for fish and/or wildlife species. Development can degrade these habitats by removing riparian vegetation or altering foreshore substrates. Segments with lower FHSI scores lack important habitat features and are more modified by historical development.

The Douglas Lake index is composed of categories that represent amounts and types of biophysical features, modifications (e.g., docks, marinas), fish habitat, ecosystem, and rare occurrences (Table 5). Each category is composed of sub-groups referred to as ‘criteria’ for which a dimensionless quantity, or score, is given based on the quantity of the related features estimated during the field survey or calculated from other data sources. The overall FHSI score is calculated as the weighted sum of criteria scores (Table 5). Weights (*Weight* $_{criterion}$) reflect that certain criteria have a stronger influence on habitat quality than others. They are defined based on other FIMP reports and professional judgement (Plewes et al., 2024; WSP, 2023). The Project Team used the FHSI score to assign each segment to one of the following FHSI rankings: Very High, High, and Moderate. There were no segments ranked as Low.

All the criteria within categories, except for the Modifications category, have positive scores and represent the segments’ contribution to specific habitats and their sensitivity to modifications. Criteria in the Modifications category are negative because the features they represent deteriorate the ecological value of the shoreline. Table 5 provides the formulas used to calculate the criteria scores (*Score* $_{criterion\ i}$). The criteria scores range from 0 to 1 and are based on attributes that are measured in percentages or assigned relative values.

$$FHSI\ Score = \sum_{i=1}^{n} Score_{Criterion\ i} \times Weight_{Criterion\ i}$$

Equation 1. Formula for the FHSI Score, with *n* the number of criteria and *Σ* the summation symbol.

The **biophysical** criteria scores quantify the value of habitat features that support the productivity of wildlife, fish, and other aquatic life. There were nine biophysical criteria included in the FHSI calculation (Table 5). These criteria represented the quality and/or quantity of riparian and aquatic vegetation, large woody debris, percent natural shoreline, substrate, and shore type. The biophysical criteria scores were calculated from data collected

as part of the FIM. For the shore and substrate criteria, if more than one shore or substrate type are present in a segment, the percentage of each type and their relative value are used to calculate the scores (Table 5).

The **fisheries category** quantifies the value of habitat for Burbot and migration of all fish species. The Burbot winter and Burbot spawning criteria were based on Indigenous Knowledge (IK). Burbot winter habitat was based on good winter Burbot fishing spots. Burbot spawning was based on known Burbot spawning areas. Juvenile Burbot Rearing criteria was not included because IK better represented the areas where Burbot are observed. Areas described as Burbot winter habitat or spawning areas were generally areas that were sheltered from the wind and had vegetation or substrates that offered cover. A migration corridor score was attributed to segments that included a known fish-bearing stream mouth and streams with known spawning habitats for non-anadromous salmonids (FIDQ, 2024).

The **ecosystem category** quantifies the amount of grassland ecosystem coverage and the presence of the cottonwood riparian ecosystem. Grasslands along Douglas Lake provide habitat for the blue-listed Great Basin Spadefoot, blue-listed Little Brown Myotis, and the red-listed American Badger (Grassland Conservation Council of BC [GCCBC], 2004). Grasslands provide important stop-over locations for migratory birds such as Sandhill Cranes (Burger, 2024). Douglas Lake is part of the Douglas Lake Plateau IBA due to its importance as a migration corridor and breeding habitat for a variety of waterfowl, raptors, and shorebirds (see 2.3.1). The percentage of grassland within the 50 m riparian area of each segment was calculated using the provincial grassland ecosystem mapping that was updated in 2015 for losses from land use disturbances (Table 5). The cottonwood riparian criteria were based on segments with broadleaf or mature forest from the FIM riparian vegetation bands. Cottonwood riparian ecosystems provide important cover, foraging, and breeding habitats for several rare or vulnerable wildlife species, including raptors, owls, and woodpeckers.

The **rare occurrences category** quantifies the presence of Critical Habitat (CH) or known occurrences for provincially-listed species (Table 5). Selected CH polygons, and CDC masked occurrence data were intersected with the 50 m riparian buffer of each segment to calculate criteria scores. CH polygons for American Badger were excluded because it covered the entire Study Area. However, CH polygons for blue-listed Great Basin Spadefoot were included. The presence of the generalized area for the CDC masked occurrence (Occurrence ID: 577014) was also included as a criteria score.

The **modifications category** quantifies artificial structures and substrate modifications along the foreshore. The artificial structures that are each represented by a criteria score include docks, groynes, and boat launches. The substrate modification criteria score is based on the percentage of the shoreline with modified substrate. The criteria scores for docks, groynes, and boat launches are based on the density of these features that were categorized as None, Low, Moderate, and High. The breakpoints splitting the modification densities into the four ranking categories use the same breakpoints as the Nicola Lake FHSI (Plewes et al., 2024). The breakpoints for docks, groynes, and boat launches are based on a combination of other lakes' FHSI and literature. Currently, there are no docks or groynes on Douglas Lake. However, the category is included because there is potential for docks and/or groynes to be built in the future.

Table 5. Parameters and formulas defined to calculate the Foreshore Habitat Sensitivity Index (FHSI).

Category	Criteria	Weight Category (%)	Percentage of FHSI (%) (Criteria Weight)	Relative Values (inside the brackets)	Formulas for Score criteria
Biophysical	Shore Type	66	21	Stream Mouth = Wetland (1); Gravel Beach = Rocky Shore = Cliff /Bluff (0.8); Sand Beach (0.5); Other (0.3)	Sum (% Shore Length of Shore Type × Relative Value) × Percentage of FHSI
	Foreshore Substrate		10	Cobble = Gravel (1); Boulder = Organic = Mud = Marl = Fines (0.8); Bedrock (0.5); Sands (0.3)	Sum (% Shore Length of Substrate × Relative Value) × Percentage of FHSI
	Percentage Natural		11	N/A	% Natural × Percentage of FHSI
	Submergent Vegetation		3		% Submergent × Percentage of FHSI
	Emergent Vegetation		3		% Emergent × Percentage of FHSI
	Overhanging Vegetation		4		% Overhanging Vegetation × Percentage of FHSI
	Large Woody Debris		4	# LWD/km > 15 (1); in]10;15] (0.8); in]5;10] (0.6); in]0;5] (0.4); > 0 (0)	Relative Value × Percentage of FHSI
	Vegetation Band 1		7	Vegetation Bandwidth Category: Band width ≥ 20 m (1); in [15;20[(0.8); in [10;15[(0.6); in [5;10[(0.4); < 5 (0.2) Vegetation Quality Category:	Vegetation Bandwidth Category × Vegetation Quality × Percentage of the FHSI
	Vegetation Band 2		3	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)	Vegetation Bandwidth Category × Vegetation Quality × Percentage of the FHSI
Fisheries	Migration Corridor	14	7	Present (1); Absent (0)	Relative Value × Percentage of FHSI
	Burbot Winter Habitat		3	Present (1); Absent (0)	
	Burbot Spawning		4	Present (1); Absent (0)	
Ecosystem	Grassland	8	4	Percent Grassland ≥ 75% (1); in [25;75[(0.7);]0;25[(0.35); 0% (0.0)*	Relative Value × Percentage of FHSI
	Cottonwood Riparian		4	Present (1); Absent (0)	Relative Value × Percentage of FHSI
Rare Occurrences	Critical Habitat Great Basin Spadefoot	5	3	Present (1); Absent (0)	
	CDC Masked Species		2	Present (1); Absent (0)	
Modifications	Substrate Modification	7	1	N/A	% Substrate Modification × Percentage of FHSI
	Docks		2	# docks/km > 10 (-1); in]5;10] (-0.75); in]0.0;5] (-0.5); = 0 (0)	Relative Value × Percentage of FHSI
	Concrete Boat Launch		3	# boat launches/km > 2 (-1); in]1,2] (-0.75); in]0.0,1] (-0.5); = 0 (0)	Relative Value × Percentage of FHSI
	Groynes		1	# groynes/km > 20 (-1); in]10;20] (-0.75); in]0.0,10] (-0.5); = 0 (0)	Relative Value × Percentage of FHSI

*closed and open brackets signify if the value is included in the range; for example, the range [25,75[comprises values larger or equal to 25 (≥) and strictly smaller than 75 (<).

Breakpoints to determine the FHSI ecological rankings were defined based on the distribution of FHSI scores and professional judgement (Figure 2).

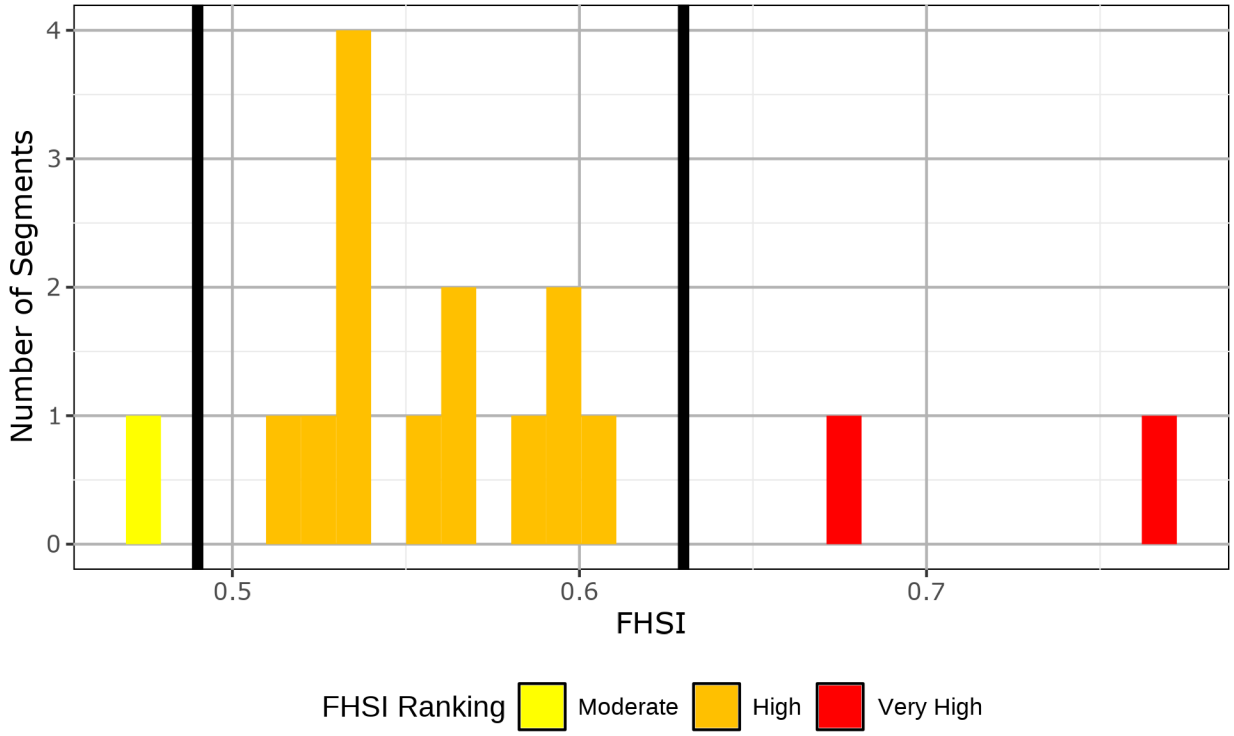


Figure 2: Histogram of FHSI scores with breakpoints for ecological ranking.

3.3.2 Zones of Sensitivity Delineation

The revised FIMP methods involve the delineation of Zones of Sensitivity (ZOS), which represent areas that contain unique and high-value habitat features (Schleppe et al., 2021). We used spatial data from the FHSI calculation, professional judgement, field observations, and verification from UNB to delineate ZOS polygons (FDG Maps). As per the FIMP guidelines, each ZOS is surrounded by a buffer to account for uncertainties and provide adequate protection from adjacent activities (Table 6).

Ecosystem and vegetation ZOS polygons were delineated from aerial imagery and field observations. The field drawn polygons for emergent vegetation were refined based on aerial and drone imagery. The cottonwood riparian and mature coniferous forest ecosystem ZOS were based on observed mature bands of vegetation using aerial imagery. The mature coniferous forest ZOS include areas where raptors are known to nest or perch. The wetland ZOS were based on a combination of Freshwater Atlas (FWA) wetland polygons and aerial imagery. The ZOS buffers for ecosystem and vegetation ZOS ranged from 15 to 30 m (Table 6)

Fisheries and wildlife ZOS were reviewed and verified by UNB. Burbot spawning and moose and deer calving sites were delineated based on Indigenous Knowledge, verified by UNB. There was no ZOS buffer used for the calving site because it encompassed the entire Island (Segment 14). The Burbot spawning was given a ZOS buffer of 30 m.

We used mapped stream mouths from field observations, FWA streamlines, and estimated Upper Nicola River High Water Mark (HWM) to delineate wildlife ZOS for riparian areas and fisheries ZOS for stream mouths. Mapped streams from FWA that had an observed inflow into Douglas Lake were assigned a wildlife ZOS by delineating a 30 m wide riparian area on both sides of the stream centerline (Table 6). A buffer of 5 m was used

for wildlife ZOS to account for inaccuracies in stream centreline mapping. The fisheries ZOS for streams that had an observed inflow, were defined by a 100 m radius semi-circle for streams and a 200 m radius semi-circle for the Upper Nicola River inlet. A 30 m buffer was used for fisheries ZOS associated with stream mouths.

Table 6: Description of Zones of Sensitivity (ZOS) and associated buffers.

ZOS	ZOS Description	ZOS Area Source	Buffer Width (m)
Aquatic Vegetation	Emergent Vegetation	Field drawn polygons	20
Ecosystem	Wetland	FWA Wetlands and drawn from imagery	30
	Cottonwood Riparian	Drawn from imagery	15
	Mature Coniferous Forest	Drawn from imagery and observations of stick nests and raptor perching	15
Fisheries	Stream Mouth	100 m and 200 m radius semi-circle from stream mouth outflow extending into littoral zone	30
	Burbot Spawning	Indigenous Knowledge (UNB)	30
Wildlife	Riparian Wildlife Habitat	30 m area on both sides of FWA streamline or drawn river polygon	5
	Moose and Deer Calving Site	Indigenous Knowledge (UNB)	0

3.4 Foreshore Development Guide (FDG)

FDG maps were prepared, but a FDG report was not completed as part of this Project. These FDG maps build on the Nicola Lake FIMP that emphasized the protection of both cultural and ecological values (Plewes et al., 2024). Culturally Sensitive Areas (CSA) were defined by the Kwusen Cultural Overview Assessment to identify areas that have important cultural and archaeological values (Kwusen, 2025). The FDG maps include the FHSI Ecological Rank for each segment, ZOS, and CSA.

4. Results

The results phase of the Project aligned with the values of Chief Siyá? (Saskatoon Berry) in relation to problem-solving, creativity, and introspection. The other Food Chiefs also provided important guidance in this stage of the Project, such as consideration of Indigenous Knowledge and historical context. The Chief N'tyxtix (King Salmon) values aligned with the standardized, action-oriented, and efficient approach typical with FIMP, whereas Chief Siyá? (Saskatoon Berry) promoted innovative, 'outside the box' thinking and different perspectives.

4.1 Foreshore Inventory Mapping (FIM)

The Douglas Lake FIM divided the 17,943 m of shoreline into 16 segments. These segments ranged in lengths from 218 m to 2,990 m. The predominant land uses found in the segments along Douglas Lake were agriculture and natural area (Table 7). Other predominant land uses included transportation and rural.

Table 7: Douglas Lake shoreline percentages and length by predominant land use.

Predominant Land Use	% Shoreline	Shoreline Length (m)
Agriculture	39.9	7.158
Natural Area	35.1	6,297
Transportation	14.9	2,675
Rural	10.1	1,813

4.1.1 Shore Types and Slope

Rocky shore and gravel were the predominant shore types along Douglas Lake (Figure 3). Rocky shore accounted for 10,144 m (57%) of the shoreline and was located along the steeper shorelines of Douglas Lake Road and the southeast side of the lake. The moderately sloped shorelines along Douglas Lake Road were comprised of 3,656 m (20%) of gravel. The remaining 23% of shoreline was comprised of stream mouth (16%), wetland (4%), and sand (2%). These shore types were associated with the floodplains of the Upper Nicola River and Spahomin Creek.

Shorelines with a moderate slope (5 – 20%) were the most common along Douglas Lake, comprising a shoreline length of 8,242 m (46%). The southeast side of the lake contained 6,078 m of Steep (20-60%) shoreline (Figure 4). The floodplains of the Upper Nicola River and Spahomin Creek were the only shorelines characterized by a Low slope (<5%) and represented 3,624 m (20%) of the shoreline.

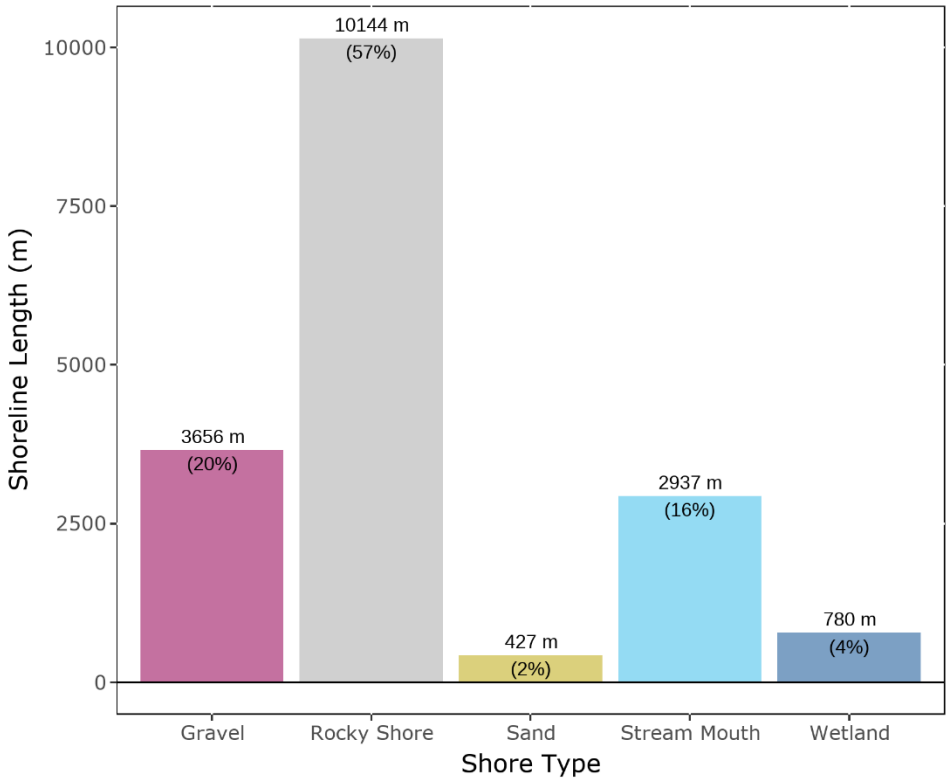


Figure 3: Length of shoreline by predominant shore types.

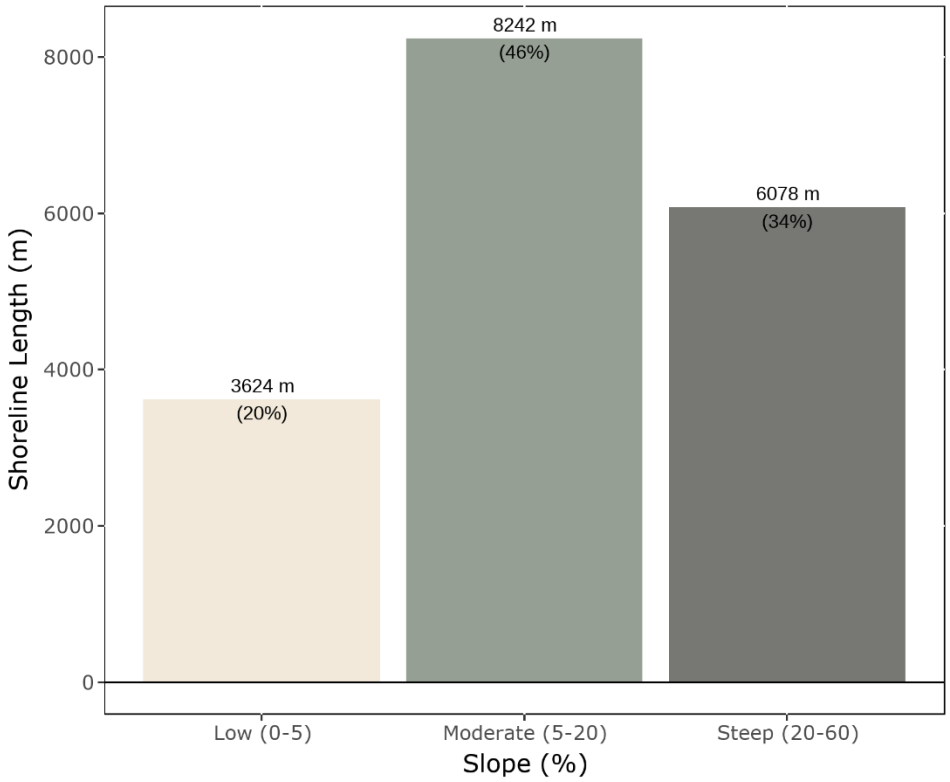


Figure 4: Length of shoreline by slope categories.

4.1.2 Foreshore Substrates

Cobble and gravel were the predominant foreshore substrates along the Douglas Lake shoreline (Figure 5) and were observed along 8,559 m (48%) and 5,458 m (30%) of the shoreline, respectively. Organic substrate occurred along 1,418 m (8%) of the shoreline, often associated with emergent vegetation. Boulders were present along all rocky and gravel shore types, comprising 1,299 m (7%) of shoreline. Small amounts of sand, fines, and bedrock were also present along the Douglas Lake foreshore (Figure 5).

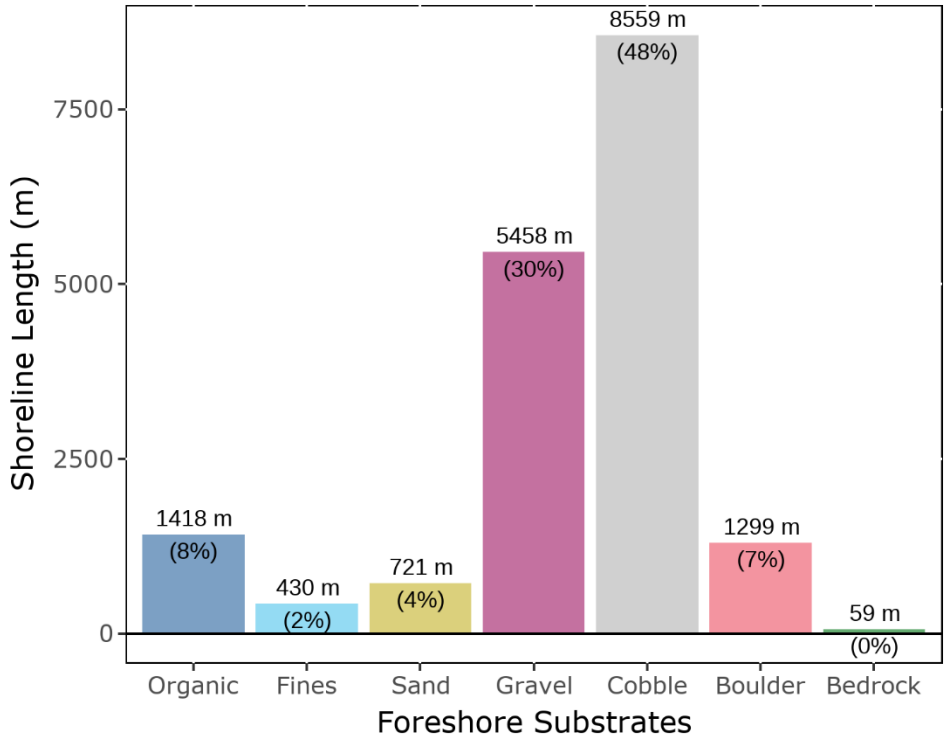


Figure 5: Length of shoreline by foreshore substrate type.

4.1.3 Riparian Vegetation

Most of the shoreline (96%) of Douglas Lake was surrounded by tall shrubs (Figure 6). Narrow shrub bands (5–10 m wide) were present in the rocky and gravel shorelines and consisted of willows and alders. Wider shrub bands (20–50 m) were observed in the wetland and stream mouth shorelines.

The remaining 4% of the shoreline was primarily either mature broadleaf forest or herbs/grasses that were found in Segment 8 – the only sand shoreline, and Segment 4, respectively (Figure 6).

Tree coverage was sparse (<10%) or nonexistent along most of the Douglas Lake shoreline. Segment 12 had moderate (10-50%) tree coverage due to patches of coniferous forest. Segment 8 was the only segment with abundant (>50%) tree coverage in the nearshore riparian vegetation band.

Due to the limited tree coverage, snags and veteran trees were present in only five and three segments, respectively. Snags were observed at Prince Phillips Point (Segment 7), in the floodplain area surrounding Upper Nicola River (Segments 8-9), and in the steeper shorelines with patches of coniferous forest (Segments 10 and 12). Veterans were observed along the segments with steep shorelines (Segments 10-12).

Overhanging vegetation was common and covered 65% of the Douglas Lake shoreline. It was present in all segments with tall shrubs as the dominant nearshore vegetation. Overhanging vegetation was most abundant along the southeastern shoreline and the Island (Segments 11-13 and 16).

Herbs/grasses were the most common vegetation in the upland riparian vegetation band (Figure 6) and were present in 13 of the segments (91% of shoreline) containing an upland riparian vegetation band (B2). Rocky and gravel shorelines typically had wide grassland bands (40-45 m). Mature broadleaf forest was the upland vegetation type for the Upper Nicola River inlet (Segment 9).

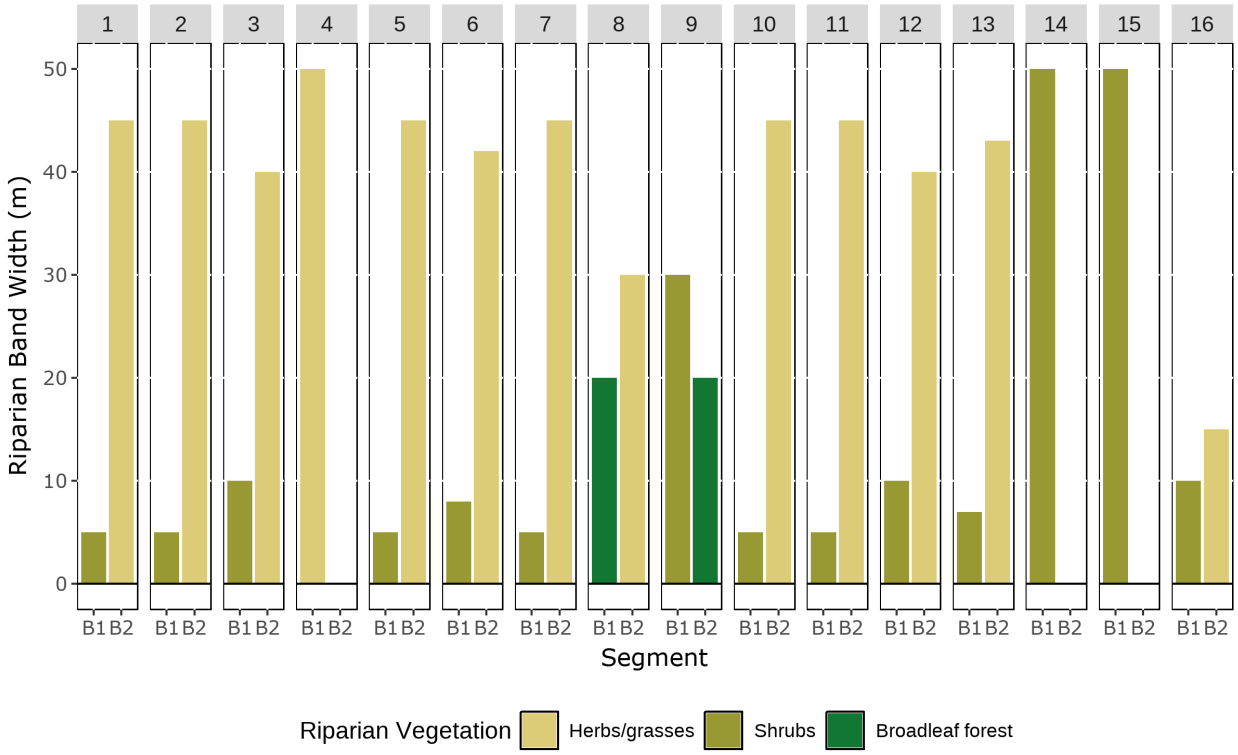


Figure 6: Riparian Band Vegetation classes and widths by segment. B1 is the nearshore riparian band and B2 is the upland riparian band.

4.1.4 Littoral Areas

The littoral areas of Douglas Lake ranged in width from 10 to 200 m. Wide littoral areas (>50 m) represent 7,450 m (42%) of the shoreline, whereas moderate littoral areas (10–50 m) comprise 5,682 m (32%) of shoreline (Figure 7). The remaining 4,813 m (27%) of the shoreline had narrow littoral areas (<10 m). The wide littoral areas were along the west side of Douglas Lake Road (Segments 2 and 3), from Prince Phillips Point to the inflow of Upper Nicola River (Segments 7-9) and surrounding Spahomin Creek (Segments 14 and 15). The rocky shorelines on the southeast side of the lake contain moderate and narrow littoral areas (Segments 10-13, 16).

Large woody debris (LWD) were observed along 15 of the 16 segments with densities reaching up to 13 pieces/km. The Island (Segment 16) was the only segment that did not contain LWD. The highest LWD densities (> 11 pieces/km) were observed along the steeper shorelines of Segments 10 and 11, respectively. LWD densities between 5 to 10 pieces/km were observed along Douglas Lake Rd (Segments 2, 4, 5) and near the Upper Nicola River inlet and Spahomin Creek mouth (Segments 8 and 14).

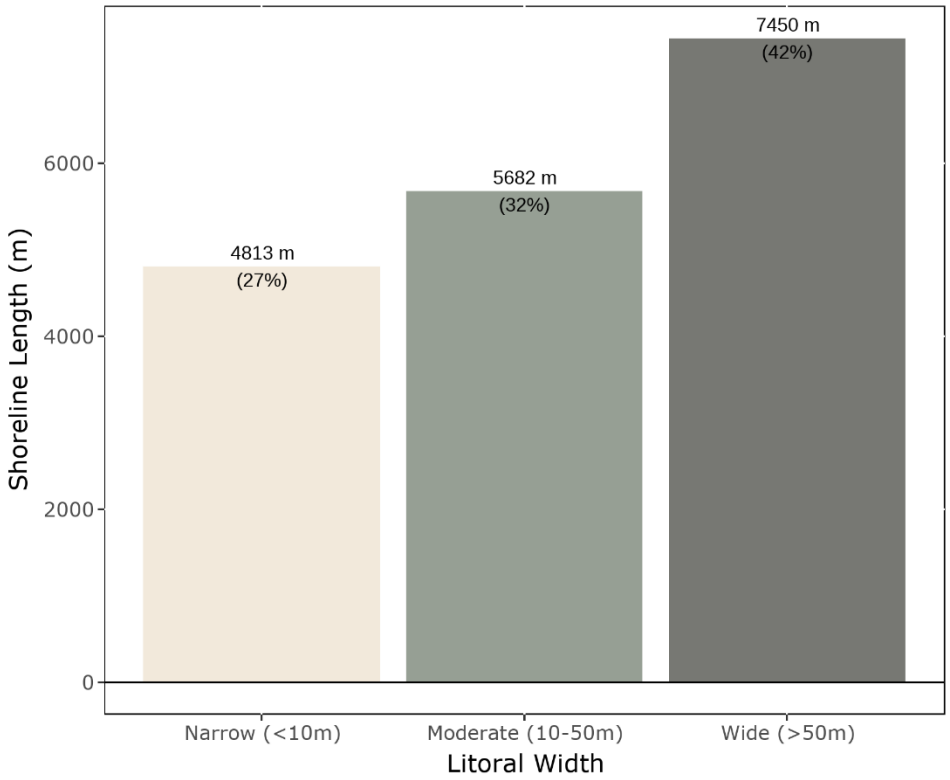


Figure 7: Length of shoreline by littoral widths.

4.1.5 Aquatic Vegetation

Submergent vegetation occurred along 4,369 m (24%) of Douglas Lake shoreline. Submergent vegetation was difficult to see in areas due to thick films of algae and reduced visibility in the water column. The Island (Segment 16) was the only segment not containing submergent vegetation (Figure 8). Submergent vegetation was most abundant in the moderate and wide littoral areas on the northeast side of the lake (Segments 5-8).

Emergent vegetation occurred along 2,583 m (14%) of Douglas Lake shoreline, primarily in littoral areas beside Douglas Lake Road and surrounding Spahomin Creek. It was the most abundant (>70%) in the sheltered littoral areas of Segments 4 and 5. In contrast, no emergent vegetation was observed along the shoreline surrounding Upper Nicola River inlet (Segments 8-10) and the Island (Segments 12 and 16) (Figure 8).

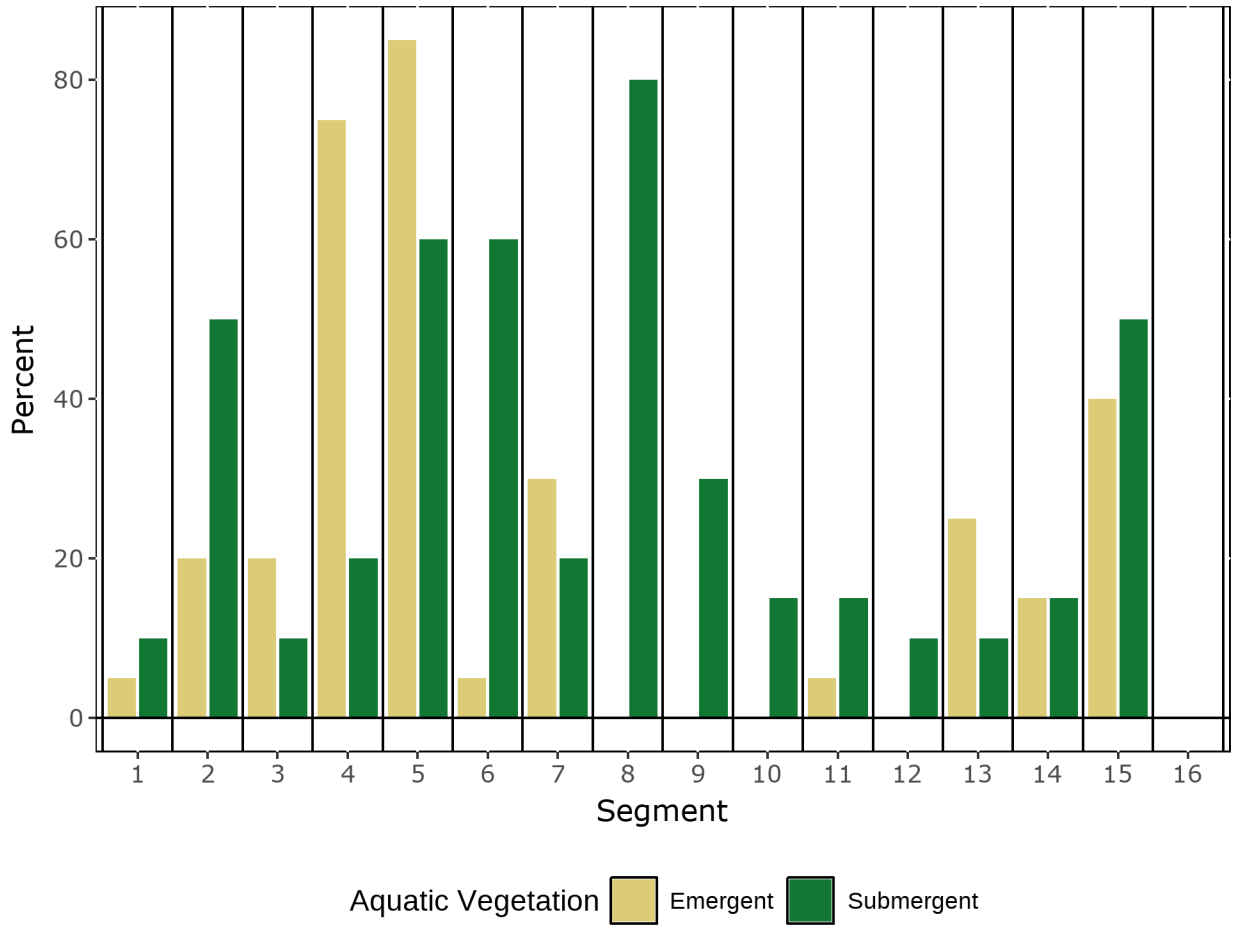


Figure 8: Percent of emergent and submergent vegetation by segment.

4.1.6 Natural versus Disturbed Shoreline

Currently, 16.0% (2,872 m) of Douglas Lake shoreline was disturbed and 84.0% (15,072 m) was natural. The historical loss of natural shoreline on Douglas Lake resulted from riparian disturbance associated with agricultural activities, residential development, and road construction. Most of the disturbed shoreline (1,798 m) had agriculture as the predominant land use (Figure 9). The predominant transportation and rural land uses accounted for 689 m and 341 m of disturbed shoreline, respectively. Only 43 m of the shorelines in natural areas were disturbed.

Most of the Douglas Lake segments had percent disturbed shorelines that correspond to medium (10-50%) and low (<10%) levels of impact. Medium level of impact occurred along 11,268 m (63%) of Douglas Lake shoreline, whereas 4,636 m (26%) was classified as having low level of impact (Figure 10). The remaining 2,040 m (11%) of shoreline was not impacted.

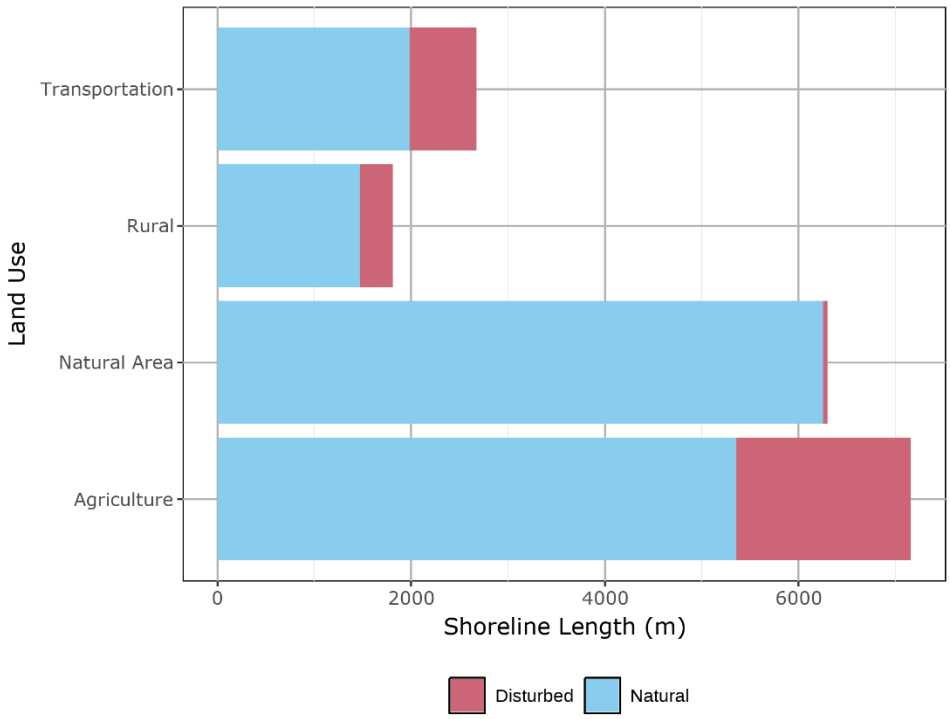


Figure 9: Length of natural and disturbed shoreline by predominant land use types.

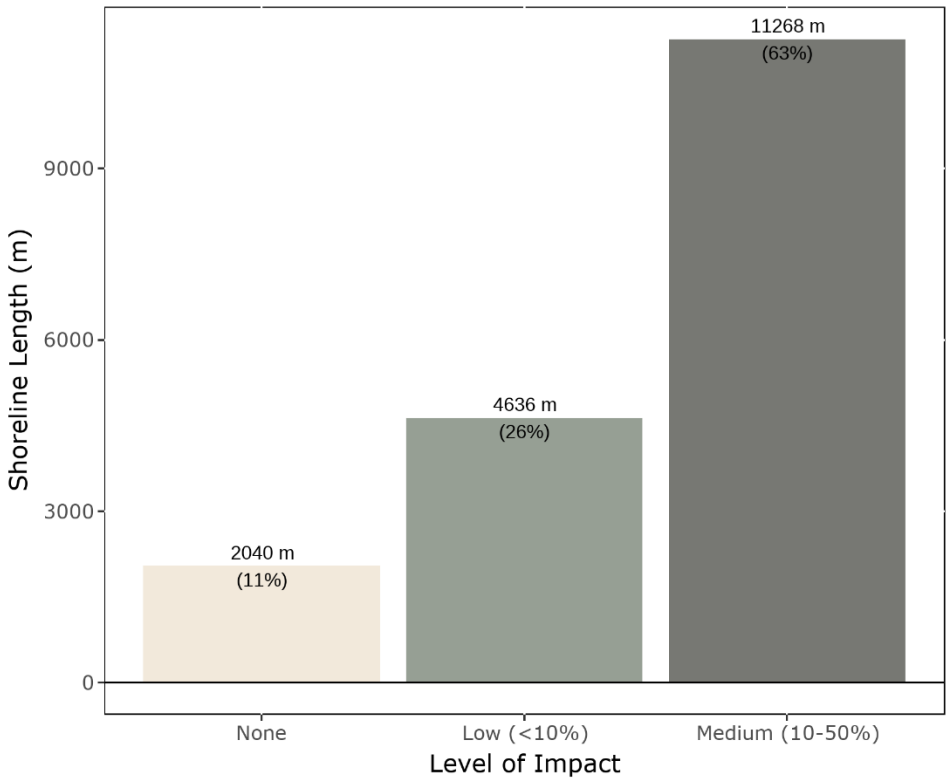


Figure 10: Length of shoreline by Level of Impact.

The segments with a medium level of impact were along Douglas Lake Rd, Douglas Lake Ranch, and agricultural areas surrounding Spahomin Creek. Disturbances in segments along Douglas Lake Rd (Segments 1-7) were attributed to cattle access, boat launches, roads, and residences (Photo 2C). Ranching activities have resulted in disturbance surrounding the Upper Nicola River inlet (Segments 8 and 9). Historical and current agricultural activities in areas surrounding the Spahomin wetland (Segment 15) and Spahomin Creek Rd (Segment 13) contributed to medium levels of disturbance.

The segments with low and no level of impact were along the major tributary inflows and the southern shoreline. Agricultural and ranching activities caused a low level of impact along the shoreline of Spahomin Creek mouth (Segment 14; Photo 2B). The southern shoreline contained some segments with low level of impact, where trace amounts of disturbance (1%) were observed in segments 10 and 12 from fencing and access roads (Figure 11). No disturbances (level of impact: none) were observed in segments 11 and 16 (Photo 2A).

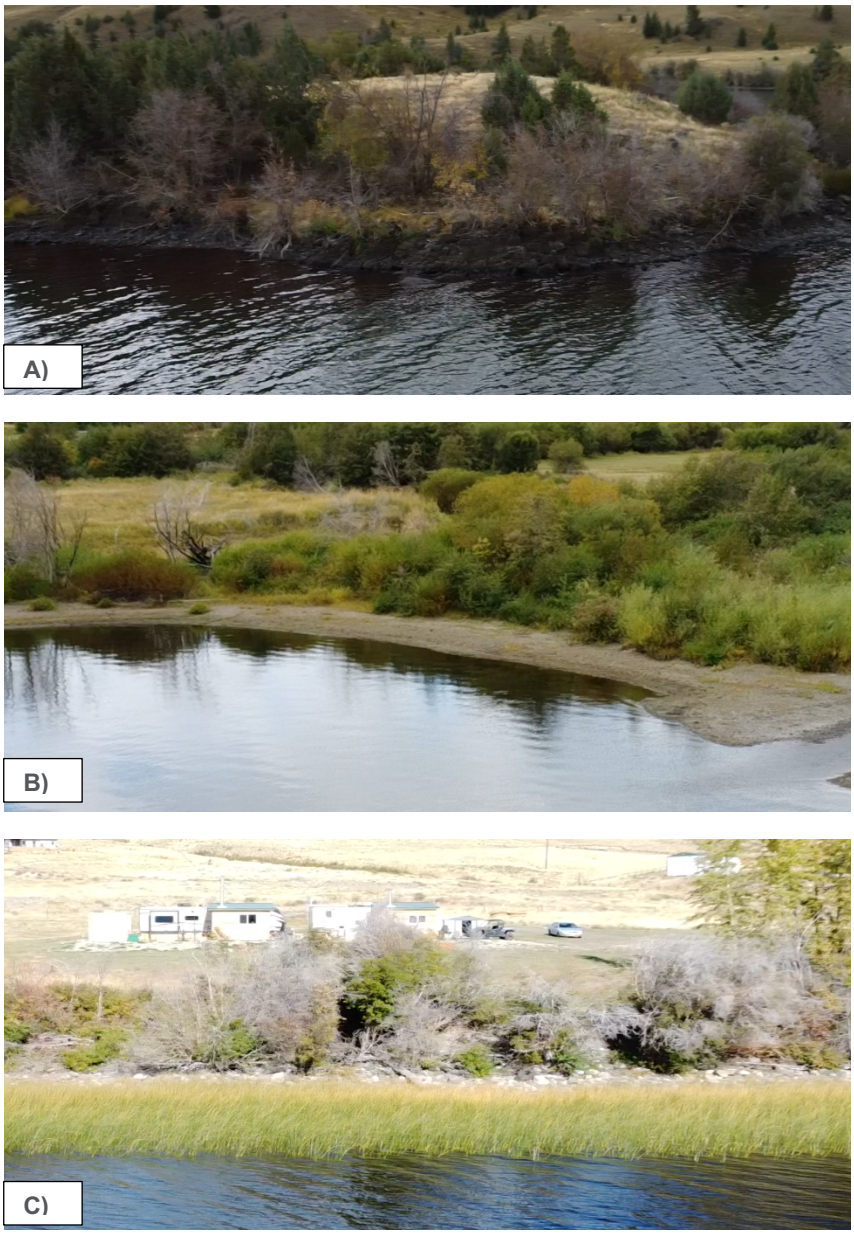


Photo 2: Examples of different levels of impact: A) None on the Island- Segment 16; B) Low (<10%) along Spahomin Creek- Segment 14; C) Medium (10-40%) near end of Segment 3 (September 25, 2024- all photos).

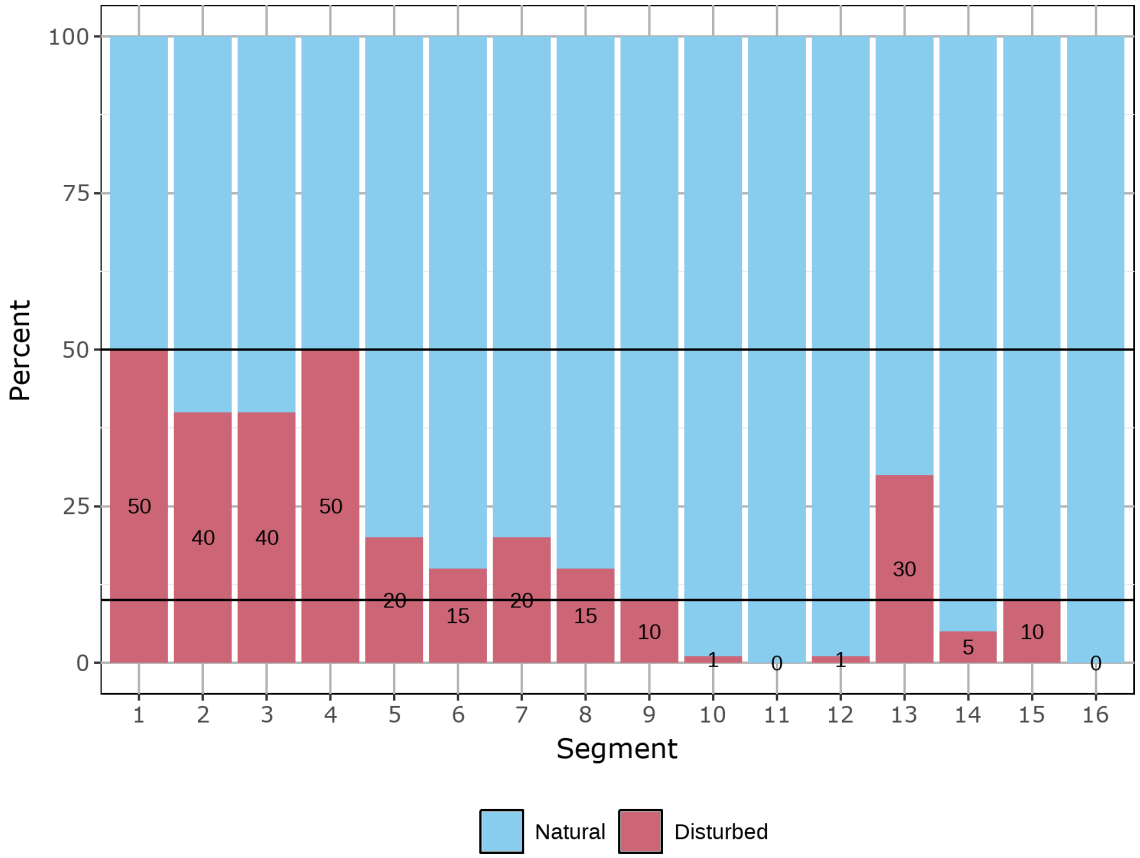


Figure 11: Percent of disturbed and natural shoreline by segment with black lines representing breakpoints between impact levels.

4.1.7 Shoreline Modifications

The Douglas Lake shoreline was primarily natural along the nearshore riparian vegetation band and the littoral area had very few shoreline modifications. There were no observations of erosion protection structures, such as retaining walls or groynes. Similarly, no overwater structures such as docks and marinas were present below the HWL.

The most abundant shoreline modifications along the Douglas Lake shoreline were fences and boat launches (Figure 12). Fences were the predominant shoreline modification (n = 6) and were observed along Douglas Lake Road and near Spahomin Creek. Boat launches were the second most common shoreline modification (n = 3). Formal boat launches were observed at the UNB Boat Launch (Segment 2) and Prince Phillips Point (Segment 7; Photo 3). An informal boat launch occurred at the east end of Segment 1. A mooring buoy was observed in Segment 11 near a Douglas Lake Ranch access road.

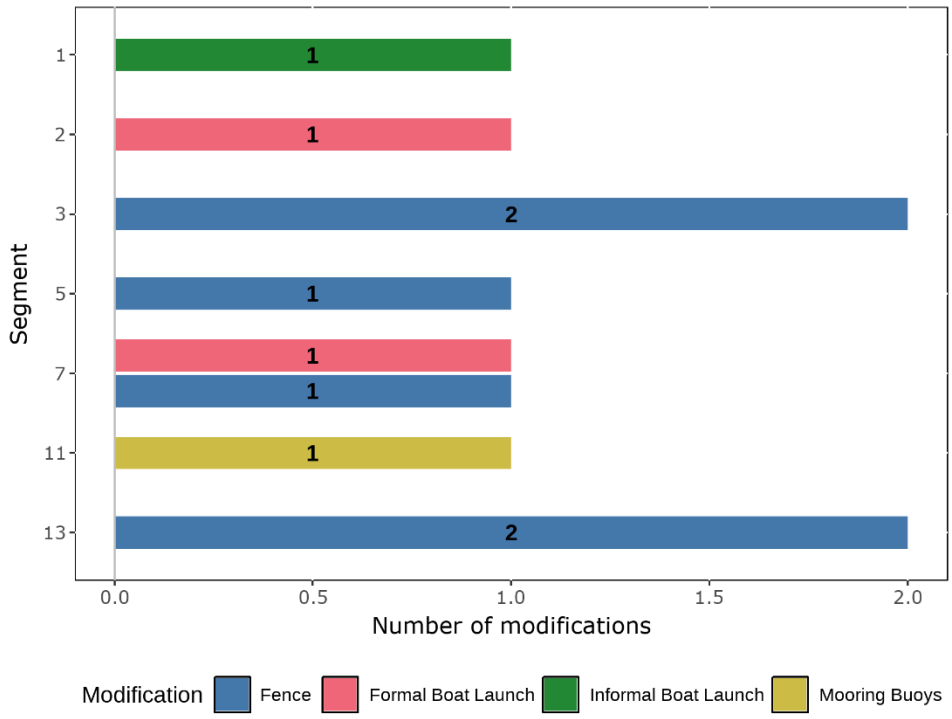


Figure 12: Shoreline modifications by segment observed in 2024.

Photo 3: Formal boat launch at Prince Phillips Point in Segment 7 (September 24, 2024).

Roads were the most prominent disturbance along the Douglas Lake shoreline (Figure 13). The adjacent Douglas Lake Road travels along approximately 8% of the shoreline (1,408 m). Substrate modification was limited to 1% of the shoreline (114 m) and was related to cattle access, boat launches and access roads (Photo 4). Erosion protection works and retaining walls did not occur along the Douglas Lake shoreline.

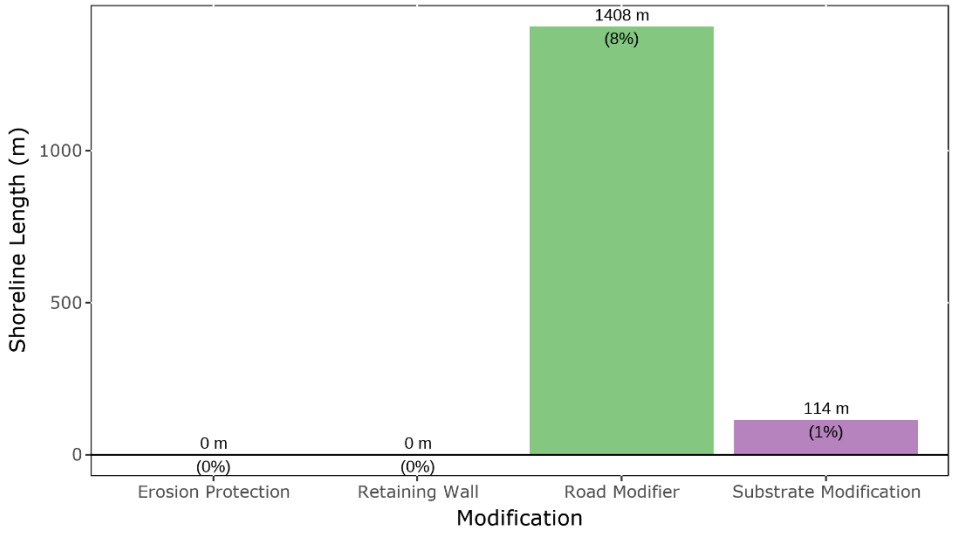


Figure 13: Length of shoreline by modification type.

Photo 4: Example of substrate modification to restrict cattle access in Segment 3 (September 24, 2024).

4.1.8 Wildlife Observations

The most common wildlife observations during the FIM survey were raptors and waterbirds (Table 8). Bald Eagles were observed in segments 6, 7 (at Prince Philips Point; Photo 5), 10, 12, and 15. The only stick nest identified was in Segment 12 and surrounded by a mature band of coniferous forest. A single American White Pelican was observed standing at the Upper Nicola River inlet fan (Segment 9) at the east end of the lake during the drone survey. Other observations include waterfowl on the lake surface or along the shoreline, generally in association with wetland shore types or emergent vegetation. They included including Common Merganser, Common Loon, Canada Goose, and Pied-billed Grebe.

Songbirds observed include American Robin, Downy Woodpecker, Northern Flicker, Song Sparrow, Vesper Sparrow, Western Meadowlark, and Yellow-rumped Warbler. Other birds documented include Belted Kingfisher, Black-billed Magpie, Common Raven, and Northern Harrier. Invasive European Starling were also frequently observed.

A single mammal sighting was recorded, involving a black bear observed along Segment 2 on September 26, 2024. Although not observed during the surveys, UNB noted that Barn Swallows have historically used the bridge crossing at the Upper Nicola River outlet for nesting (Segment 1). They also identified the potential presence of Burrowing Owls due to a breeding and recovery program occurring nearby and the availability of suitable habitats around the lake. River otters have also been observed by UNB at Douglas Lake.

Table 8: Summary of Douglas Lake wildlife observations during field surveys.

Segment No.	Date (2024)	Common Name	Scientific Name	Comments
2	Sep. 26	Black Bear	*Ursus americanus*	Observed along shoreline, then ran up bank and across the road
6	Sep. 24	Bald Eagle	*Haliaeetus leucocephalus*	Perching on pole
7	Sep. 24	Bald Eagle	*Haliaeetus leucocephalus*	Perching on pole
7	Sep. 24	Osprey	*Pandion haliaetus*	Perching on wildlife tree
9	Sep. 24	American White Pelican	*Pelecanus erythrorhynchos*	Recorded by drone on the Upper Nicola River inlet fan
10	Sep. 24	Bald Eagle	*Haliaeetus leucocephalus*	Perching on tree
12	Sep. 24	n/a	n/a	Stick nest
12	Sep. 24	Bald Eagle	*Haliaeetus leucocephalus*	Perching on tree
13	Sep. 24	Great Blue Heron	*Ardea herodias*	2 Observed near wetland
15	Sep. 24	Bald Eagle	*Haliaeetus leucocephalus*	Perching on tree

Photo 5: Bald Eagle perching on a wildlife tree at Prince Phillips Point- Segment 7 (September 24, 2024).

4.2 Foreshore Habitat Sensitivity Index

The Douglas Lake FHSI shoreline ranking was dominated by sections with High ecological value (84.7%) followed by Very High (13.5%). Only 1.8% of the lake shoreline had Moderate ecological value (Figure 14). The shoreline with Very High FHSI contained the mouths of Upper Nicola River and Spahomin Creek (Figure 15). The small portion of shoreline with Moderate FHSI was disturbed by agricultural activities.

Two of the 16 segments had Very High FHSI, representing 2.4 km of shoreline (Figure 15). These segments had important wildlife and fisheries values due to the presence of the mouth of Upper Nicola River (Segment 9), and Spahomin Creek (Segment 15). Segment 9 also contained a wetland that provides habitat for wildlife such as moose and birds.

Thirteen of the 16 segments had High FHSI, representing 15.2 km of the shoreline (Figure 15). Eleven of these segments were composed principally of rocky or gravel shorelines (Figure 17). These segments were located along Douglas Lake Road (Segments 1, 2, 3, 5, 6, 7) and the southern side of the lake (Segments 10, 11, 12, 13, 16). The two remaining segments were composed of sand (Segment 8) and wetland shorelines (Segment 15). Segment 8 was located near the Upper Nicola River inlet and Segment 15 was located near Spahomin Creek inflow.

The remaining Segment 4 had Moderate FHSI, representing 0.33 km of shoreline (Figure 15). The riparian area of Segment 4 was disturbed by agriculture activities (Photo 7). However, the littoral area contained large patches of emergent vegetation.

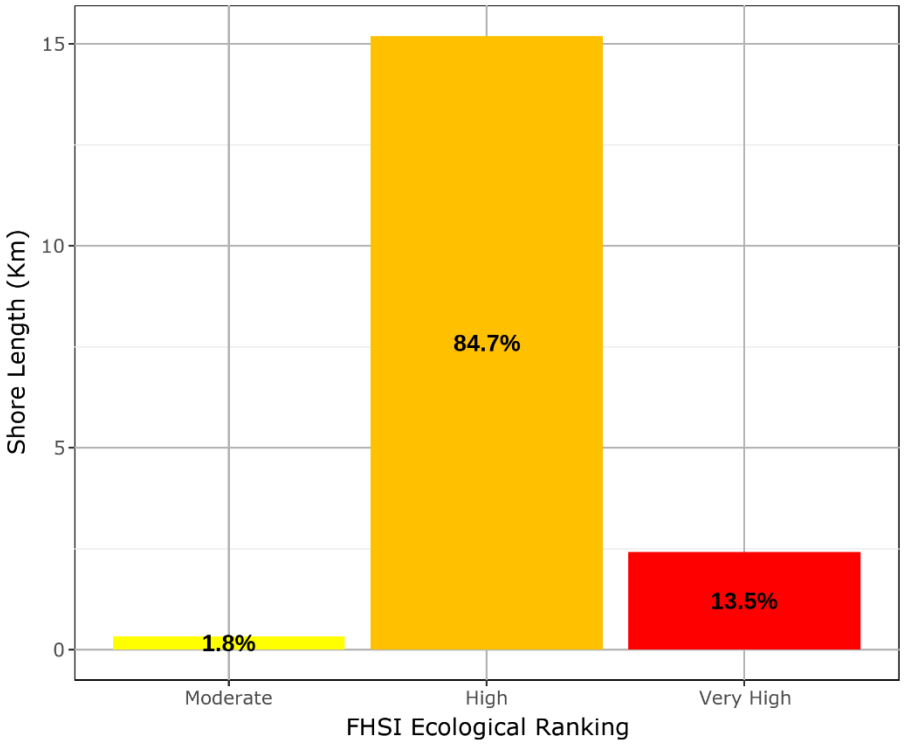


Figure 14. Grouping of the 16 segments by their Foreshore Habitat Sensitivity Index (FHSI) ecological ranking and corresponding length and proportion of the Douglas Lake shoreline.

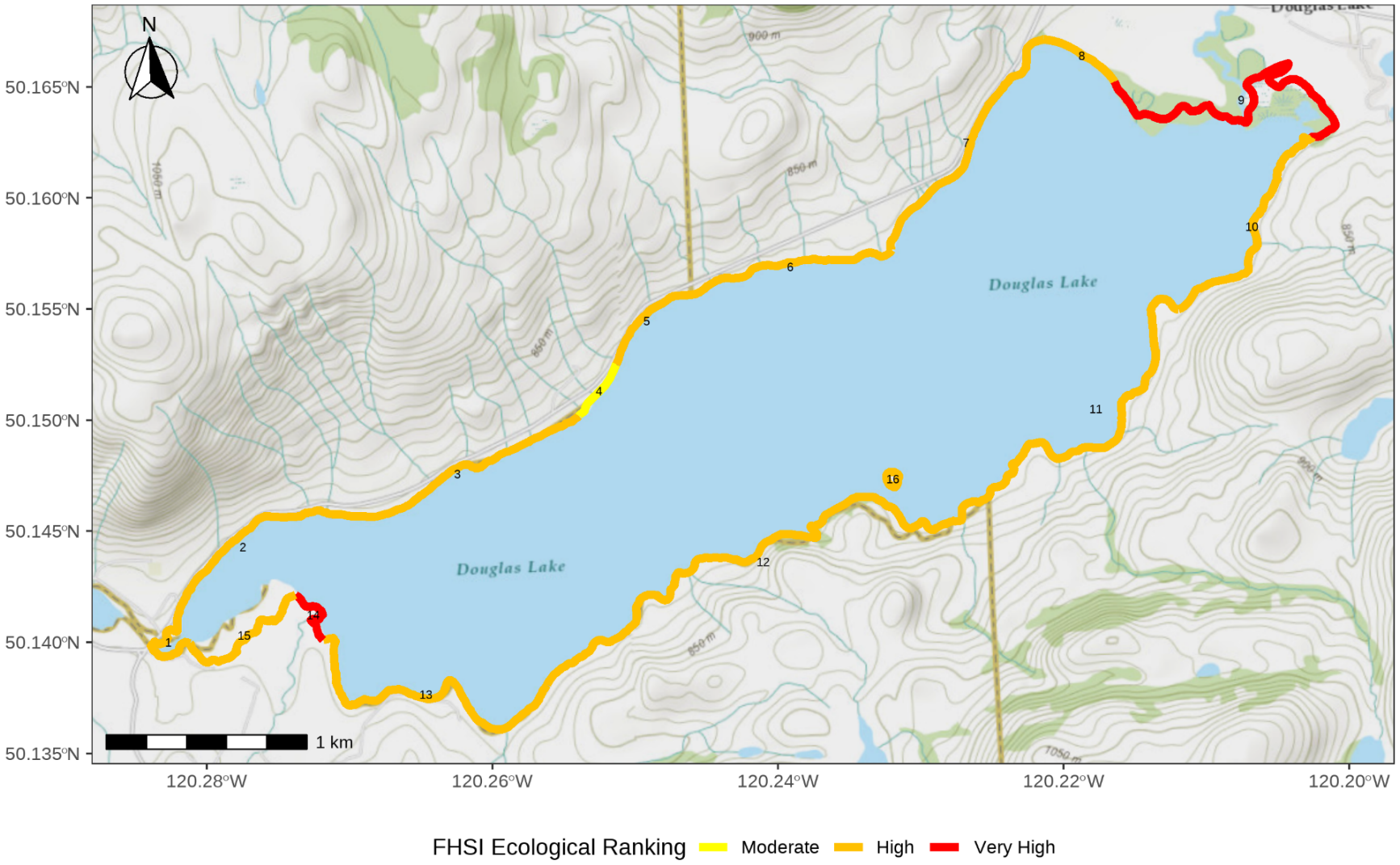


Figure 15: Map of Foreshore Habitat Sensitivity Index (FHSI) ecological rankings for Douglas Lake.

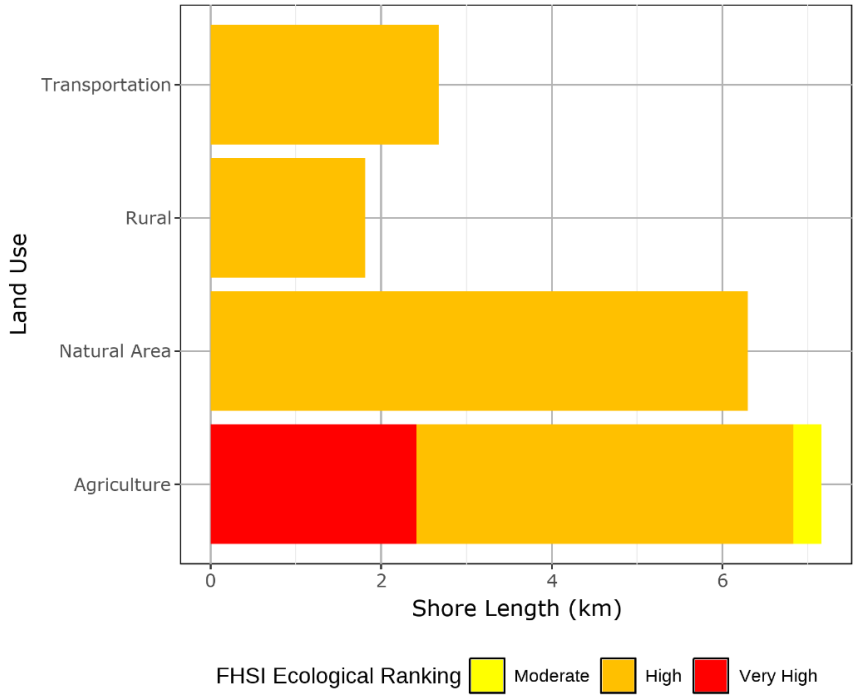


Figure 16. Grouping of the 16 segments by their predominant land use and corresponding length of the Douglas Lake shoreline. Also shown is the Foreshore Habitat Sensitivity Index (FHSI) ecological ranking of the segments.

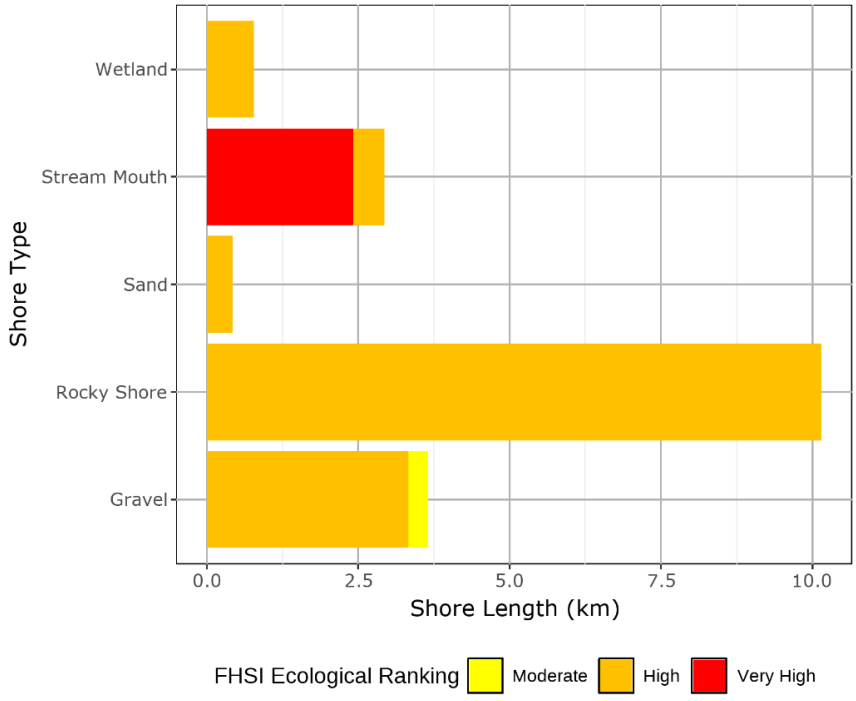


Figure 17. Grouping of the 16 segments by their predominant shore type and corresponding length of the Douglas Lake shoreline. Also shown is the Foreshore Habitat Sensitivity Index (FHSI) ecological ranking of the segments.

Photo 6: View of the Upper Nicola River mouth (Segment 9) (September 24, 2024).

Photo 7: View of Segment 4 shoreline with some riparian disturbance but limited littoral disturbance (September 25, 2024).

4.3 Zones of Sensitivity

The four types of ZOS identified for Douglas Lake were fisheries, wildlife, vegetation, and ecosystem. ZOS polygons range in size from 150 to 521,307 m^2. Most of the ZOS were within floodplain areas or wide littoral zones. Floodplain areas contained stream mouths and valuable riparian ecosystems including wetlands and cottonwood riparian communities. The wide littoral zones featured patches of emergent vegetation, and some served as Burbot spawning areas known to the UNB.

The fisheries ZOS were associated with stream mouths and Burbot spawning. There were 3 stream mouth ZOS surrounding the tributaries that had visible inflows to Douglas Lake. The stream mouth locations associated with Upper Nicola River inlet and Spahomin Creek were important migration corridors for Kokanee and Rainbow Trout. The unnamed creek in Segment 11 provides valuable input of water and nutrients during spring freshet (B. Holmes, personal communication, November 14, 2024). The two Burbot spawning ZOS were within wide littoral areas in the northeast corner of the lake (Segments 7-9) and near the end of Segment 2.

The wildlife ZOS were associated with stream riparian areas, and a known calving site for moose and deer on the Douglas Lake Island. Stream riparian areas were considered wildlife ZOS because the riparian ecosystems provide important wildlife corridors as well as cover, foraging, and breeding habitat for birds and other wildlife. The riparian areas of all streams with visible inflows were included as wildlife ZOS (Table 9). The island (Segment 16) is an important calving site for moose and deer (B. Holmes, personal communication, November 14, 2024).

Table 9: Summary of stream riparian areas designated as wildlife ZOS.

Segment No.	ZOS Description	ZOS Rationale
9	Stream Riparian Area	Upper Nicola River inlet riparian area
11	Stream Riparian Area	unnamed creek riparian area
14	Stream Riparian Area	Spahomin Creek riparian area

The ZOS for vegetation was based on the occurrence of native emergent vegetation, such as bulrush (Photo 8). There were 11 segments that have at least one emergent vegetation ZOS. The vegetation ZOS were concentrated in the shallow areas along Douglas Lake Road (Segments 1-7) and surrounding the Spahomin Creek outlet (Segments 13-15). Segment 11 contained one vegetation ZOS that was located within a bay with gravel shoreline.

Photo 8: Emergent vegetation in Segment 5 (September 25, 2024).

The ZOS for ecosystems included wetlands and cottonwood riparian communities, situated within the floodplains of the Upper Nicola River and Spahomin Creek. There were five cottonwood riparian ZOS located in the floodplain of the Upper Nicola River inlet (Segments 7-9; Photo 9). These ecosystems provided valuable habitat for a range of wildlife species, including nesting, foraging, and roosting habitat. The two wetland ZOS were located near Upper Nicola River inlet (Segment 9) and Spahomin Creek (Segment 15). Wetlands are valuable ecosystems that provide habitat for terrestrial and aquatic species, improve lake water quality by filtering nutrients and pollutants, and provide flood mitigation through water storage (Kingsford et al., 2016).

Mature coniferous forest was associated with an ecosystem ZOS because mature coniferous woodland and wildlife trees were relatively rare along the Douglas Lake shoreline. There were two mature coniferous forest ZOS located in Segment 10 and 12 (Photo 10). During the FIM survey, a bald eagle was seen perched within the Segment 10 ZOS. The mature coniferous forest ZOS in Segment 12 is an important nesting site for bald eagles (B. Holmes, personal communication, November 14, 2024).

Photo 9: View of cottonwood riparian ZOS in Segment 7 and 8 (September 24, 2024).

Photo 10: View of mature coniferous forest ZOS in Segment 12 (September 25, 2024).

4.4 Culturally Sensitive Areas

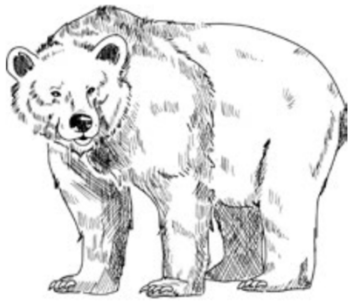
The Kwusen Cultural Overview Assessment (COA) is summarized in a February 10, 2025, memorandum that provides a summary of desktop review, interviews, and field assessment. The overall finding emphasized the entire Douglas Lake, and its foreshore is a sacred and culturally significant place that requires protection and stewardship (Kwusen, 2025). The UNB have deep knowledge, spiritual and cultural connections to the lands, water, and non-human inhabitants of Douglas Lake (Kwusen, 2025). Before colonization, the Syilx people lived year-round on both ends of Douglas Lake.

The COA identified 4 large CSA along the Douglas Lake foreshore. CSA are areas that are especially spiritually and culturally significant, that must be protected from development (Kwusen, 2025). These CSA occur along 10, 945 m (61%) of shoreline and overlap with 13 of the 16 shoreline segments (Table 10). Segments 10, 11, and 15 are the only segments that do not contain a CSA.

Table 10: Summary of Culturally Sensitive Areas and associated segments.

Segment No.	CSA No.	Area Description
5 to 9	1	large area from Prince Phillips Point to Upper Nicola River inlet
2 to 5	2	large area from UNB boat launch to end of Segment 5
1, 2	3	large area from Upper Nicola River outlet to UNB boat launch
12 to 14, 16	4	large area from the Island to Spahomin Creek inflow

5. Discussion



Discussion aligns most with the values of Chief Skəmx̌ist (Black Bear) and Chief Sp̓iȺm̓ (Bitter Root). Writing the discussion required careful contemplation and reflection on the results and relevant western scientific literature. The results were viewed through a holistic lens that considered connections through space and time.

The FHSI analysis and Cultural Overview Assessment revealed the entire Douglas Lake shoreline has important ecological and cultural values. The FHSI analysis showed that 98.2% of the Douglas Lake shoreline has High and Very High ecological values, whereas the CSA overlap approximately 61% of the shoreline. Although, the FHSI analysis ranked Segment 4 as Moderate ecological value. CSA #2 and emergent vegetation ZOS showed that Segment 4 has maintained important cultural and ecological values.

The FHSI analysis, ZOS, and CSA highlight three key shoreline areas that have very important cultural and ecological values.

1. **Upper Nicola River floodplain and surrounding shoreline**

   The FHSI analysis identified the Upper Nicola River inlet as Very High ecological value. The surrounding shoreline contains CSA and numerous ZOS from Segment 7-9. The wide littoral area surrounding the Upper Nicola River inlet is an important migration corridor for Kokanee and burbot spawning. The cottonwood riparian and wetlands provide important habitat for amphibians, birds and large wildlife such as moose.

2. **Island and southwest shoreline**

   The Island (Segment 16) and the shoreline southwest of the Island (Segment 12) have important wildlife and cultural values. The mature coniferous and wildlife trees along the shoreline of Segment 12 provide nesting and perching habitat for raptors. The Island is a moose and deer calving site and has high cultural significance.

3. **Spahomin Creek floodplain**

   The area surrounding the Spahomin Creek mouth (Segments 14-15) has important fisheries values. Most of the Spahomin Creek mouth overlaps with CSA #4 Spahomin Creek mouth is an important migration corridor for Rainbow Trout and Mountain Whitefish. The nearby patches of emergent vegetation associated with the Spahomin wetland provide habitat and cover for migrating fish.

Most of the existing FIM surveys focused on lakes > 1000 ha with higher development pressures than Douglas Lake. The shoreline of Douglas Lake has remained largely unchanged since the 1970s, as observed in the 1976 aerial photos. Table 11 compares Douglas Lake with lakes of similar size and/or land use. Like Nicola Lake, agriculture is the predominant land use, comprising 40% of the Douglas Lake shoreline.

Table 11: Comparison of Douglas Lake to Nicola Lake and Columbia Basin lakes by lake size, land use, and dock density.

Metric	Douglas Lake	Nicola Lake	Whiteswan Lake	Whitetail Lake
Surface Area (ha)	680	2500	378	166
Lake Shoreline (km)	17.9	51.7	12.9	9.9
Number of Segments	16	42	22	6
Predominant Land Uses	Agriculture (40%)	Agriculture (32%)	Park (34%)	Rural (65%)
	Natural Area (35%)	Transportation (25%)	Transportation (32%)	Forestry (35%)
	Transportation (15%)	Rural (14%)	Rural (15%)	
	Rural (10%)	Single Family (14%)	Recreation (13%)	
% Natural Shoreline	84	49	59	83
Survey Year	2024	2023	2020	2020
Docks density in most recent survey (docks/km)	0	2.73	0.23	3.63

Data for Nicola, Whiteswan, and Whitetail Lake obtained from Plewes et al., 2024, Masse et al., 2021, and Wood 2021.

The shoreline of Douglas Lake was mostly natural with very few shoreline modifications. The percentage of natural shoreline was similar for Douglas Lake and Whitetail Lake, at 84% and 83%, respectively (Table 11). However, Whitetail Lake had higher littoral disturbance due to the presence of docks. Douglas Lake was the only lake surveyed using the revised FIMP methodology that did not have a dock. Whiteswan Lake had the lowest dock density of 0.23 docks/km of the Columbia Basin Lakes surveyed from 2020-2023.

Agriculture and transportation were the predominant land uses that have disturbed the Douglas Lake shoreline. Douglas Lake Road was the most prominent disturbance along the shoreline and provided access to the two major boat launches. Agricultural activities resulted in small disturbances of vegetation and substrates through the construction of cattle access gates and access roads. Historical studies and Indigenous Knowledge observed nutrient loading from upstream feedlots and agricultural land (Jones and Carmichael, 1979; Holmes et al. 1988; Kwusen, 2025). Nutrient loading from agricultural land was associated with higher concentrations of cyanobacteria in lakes throughout the north temperate-subarctic regions (Doubek et al., 2015; Taranu et al., 2015).

The shoreline of Douglas Lake is relatively undeveloped and has existing legislation that restricts future foreshore development due to the lake's sensitive habitats and poor water quality. Most of the Douglas Lake shoreline

adjacent to the UNB Reserve is covered by Environmentally Significant Area (ESAs), which limits further development (UNB, 2016). Under the 2004 Lakeshore Development guideline, future foreshore development is restricted for the TNRD shoreline.

6. Recommendations

Recommendations were developed with the intention of protecting and maintaining littoral and riparian habitats associated with Douglas Lake and in keeping with the values represented by the Food Chiefs, including action, innovation, collaboration, Traditional Knowledge, and cultural significance. The values of Chief N'tyxtix̌ (King Salmon) values are important for the efficient and effective implementation of recommendations. Douglas Lake recommendations focus on protecting existing fish, wildlife, cultural and water quality resources.

- A more inclusive process for foreshore development applications should be developed that prioritizes working together to protect Douglas Lake ecological and cultural values. This process must be supported by relationships between all levels of government and First Nations. Communication must also be prioritized during all stages of the development planning process. The use of FDG maps in this process is important to increasing awareness of cultural and ecological values.
    - This collaborative process should be guided by the Framework and utilize a Syilx-led decision-making process.
    - A stepwise process or workflow should be developed to provide clarity to the collaboration process and confirm that the expectations of First Nations are met in relation to appropriately addressing Traditional, cultural, and ecological values during implementation of lake management strategies or development approval decisions.
- A Terms of Reference (TOR) should be developed collaboratively, with guidance from the Framework, to provide proponents with expectations for environmental and archaeological assessments. The TOR will provide clarity to qualified professionals during the assessment of Traditional and/or ecological values and inform the prescription of mitigation measures to avoid important features, as well as meeting expectations associated with restoration or conservation of existing cultural and environmental values.
- Provide educational materials and outreach to foreshore property owners with information about avoidance of harmful activities, such as cattle access to the foreshore and discharge of harmful materials to tributary streams.
    - The 'Cows and Fish' Riparian Management Society in Alberta provides a template for accessible and easy to interpret guidance and training related to grazing management and the conservation of riparian values using a community-driven approach (https://cowsandfish.org/).
    - This approach should be applied to the First Nations and privately owned agricultural land surrounding the lake to manage cattle access in shoreline areas with ZOS and/or Very High and High ecological value.
    - Cattle grazing management must be approached in a balanced and holistic way, with guidance from the Framework, to achieve the needs of livestock while maintaining existing cultural and ecological values.
- First Nations and provincial government should update, replace, or build upon existing tools to consider and plan for the cumulative effects of climate change, invasive species, and water withdrawal.
    - Existing tools, such as hydrological modelling and provincial Cumulative Effects Management Framework (CEMF) should be reviewed to determine if they are working effectively and adequately addressing the findings of Nicola watershed working groups and research.

  - Tools should be updated and developed that support an action-oriented and clear path to foreshore protection and restoration. These tools need to use an adaptive management framework that continuously responds to the evolving needs and challenges.

- The entire Douglas Lake shoreline should have mechanisms for maintenance and protection of cultural and ecological values. A collaborative effort between Upper Nicola Band, non-profit and non-governmental organizations (e.g., land trusts), and all levels of government, is required to establish the appropriate protection mechanisms and secure funding. Potential mechanisms include conservation covenants, conservation zones, or land acquisitions. Priority areas and recommended protection mechanisms include:
  - Conservation covenants for the foreshore area from Prince Phillips Point to the Upper Nicola River inlet;
  - Conservation zones or land acquisitions from the Island to the Spahomin Creek mouth; and
  - Conservation covenants from the Upper Nicola River outlet to the northern extent of IR #3 along Douglas Lake Rd.
- Conduct invasive species management mapping and identification of problem areas that require management or prescriptions.
  - Management of established invasive species such as Yellow Perch must be determined in a collaborative way with agreed-upon eradication strategies, including the use of piscicide (e.g., Rotenone), or alternative adaptive management processes.
  - Education and outreach should be done to prevent the spread or establishment of new or additional invasive species, potentially including zebra and quagga mussels.
- Data sharing agreements should be established between First Nations and other government (provincial and federal) and non-government (naturalist societies, conservation groups) organizations to maintain accurate and up to date SAR survey data related to Great Basin Spadefoot, American Badger and other species of management concern associated with Douglas Lake such as Lewis's Woodpecker, American Pelican, and Sandhill Crane.
  - Agreements should provide a central data storage and management location as well as a custodian of the data that regularly checks, updates, and maintains the database.
  - The information should be accessible within a GIS-based web mapping tool, which will inform decision-making related to land use management referrals or proposed development activities.

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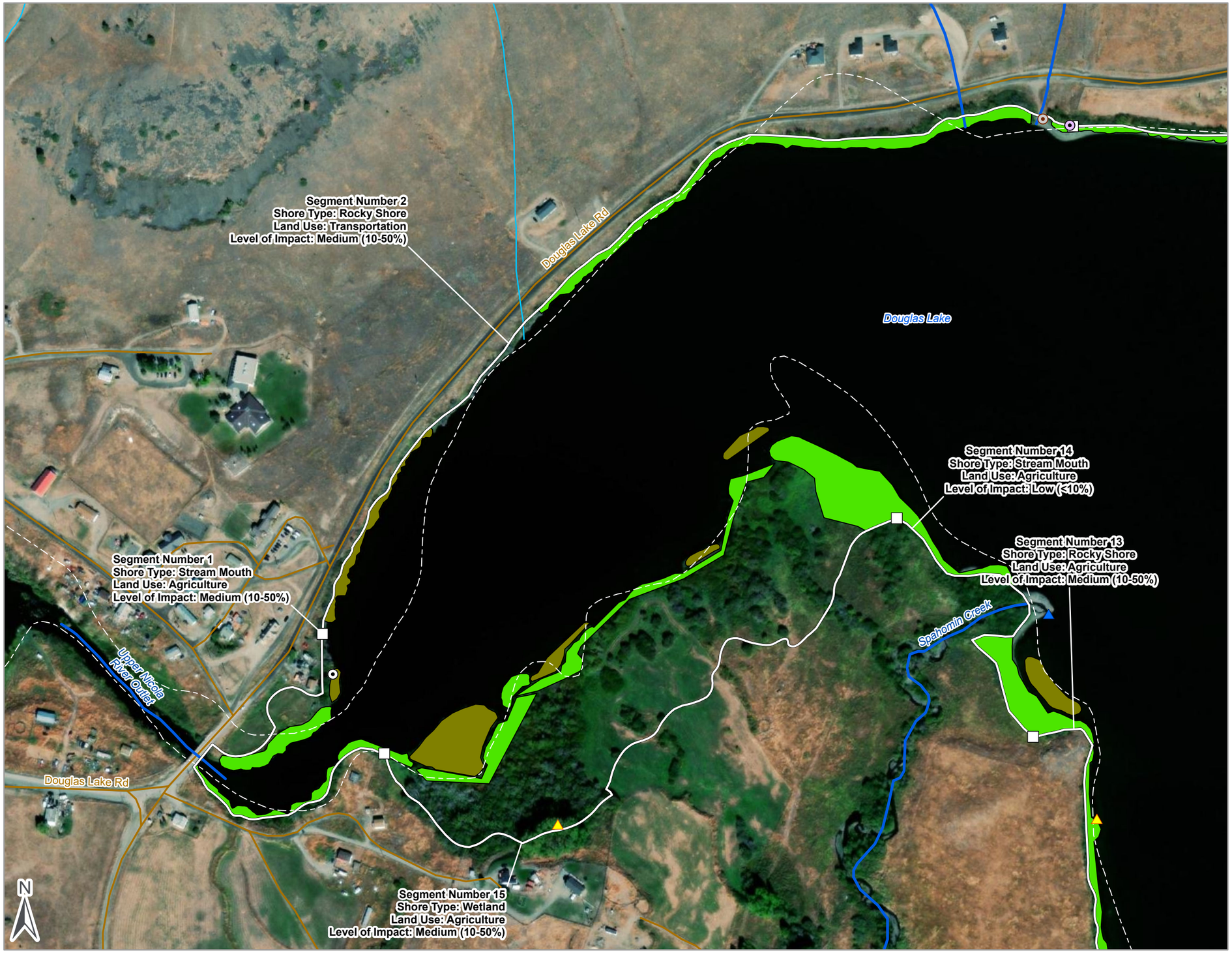
FIM Maps

SEGMENTS - 1, 2, 14, 15



DOUGLAS LAKE FIMP ASSESSMENT

- Segment Break
- Foreshore Inventory Mapping Segment
- Digital Road Atlas

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- BC Parcels
- Freshwater Atlas Wetlands

FIM Aquatic Vegetation

- Emergent Vegetation (EV)
- Overhanging Vegetation (OV)

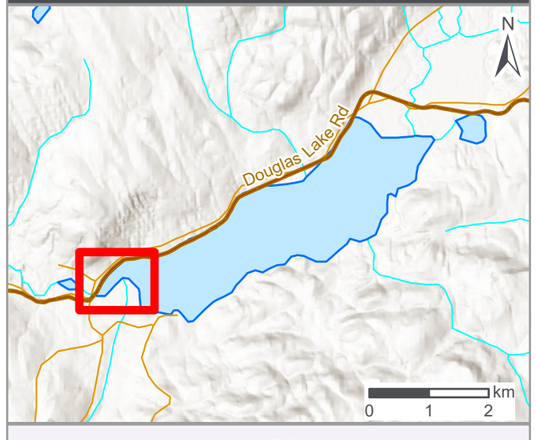
FIM Points

- Creek / River Mouth
- Stick Nest
- Wildlife
- Fence
- Formal Boat Launch
- Informal Boat Launch
- Cattle Access
- Mooring Buoys
- Pump House
- Water Infrastructure
- Other

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

LOCATION MAP



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Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 2.1

SEGMENTS - 3

DOUGLAS LAKE FIMP ASSESSMENT

- Segment Break
- Foreshore Inventory Mapping Segment
- Digital Road Atlas

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- BC Parcels
- Freshwater Atlas Wetlands

FIM Aquatic Vegetation

- Emergent Vegetation (EV)
- Overhanging Vegetation (OV)

FIM Points

- Creek / River Mouth
- Stick Nest
- Wildlife
- Fence
- Formal Boat Launch
- Informal Boat Launch
- Cattle Access
- Mooring Buoys
- Pump House
- Water Infrastructure
- Other

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

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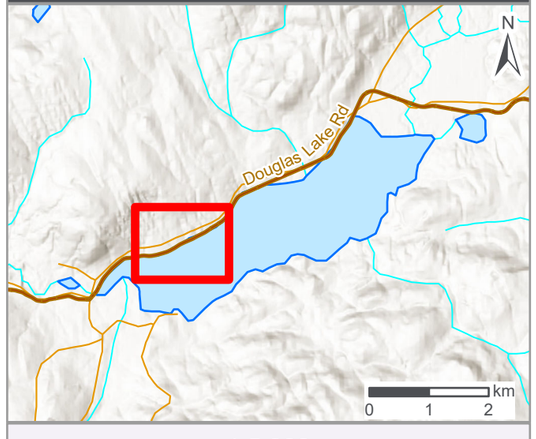

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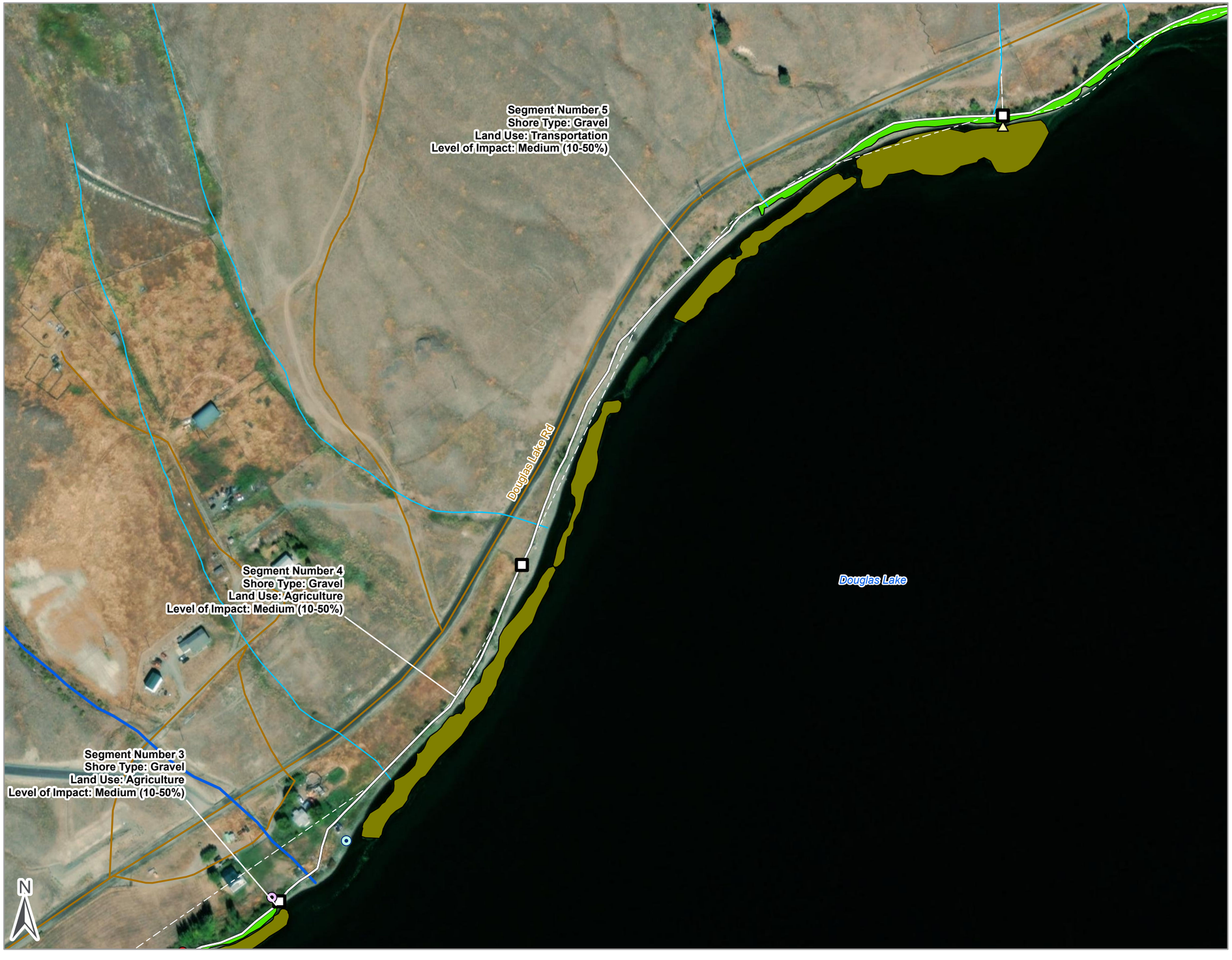
Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 2.2

SEGMENTS - 4 and 5



DOUGLAS LAKE FIMP ASSESSMENT

- Segment Break
- Foreshore Inventory Mapping Segment
- Digital Road Atlas

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- BC Parcels
- Freshwater Atlas Wetlands

FIM Aquatic Vegetation

- Emergent Vegetation (EV)
- Overhanging Vegetation (OV)

FIM Points

- Creek / River Mouth
- Stick Nest
- Wildlife
- Fence
- Formal Boat Launch
- Informal Boat Launch
- Cattle Access
- Mooring Buoys
- Pump House
- Water Infrastructure
- Other

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

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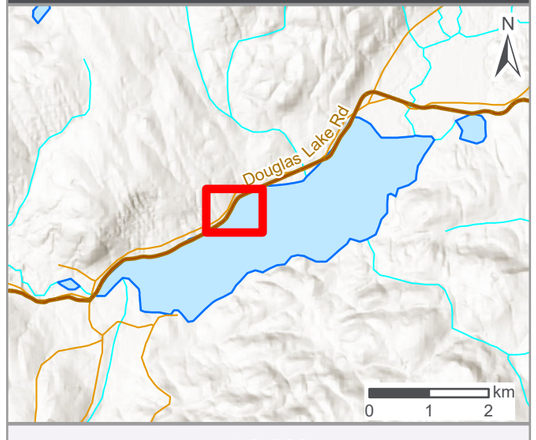

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Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 2.3

SEGMENTS - 6

DOUGLAS LAKE FIMP ASSESSMENT

- Segment Break
- Foreshore Inventory Mapping Segment
- Digital Road Atlas

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- BC Parcels
- Freshwater Atlas Wetlands

FIM Aquatic Vegetation

- Emergent Vegetation (EV)
- Overhanging Vegetation (OV)

FIM Points

- Creek / River Mouth
- Stick Nest
- Wildlife
- Fence
- Formal Boat Launch
- Informal Boat Launch
- Cattle Access
- Mooring Buoys
- Pump House
- Water Infrastructure
- Other

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

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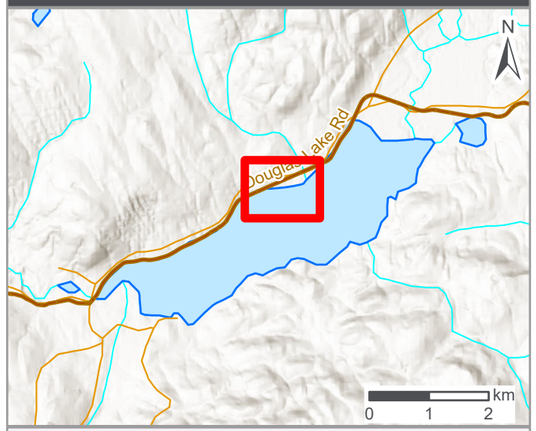

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Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 2.4

SEGMENTS - 7

DOUGLAS LAKE FIMP ASSESSMENT

- Segment Break
- Foreshore Inventory Mapping Segment
- Digital Road Atlas

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- BC Parcels
- Freshwater Atlas Wetlands

FIM Aquatic Vegetation

- Emergent Vegetation (EV)
- Overhanging Vegetation (OV)

FIM Points

- Creek / River Mouth
- Stick Nest
- Wildlife
- Fence
- Formal Boat Launch
- Informal Boat Launch
- Cattle Access
- Mooring Buoys
- Pump House
- Water Infrastructure
- Other

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

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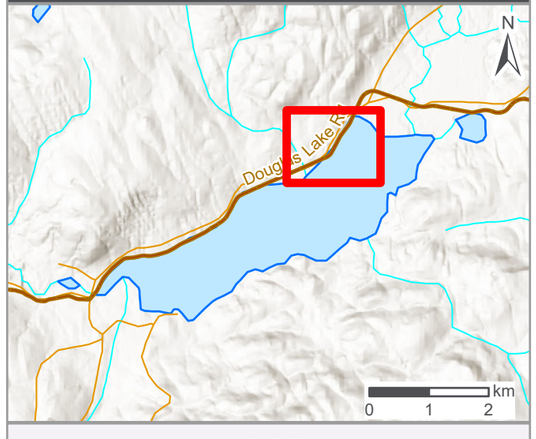

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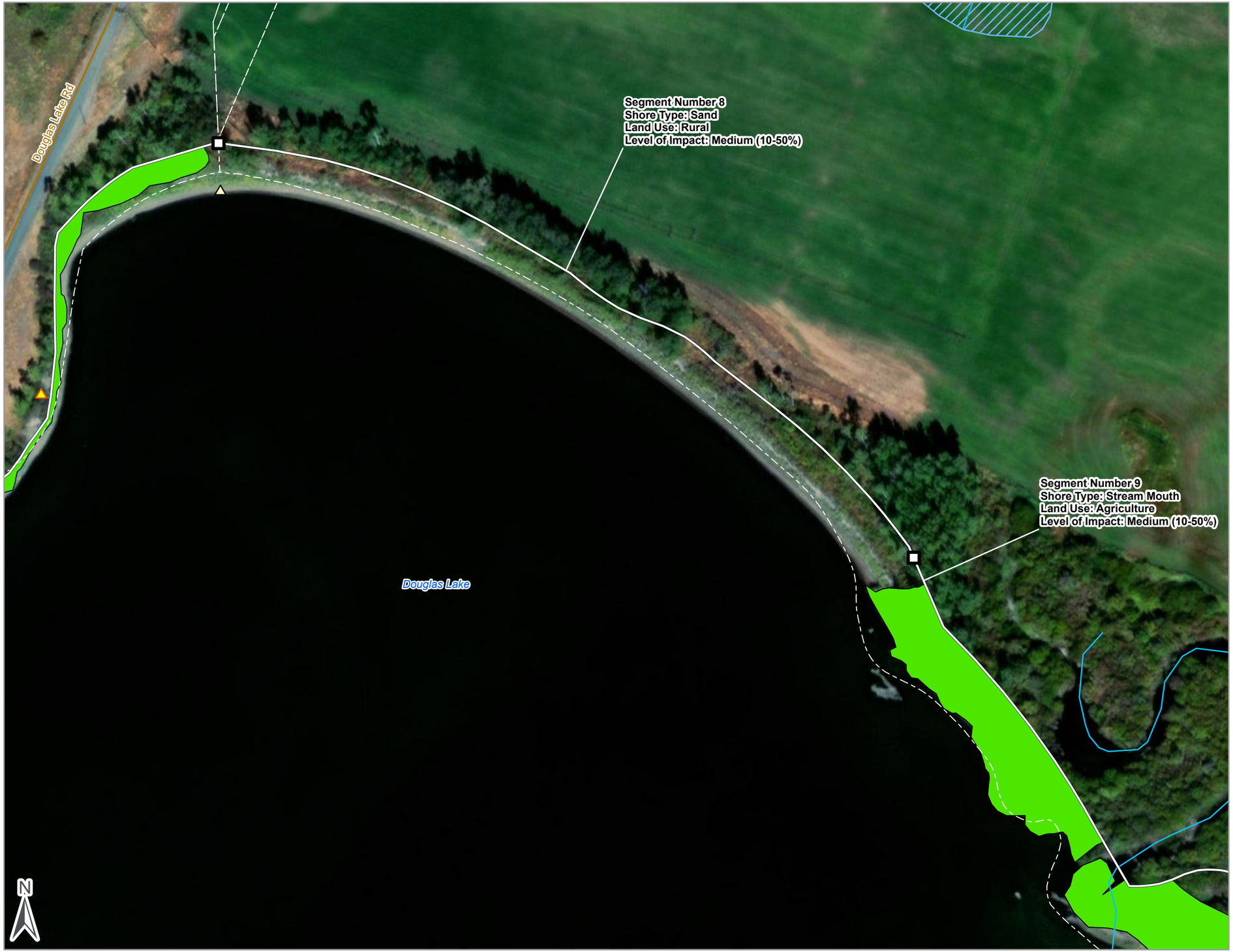
Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 2.5

SEGMENTS - 8



DOUGLAS LAKE FIMP ASSESSMENT

- Segment Break
- Foreshore Inventory Mapping Segment
- Digital Road Atlas

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- BC Parcels
- Freshwater Atlas Wetlands

FIM Aquatic Vegetation

- Emergent Vegetation (EV)
- Overhanging Vegetation (OV)

FIM Points

- Creek / River Mouth
- Stick Nest
- Wildlife
- Fence
- Formal Boat Launch
- Informal Boat Launch
- Cattle Access
- Mooring Buoys
- Pump House
- Water Infrastructure
- Other

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

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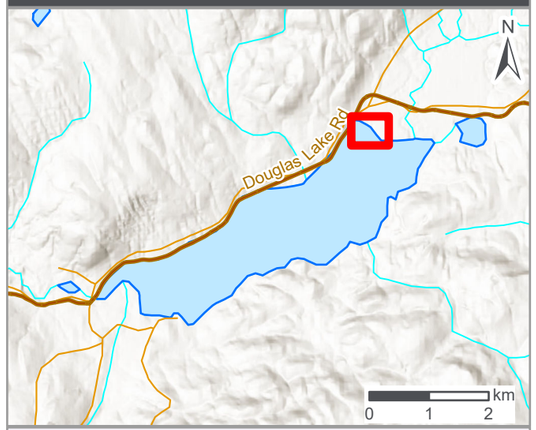

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Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 2.6

SEGMENTS - 9

DOUGLAS LAKE FIMP ASSESSMENT

- Segment Break
- Foreshore Inventory Mapping Segment
- Digital Road Atlas

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- BC Parcels
- Freshwater Atlas Wetlands

FIM Aquatic Vegetation

- Emergent Vegetation (EV)
- Overhanging Vegetation (OV)

FIM Points

- Creek / River Mouth
- Stick Nest
- Wildlife
- Fence
- Formal Boat Launch
- Informal Boat Launch
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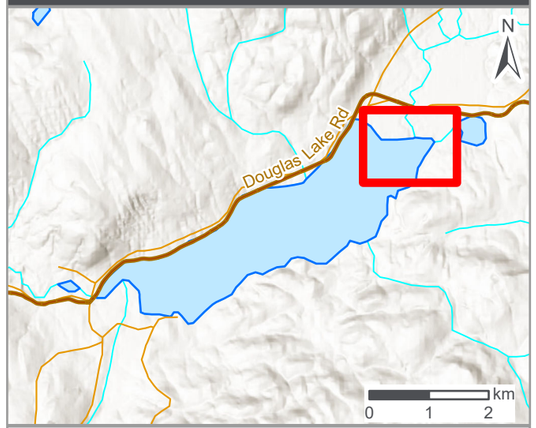
- Mooring Buoys
- Pump House
- Water Infrastructure
- Other

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

LOCATION MAP



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Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 2.7

SEGMENTS - 10

DOUGLAS LAKE FIMP ASSESSMENT

- Segment Break
- Foreshore Inventory Mapping Segment
- Digital Road Atlas

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- BC Parcels
- Freshwater Atlas Wetlands

FIM Aquatic Vegetation

- Emergent Vegetation (EV)
- Overhanging Vegetation (OV)

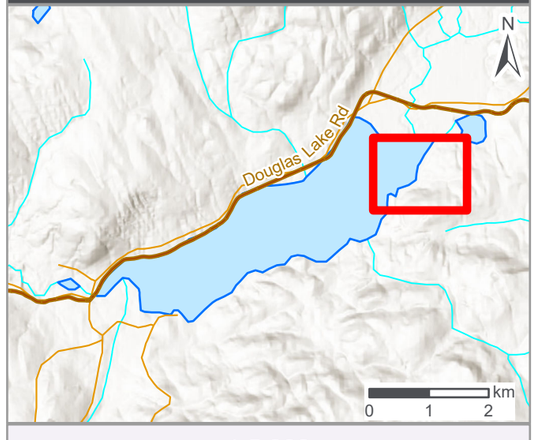
FIM Points

- Creek / River Mouth
- Stick Nest
- Wildlife
- Fence
- Formal Boat Launch
- Informal Boat Launch
- Cattle Access
- Mooring Buoys
- Pump House
- Water Infrastructure
- Other

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

LOCATION MAP



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Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 2.8

SEGMENTS - 11

DOUGLAS LAKE FIMP ASSESSMENT

- Segment Break
- Foreshore Inventory Mapping Segment
- Digital Road Atlas

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- BC Parcels
- Freshwater Atlas Wetlands

FIM Aquatic Vegetation

- Emergent Vegetation (EV)
- Overhanging Vegetation (OV)

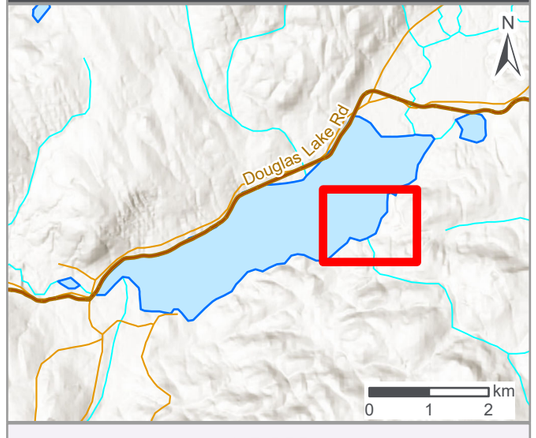
FIM Points

- Creek / River Mouth
- Stick Nest
- Wildlife
- Fence
- Formal Boat Launch
- Informal Boat Launch
- Cattle Access
- Mooring Buoys
- Pump House
- Water Infrastructure
- Other

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

LOCATION MAP



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Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 2.9

SEGMENTS - 12a and 16

DOUGLAS LAKE FIMP ASSESSMENT

- Segment Break
- Foreshore Inventory Mapping Segment
- Digital Road Atlas

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- BC Parcels
- Freshwater Atlas Wetlands

FIM Aquatic Vegetation

- Emergent Vegetation (EV)
- Overhanging Vegetation (OV)

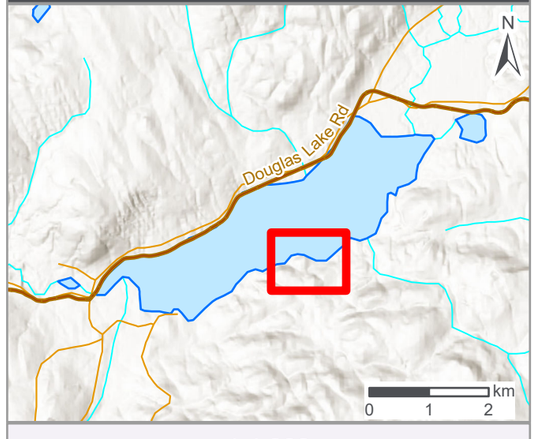
FIM Points

- Creek / River Mouth
- Stick Nest
- Wildlife
- Fence
- Formal Boat Launch
- Informal Boat Launch
- Cattle Access
- Mooring Buoys
- Pump House
- Water Infrastructure
- Other

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

LOCATION MAP



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Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 2.10

SEGMENTS - 12b

DOUGLAS LAKE FIMP ASSESSMENT

- Segment Break
- Foreshore Inventory Mapping Segment
- Digital Road Atlas

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- BC Parcels
- Freshwater Atlas Wetlands

FIM Aquatic Vegetation

- Emergent Vegetation (EV)
- Overhanging Vegetation (OV)

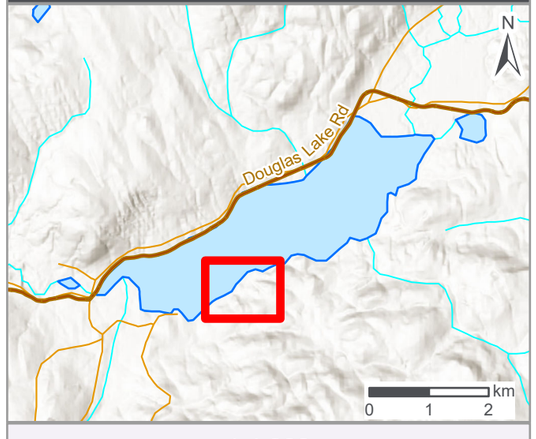
FIM Points

- Creek / River Mouth
- Stick Nest
- Wildlife
- Fence
- Formal Boat Launch
- Informal Boat Launch
- Cattle Access
- Mooring Buoys
- Pump House
- Water Infrastructure
- Other

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

LOCATION MAP



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Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 2.11

SEGMENTS - 13

DOUGLAS LAKE FIMP ASSESSMENT

- Segment Break
- Foreshore Inventory Mapping Segment
- Digital Road Atlas

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- BC Parcels
- Freshwater Atlas Wetlands

FIM Aquatic Vegetation

- Emergent Vegetation (EV)
- Overhanging Vegetation (OV)

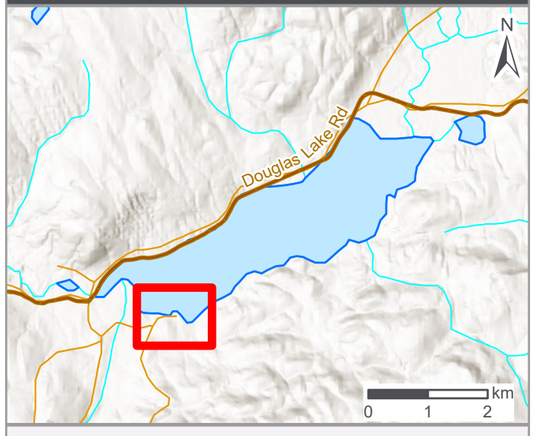
FIM Points

- Creek / River Mouth
- Stick Nest
- Wildlife
- Fence
- Formal Boat Launch
- Informal Boat Launch
- Cattle Access
- Mooring Buoys
- Pump House
- Water Infrastructure
- Other

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

LOCATION MAP



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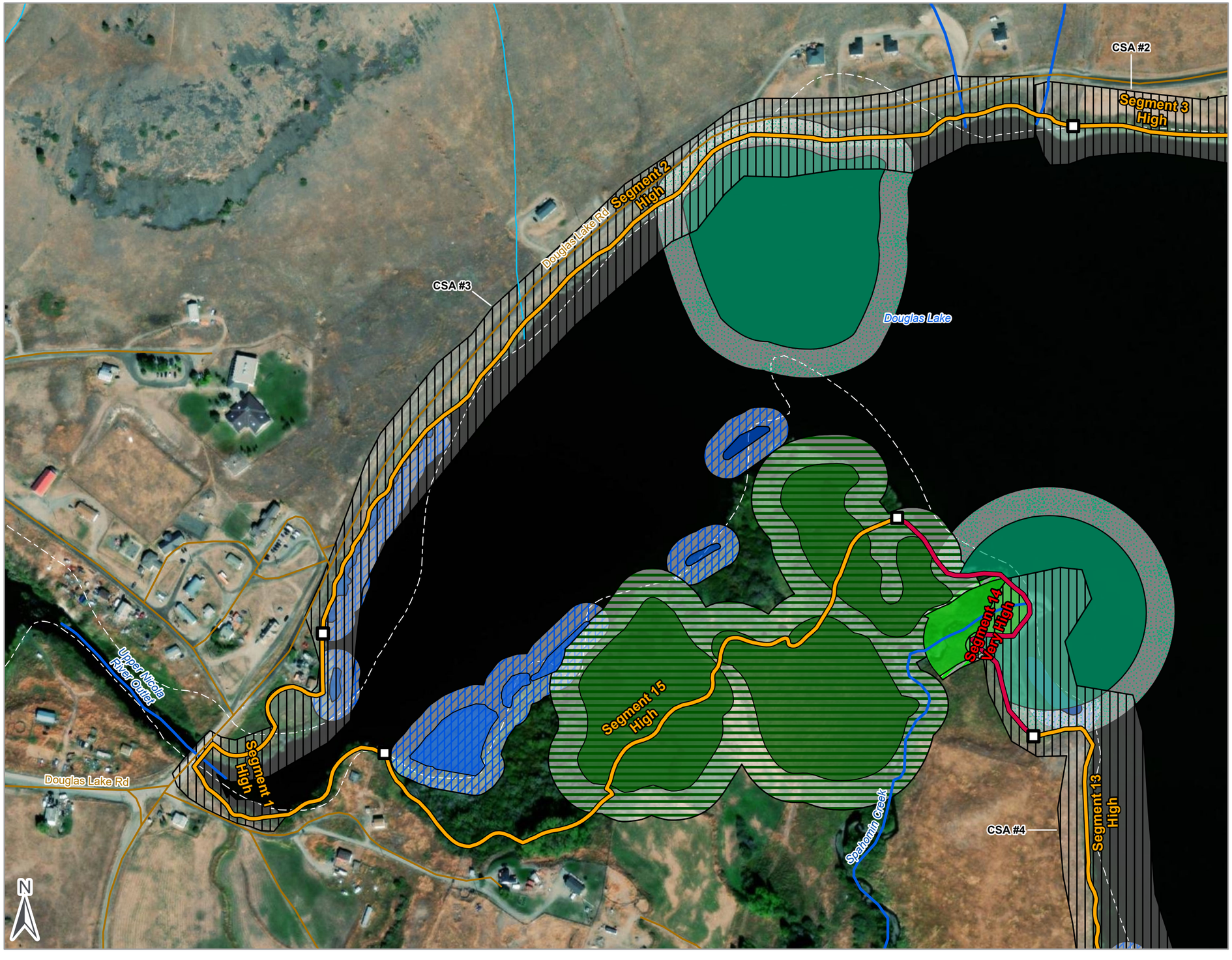
Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 2.12

FDG Maps

SEGMENTS- 1, 2, 14, 15



DOUGLAS LAKE FDG ASSESSMENT

- Segment Break
- Digital Road Atlas

Foreshore Inventory Mapping Segments

Foreshore Habitat Sensitivity Ranking

- Very High
- High
- Moderate

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- Culturally Sensitive Area (CSA)

Zones of Sensitivity (ZOS)

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

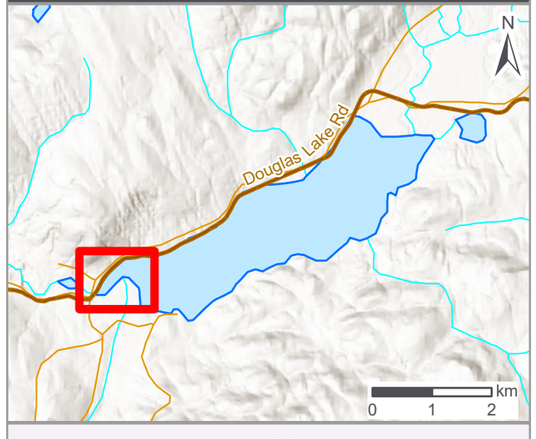
Zones of Sensitivity (ZOS) Buffers

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

LOCATION MAP



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Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 1.1

SEGMENTS- 3

DOUGLAS LAKE FDG ASSESSMENT

- Segment Break
- Digital Road Atlas

Foreshore Inventory Mapping Segments

Foreshore Habitat Sensitivity Ranking

- Very High
- High
- Moderate

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- Culturally Sensitive Area (CSA)

Zones of Sensitivity (ZOS)

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

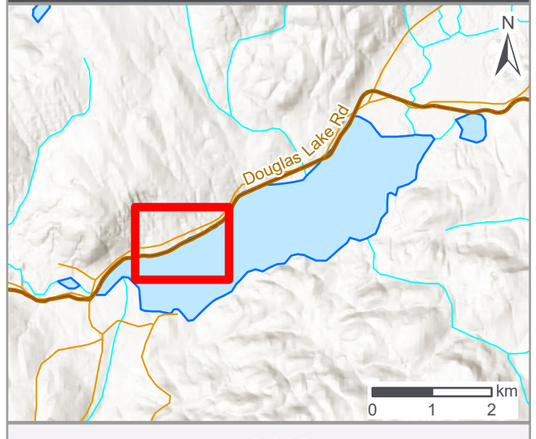
Zones of Sensitivity (ZOS) Buffers

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

LOCATION MAP



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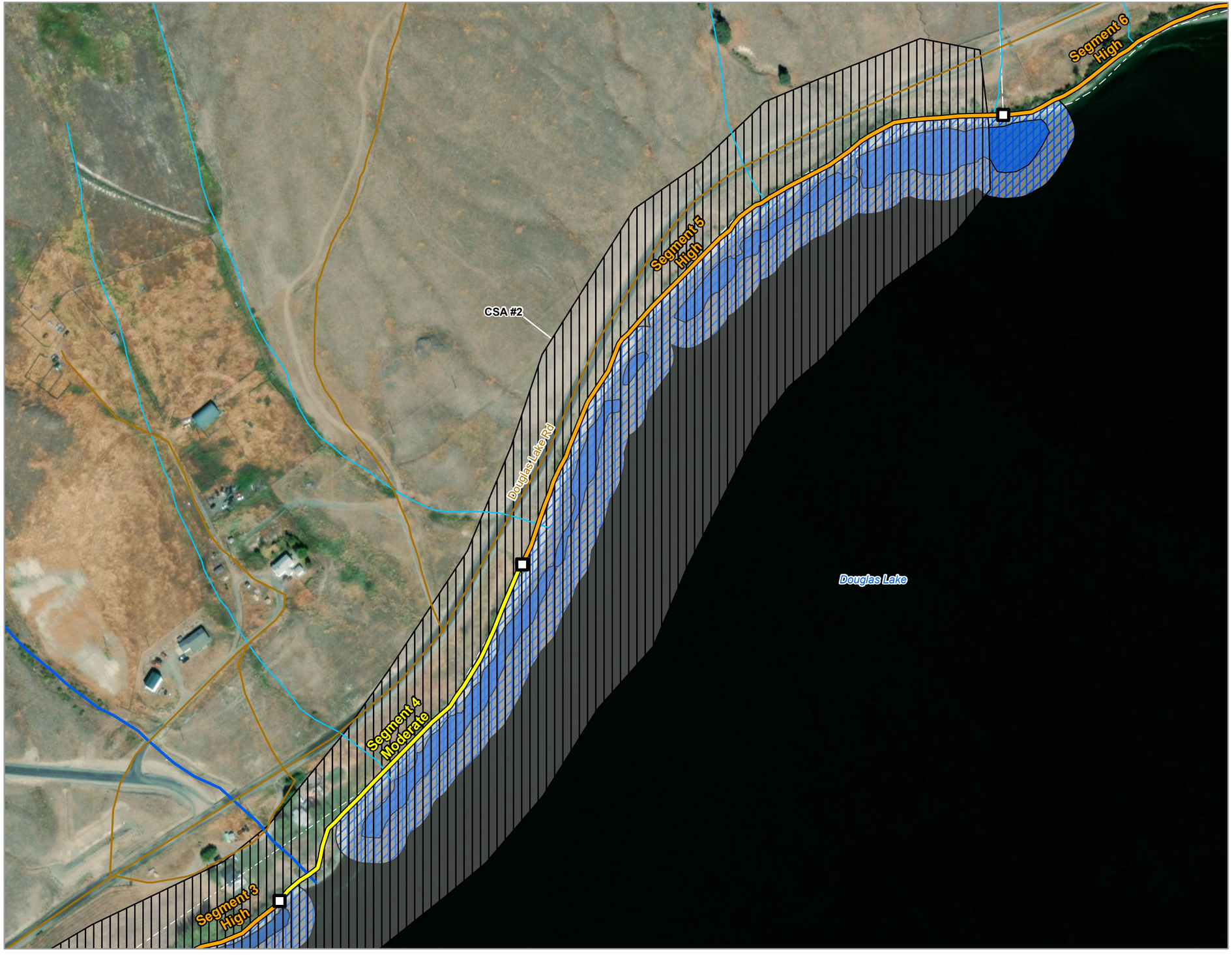
Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 1.2

SEGMENTS- 4 and 5



DOUGLAS LAKE FDG ASSESSMENT

- Segment Break
- Digital Road Atlas

Foreshore Inventory Mapping Segments

Foreshore Habitat Sensitivity Ranking

- Very High
- High
- Moderate

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- Culturally Sensitive Area (CSA)

Zones of Sensitivity (ZOS)

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

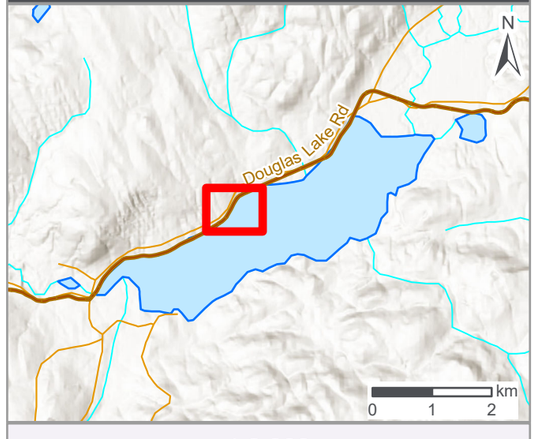
Zones of Sensitivity (ZOS) Buffers

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

LOCATION MAP



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0 80 160 Meters

Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 1.3

SEGMENTS- 6

DOUGLAS LAKE FDG ASSESSMENT

- Segment Break
- Digital Road Atlas

Foreshore Inventory Mapping Segments

Foreshore Habitat Sensitivity Ranking

- Very High
- High
- Moderate

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- Culturally Sensitive Area (CSA)

Zones of Sensitivity (ZOS)

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

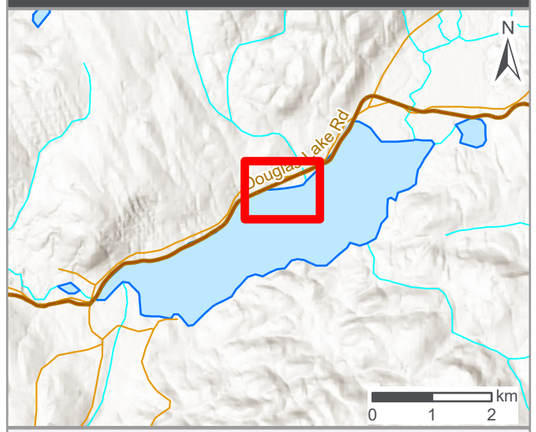
Zones of Sensitivity (ZOS) Buffers

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

LOCATION MAP



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0 110 220 Meters

Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 1.4

SEGMENTS- 7

DOUGLAS LAKE FDG ASSESSMENT

- Segment Break
- Digital Road Atlas

Foreshore Inventory Mapping Segments

Foreshore Habitat Sensitivity Ranking

- Very High
- High
- Moderate

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- Culturally Sensitive Area (CSA)

Zones of Sensitivity (ZOS)

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

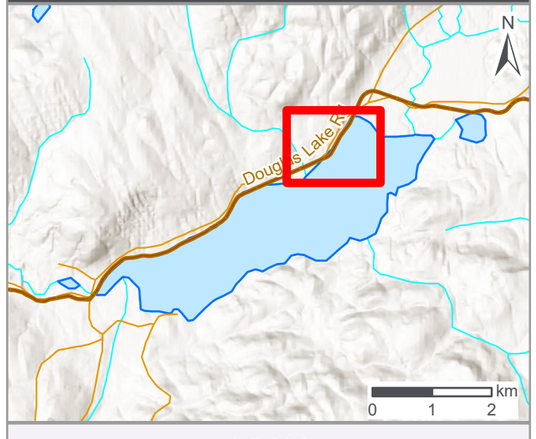
Zones of Sensitivity (ZOS) Buffers

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

LOCATION MAP



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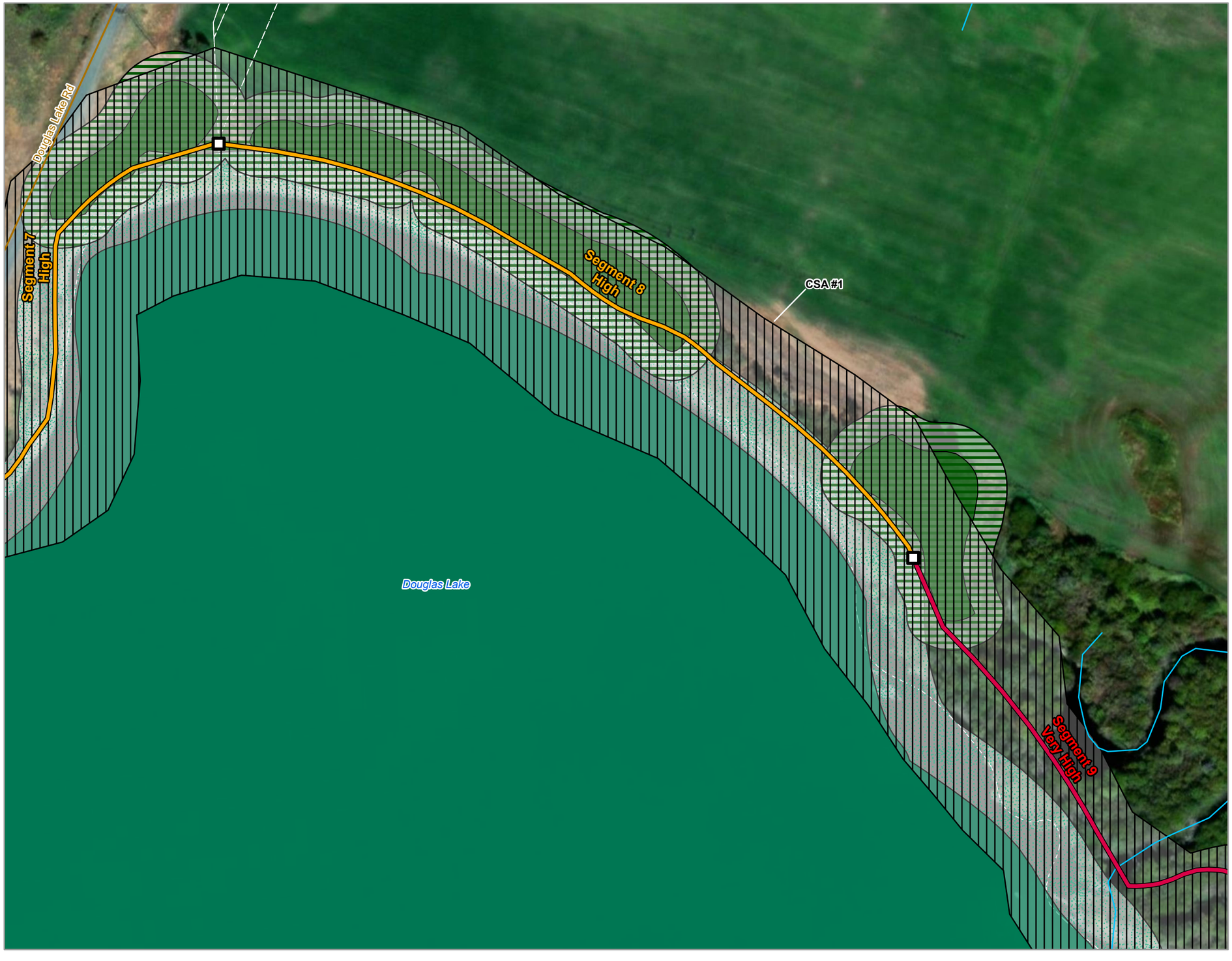
Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 1.5

SEGMENTS- 8



DOUGLAS LAKE FDG ASSESSMENT

- Segment Break
- Digital Road Atlas

Foreshore Inventory Mapping Segments

Foreshore Habitat Sensitivity Ranking

- Very High
- High
- Moderate

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- Culturally Sensitive Area (CSA)

Zones of Sensitivity (ZOS)

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

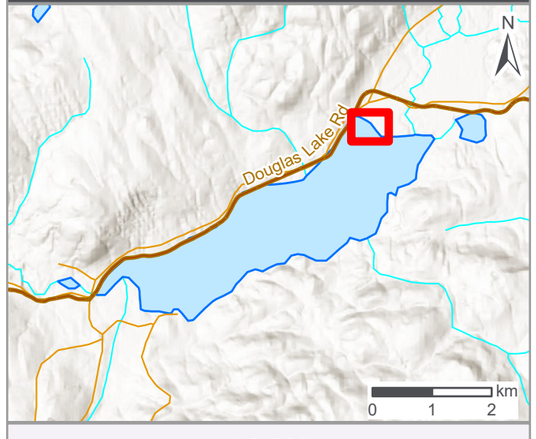
Zones of Sensitivity (ZOS) Buffers

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

LOCATION MAP



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Meters
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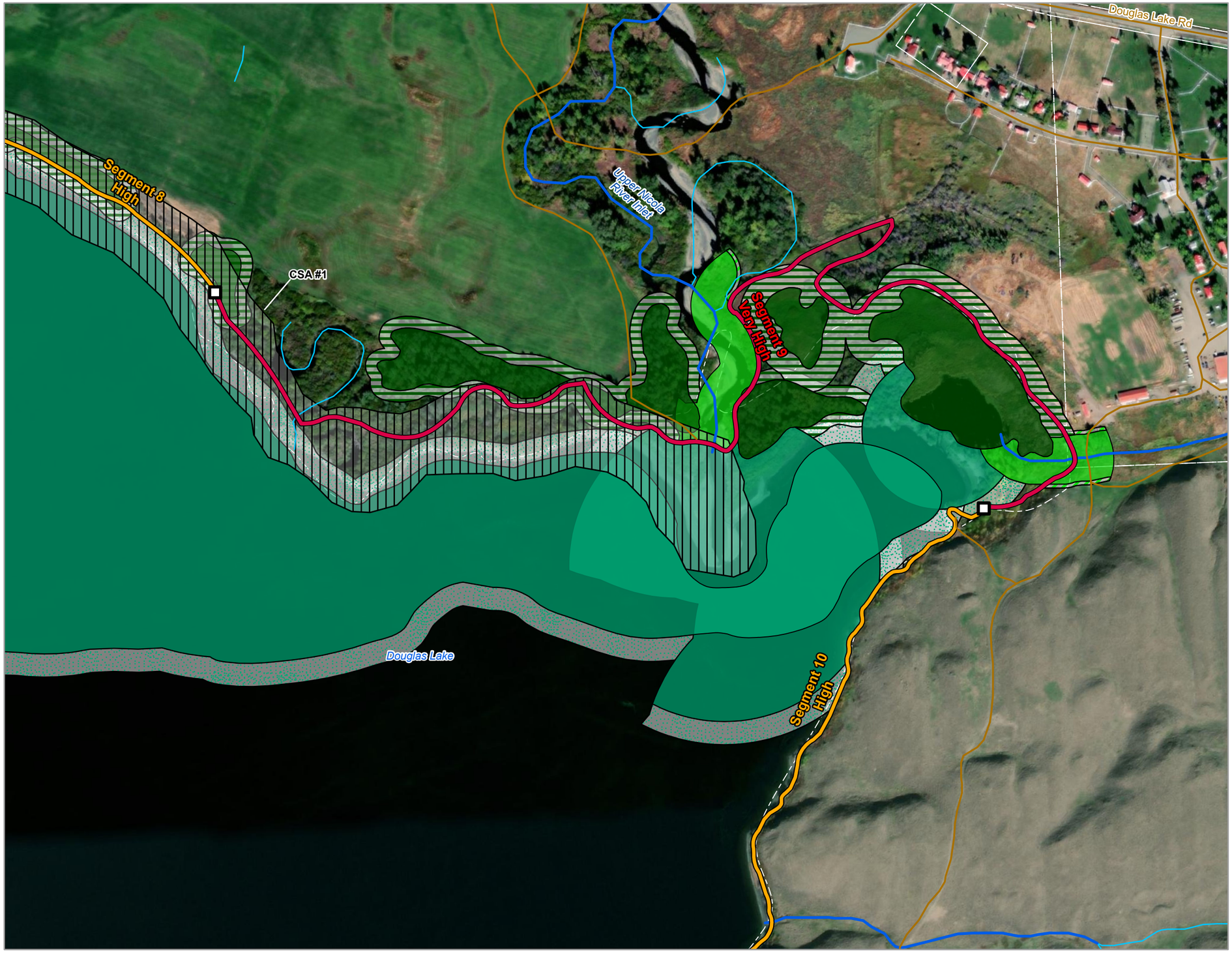
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 1.6

SEGMENTS- 9



DOUGLAS LAKE FDG ASSESSMENT

- Segment Break
- Digital Road Atlas

Foreshore Inventory Mapping Segments

Foreshore Habitat Sensitivity Ranking

- Very High
- High
- Moderate

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- Culturally Sensitive Area (CSA)

Zones of Sensitivity (ZOS)

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

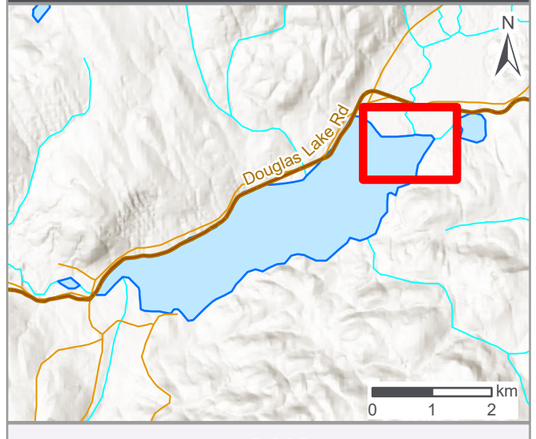
Zones of Sensitivity (ZOS) Buffers

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

LOCATION MAP



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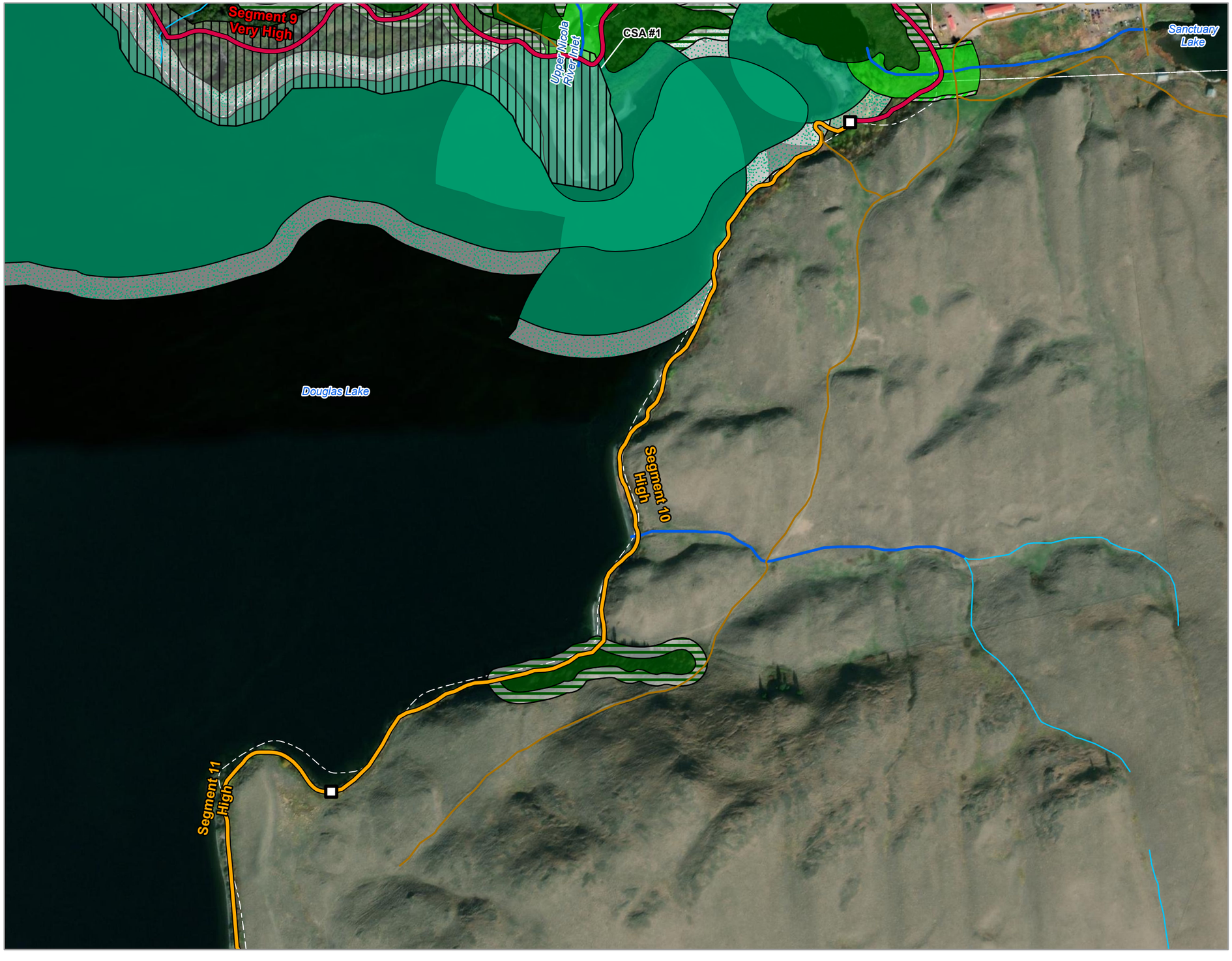
Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 1.7

SEGMENTS- 10



DOUGLAS LAKE FDG ASSESSMENT

- Segment Break
- Digital Road Atlas

Foreshore Inventory Mapping Segments

Foreshore Habitat Sensitivity Ranking

- Very High
- High
- Moderate

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- Culturally Sensitive Area (CSA)

Zones of Sensitivity (ZOS)

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

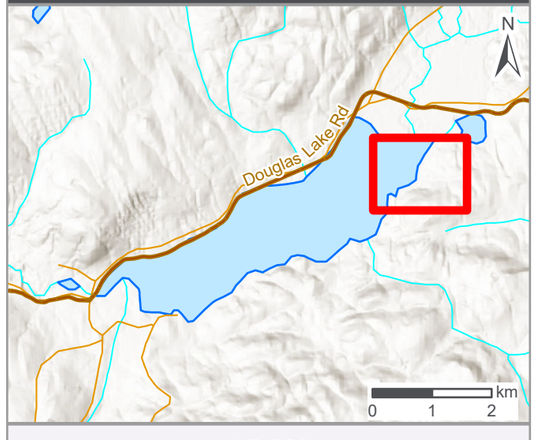
Zones of Sensitivity (ZOS) Buffers

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

LOCATION MAP



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0 140 280 Meters

Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 1.8

SEGMENTS- 11

DOUGLAS LAKE
FDG ASSESSMENT

- Segment Break
- Digital Road Atlas

Foreshore Inventory Mapping Segments

Foreshore Habitat Sensitivity Ranking

- Very High
- High
- Moderate

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- Culturally Sensitive Area (CSA)

Zones of Sensitivity (ZOS)

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

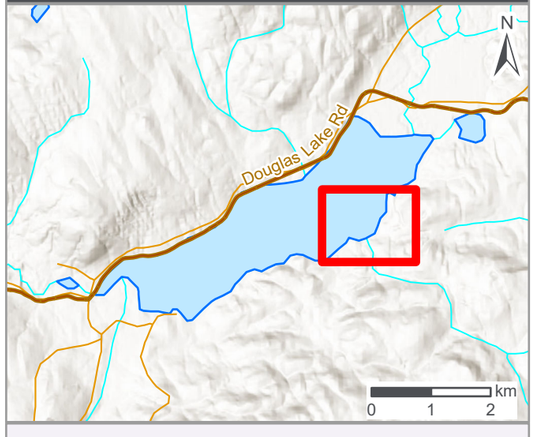
Zones of Sensitivity (ZOS) Buffers

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

LOCATION MAP



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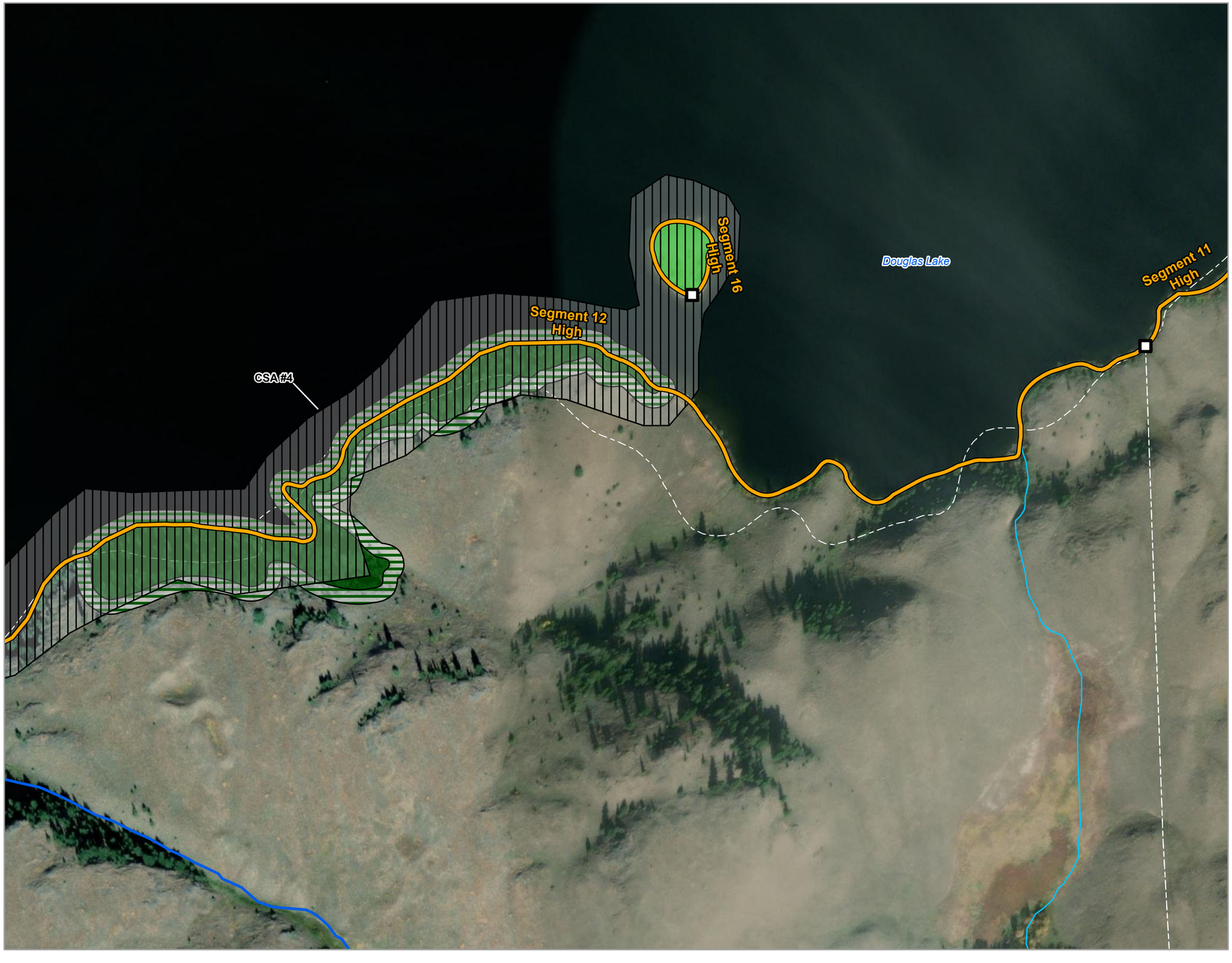
Meters
0 140 280

Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 1.9

SEGMENTS- 12a and 16



DOUGLAS LAKE FDG ASSESSMENT

- Segment Break
- Digital Road Atlas

Foreshore Inventory Mapping Segments

Foreshore Habitat Sensitivity Ranking

- Very High
- High
- Moderate

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)
- Culturally Sensitive Area (CSA)

Zones of Sensitivity (ZOS)

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

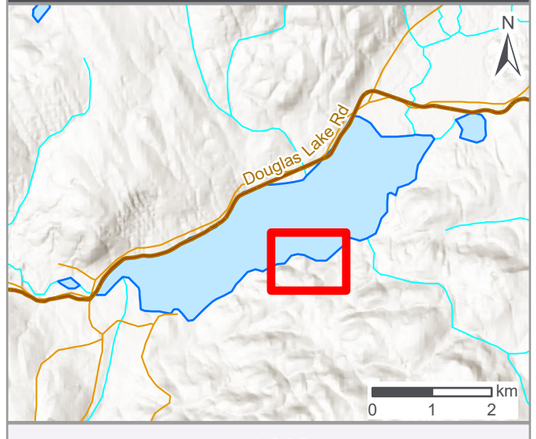
Zones of Sensitivity (ZOS) Buffers

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

LOCATION MAP



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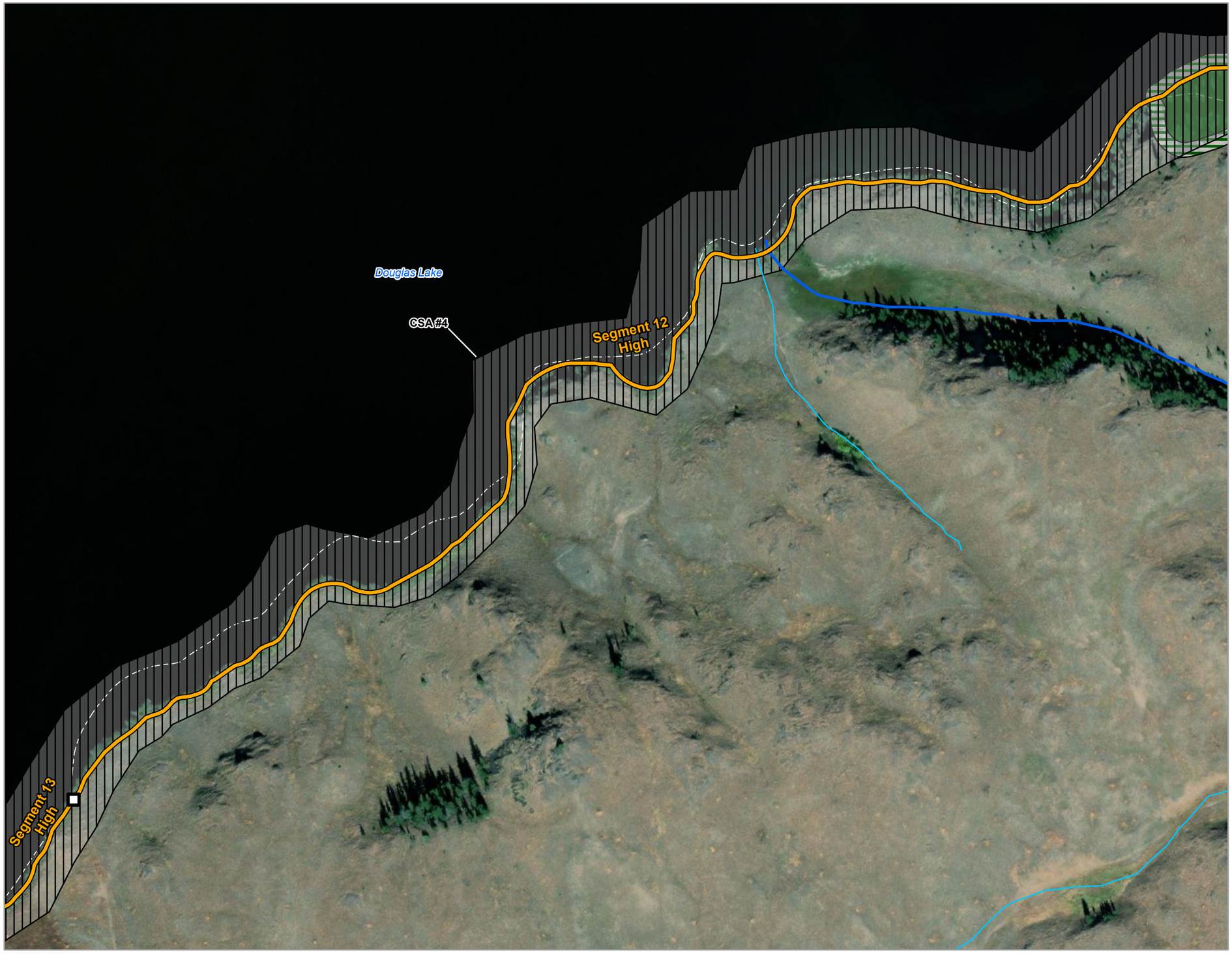
0 110 220 Meters

Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 1.10

SEGMENTS- 12b



DOUGLAS LAKE FDG ASSESSMENT

- Segment Break
- Digital Road Atlas

Foreshore Inventory Mapping Segments

Foreshore Habitat Sensitivity Ranking

- Very High
- High
- Moderate

Streams and Rivers

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- Stream Order (2-6)
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Zones of Sensitivity (ZOS)

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- Fisheries
- Wildlife
- Ecosystem

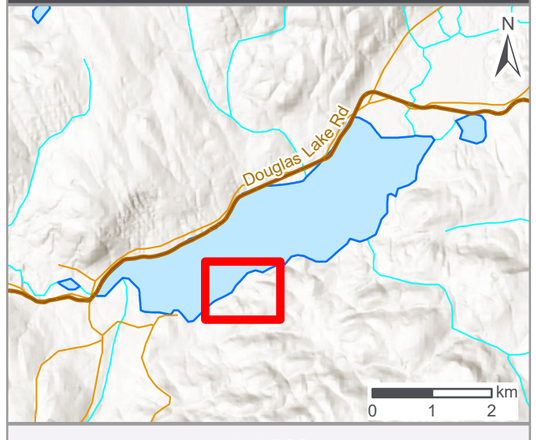
Zones of Sensitivity (ZOS) Buffers

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

LOCATION MAP



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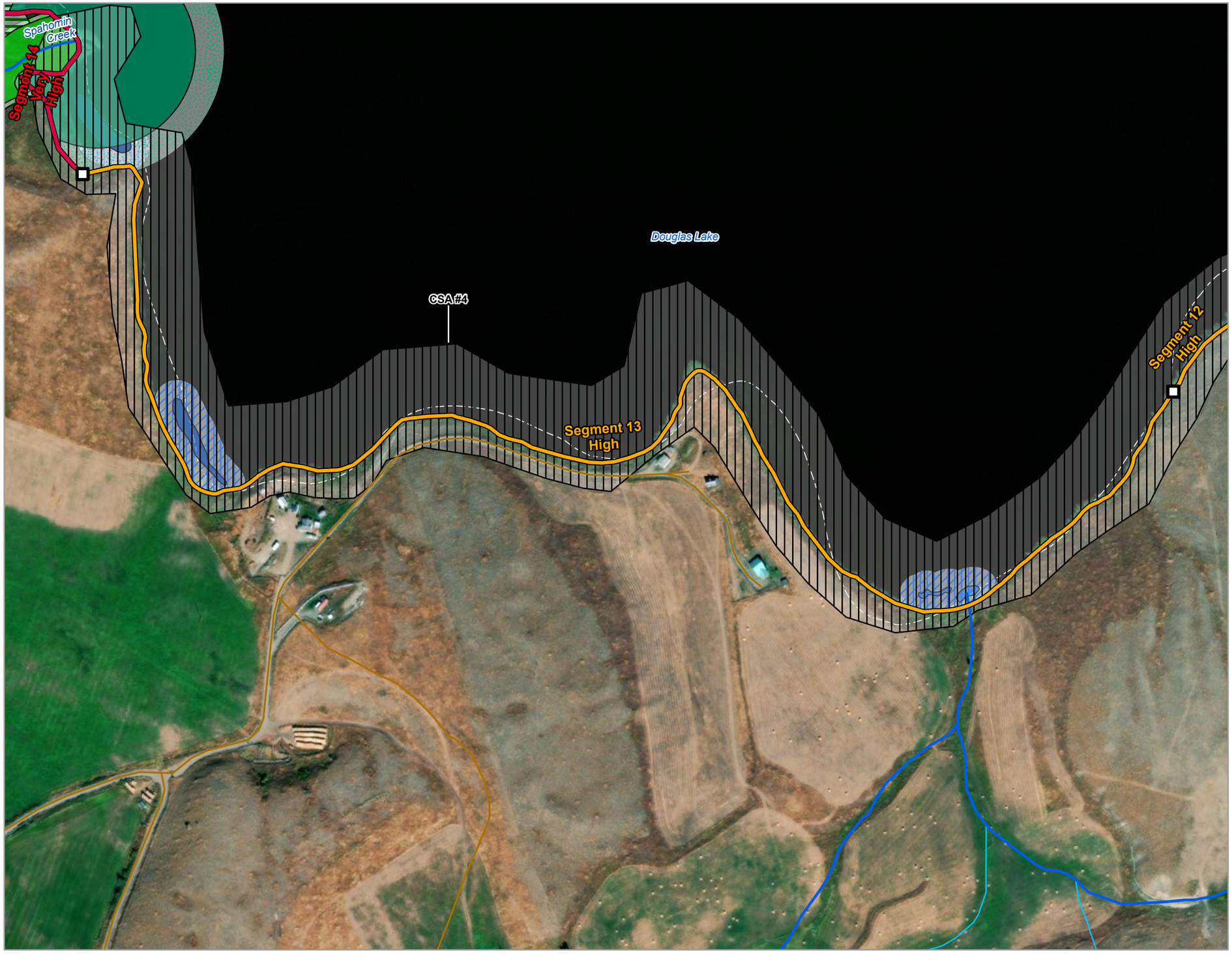
0 110 220 Meters

Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 1.11

SEGMENTS- 13



DOUGLAS LAKE FDG ASSESSMENT

- Segment Break
- Digital Road Atlas

Foreshore Inventory Mapping Segments

Foreshore Habitat Sensitivity Ranking

- Very High
- High
- Moderate

Streams and Rivers

- Stream Order (1)
- Stream Order (2-6)

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Zones of Sensitivity (ZOS)

- Vegetation
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- Wildlife
- Ecosystem

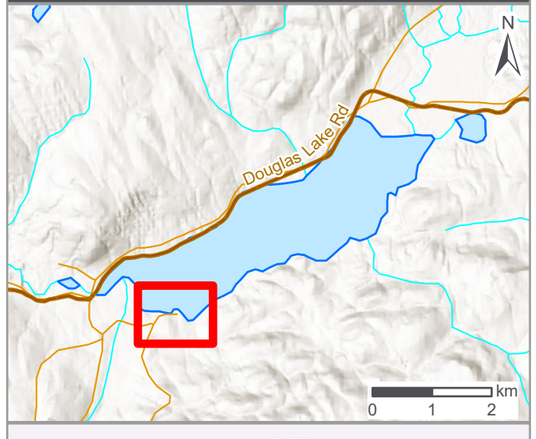
Zones of Sensitivity (ZOS) Buffers

- Vegetation
- Fisheries
- Wildlife
- Ecosystem

References

Aerial Imagery: Vivid Maxar. Imagery Date: 8/31/2016

LOCATION MAP



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Project No.: 240315
Client: Living Lakes Canada and Upper Nicola Band
NAD 1983 UTM Zone 10N

Date: 2025/03/17
Drawn: MB Check: RP

Figure 1.12