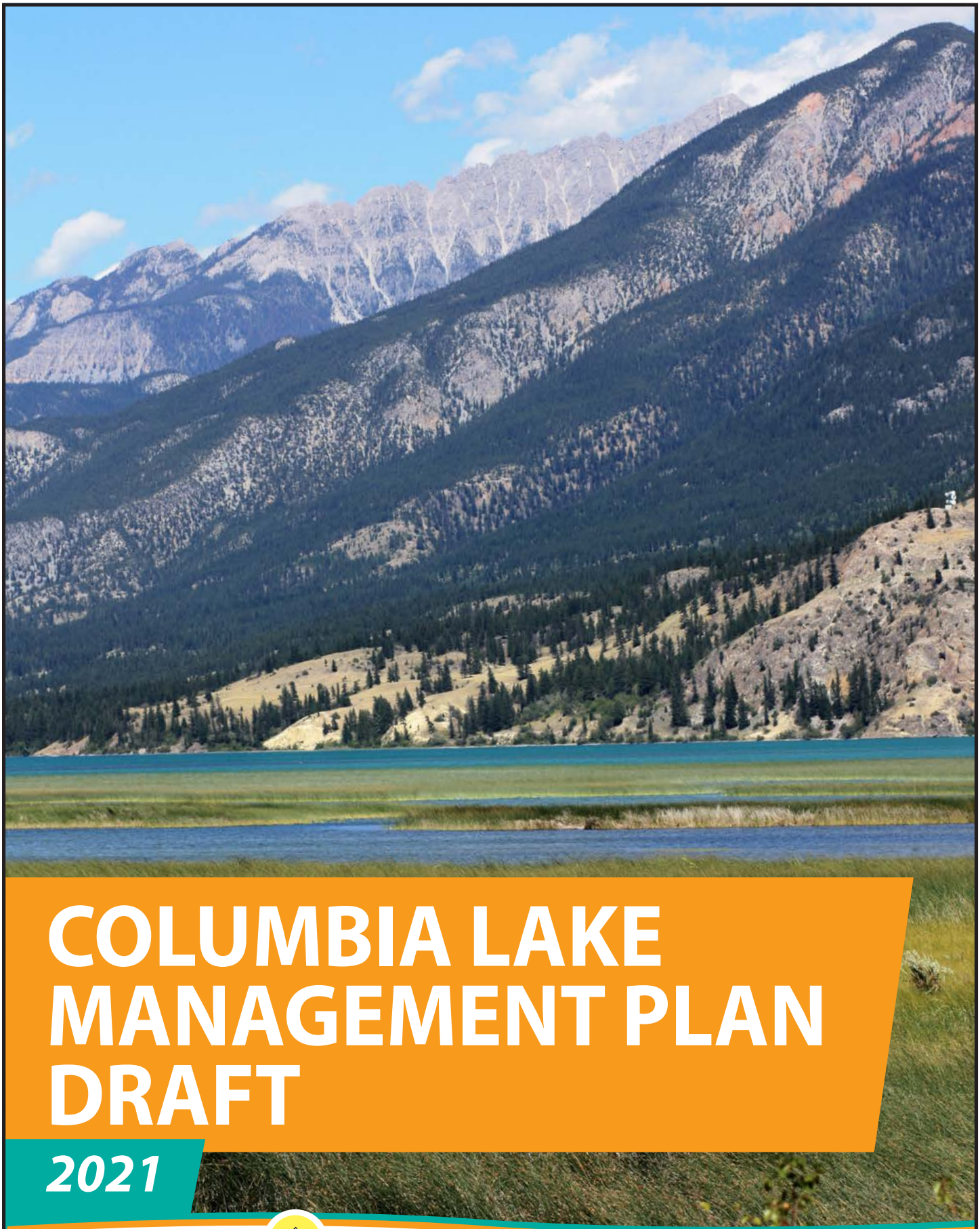

COLUMBIA LAKE MANAGEMENT PLAN DRAFT

2021

Village of Canal Flats

Regional District of East Kootenay

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EXECUTIVE SUMMARY

The Columbia Lake Management Plan has been developed by the Regional District of East Kootenay (RDEK) in collaboration with the Village of Canal Flats. The new Plan is intended to provide a framework for considering the future ecological health of Columbia Lake, needs of recreational users, protection of cultural values and economic opportunities as part of decision making and planning for the Lake. The primary scope of the Plan is to guide local government decision making, referral responses and policy direction.

Columbia Lake is the headwaters of the Columbia River and wetland system. The Lake is located in the trench to the east of the Kootenay ranges of the Rocky Mountains. The Village of Canal Flats is located at the south end of the Lake. At the north end of the Lake are the Columbia River and wetland system. The Columbia Lake area is within the unceded territory of the Ktunaxa nation and has been traditionally used and stewarded by the Shuswap Indian Band.

The Plan contains information on the physical characteristics, climate, water quantity, water quality and management of various habitats associated with the Lake. The Plan discusses current Lake management and the multi-season recreational use of the Lake. Compared to other lakes in the RDEK, Columbia Lake has very limited water access for recreational users due to topography and the upland development pattern. Primary access to the Lake is at the public boat launch operated by and within the Village of Canal Flats. The demand for and interest in moorage and alterative access points are anticipated to increase as the communities in the immediate area grow.

The development of the Plan was informed by guidance from a Technical Steering Committee and public engagement on issues and management opportunities for the Lake. The consultation conducted during the Plan process identified that regardless of differing interests that common values emerged. Common values focussed on the relatively pristine nature of Columbia Lake, low recreational pressure compared to other lakes in the region and a general desire to preserve the largely undeveloped east side of the Lake for ecological and cultural reasons.

The Plan includes a high level summary of the Assets (community, cultural, natural environment, recreation and stewardship) and Concerns (community, natural environment, recreation, and regulation) that were identified and explored within the process. These Assets and Concerns informed the management recommendations contained with the Plan.

Management recommendations within this Plan are intended to be used by the RDEK and the Village of Canal Flats in collaboration with the public, local communities, other levels of government (Indigenous, Provincial and Federal), conservation land managers and local organizations with an interest in the future conservation and use of the Lake. The Plan contains sixty-five management recommendations and sixteen priority actions.

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Acronyms

CLES	Columbia Lake East Side Partnership
CLMP	Columbia Lake Management Plan
EKILMP	East Kootenay Integrated Lake Management Partnership
FIMP	Foreshore Integrated Management Planning
MECCS	Ministry of the Environment and Climate Change Strategy
MFLNRORD	Ministry of Forests, Lands, Natural Resource Operations and Rural Development
MIRR	Ministry of Indigenous Relations and Reconciliation
RDEK	Regional District of East Kootenay
SHIM	Sensitive Habitat Inventory Mapping
VORR	Vessel Operations and Restriction Regulation
WMA	Wildlife Management Area

1.0 INTRODUCTION

The new Columbia Lake Management Plan has been developed by the Regional District of East Kootenay (RDEK) in collaboration with the Village of Canal Flats to renew the guidance of local government decision making for matters related to Columbia Lake. The Plan recognizes the range of jurisdictions that are responsible for managing the Lake and the surrounding upland parcels. A collaborative multijurisdictional approach to managing this natural asset will assist local governments to take proactive steps to ensure the ecological health of Columbia Lake and manage current and future recreational uses.

Columbia Lake has diverse ecological, cultural, recreation and economic values. The surface of Columbia Lake and surrounding land is a mix of private, public and conservation lands. The RDEK and the Village of Canal Flats will use the Columbia Lake Management Plan to guide the long-term management of the Lake by providing direction to local government decision making, providing advice to other levels of government and identifying opportunities for future stewardship of the Lake.

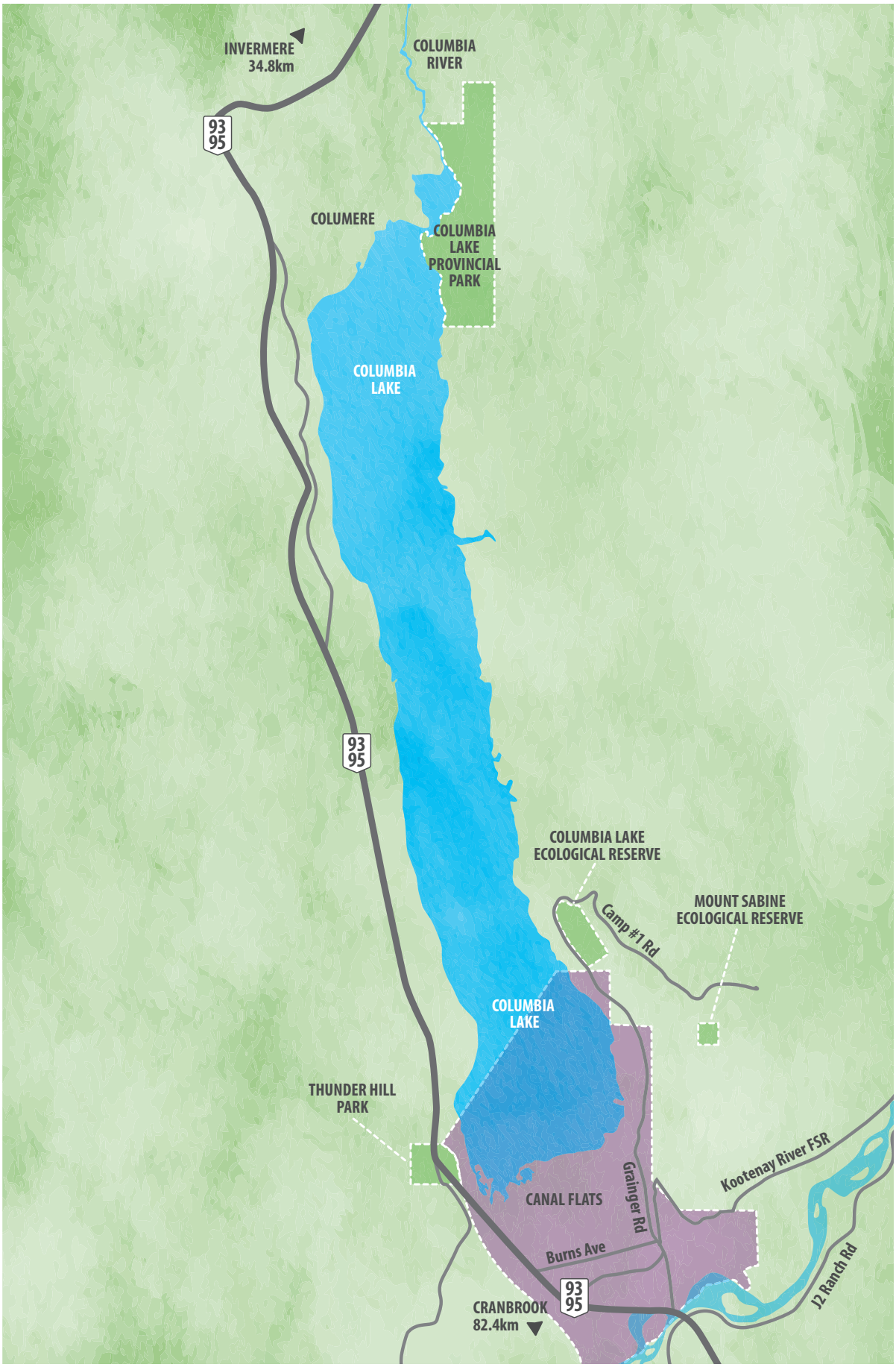
Columbia Lake is located in the Rocky Mountain Trench – a broad valley between the Rocky Mountains on the east and the Purcell Range of the Columbia Mountains on the west. Columbia Lake is the headwaters of the Columbia River. The Village of Canal Flats is located at the south end of Columbia Lake. Communities under RDEK jurisdiction are located on the west and northwest shorelines of the Lake. The community of Fairmont Hot Springs is located north of the Lake.

1.1 Plan Purpose

The new Columbia Lake Management Plan is intended to provide a decision making framework to ensure that the future ecological health of Columbia Lake, needs of recreational users, protection of cultural values and economic opportunities are considered. Specific objectives of the planning process utilized to develop the new Plan included:

- Understanding the current 'State of the Lake' and what has changed since the 1997 Management Plan;
- Engaging the public and stakeholders in the process to gather information and inform decision making about recommendations for management strategies; and
- Preparing a Lake Management Plan that contains clear policies and recommendations for lake use and management that are practical, enforceable and which recognize the community vision of residents of the Village of Canal Flats and the RDEK.

While the primary scope of this management plan is to guide local government decision making, referral responses and policy direction, it is important to acknowledge the multijurisdictional management landscape that surrounds Columbia Lake. Collaborative and cooperative engagement with First Nations, the community and other levels of government will be necessary in order to move forward with the recommendations contained within this Plan.


INVERMERE
34.8km
COLUMBIA
RIVER
93
95
COLUMERE
COLUMBIA
LAKE
PROVINCIAL
PARK
COLUMBIA
LAKE
93
95
COLUMBIA LAKE
ECOLOGICAL RESERVE
MOUNT SABINE
ECOLOGICAL RESERVE
Camp #1 Rd
COLUMBIA
LAKE
THUNDER HILL
PARK
Kootenay River FSR
Grainger Rd
CANAL FLATS
Burns Ave
J2 Ranch Rd
93
95
CRANBROOK
82.4km

1.2 Planning Process

The planning process began in April 2020. Preliminary research on the state of the Lake was the first step in the planning process. In order to guide the process and ensure that a comprehensive land and resource management perspective was integrated, a Technical Committee was identified. Government land managers representing a range of organizations and levels of government were invited to participate as part of Technical Committee discussion. The Technical Committee invited representation from:

- Shuswap Indian Band
- Ɂakisq̓nuk First Nation
- BC Parks
- Ministry of Forests, Lands, Natural Resource Operations and Rural Development (MFLNRORD)
- Ministry of Indigenous Relations and Reconciliation (MIRR)
- Transport Canada – Office of Boating Safety
- Village of Canal Flats

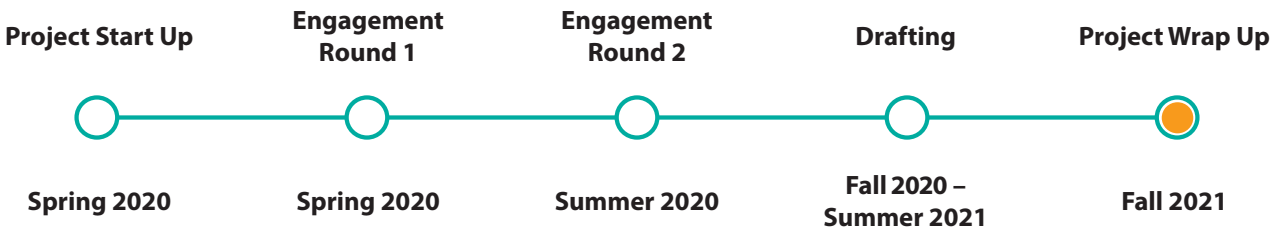
The Technical Committee provided background and scoping information at the beginning of the process. The committee also provided input and reviewed the draft management options as well as the draft Columbia Lake Management Plan.

Public engagement for the Columbia Lake Management Plan was scheduled to begin in the spring of 2020. Due to the COVID-19 pandemic, the engagement process pivoted from traditional in person workshops to using an online engagement platform. The RDEK undertook two rounds of public engagement in 2020. The initial round of engagement provided an opportunity for members of the public to identify where and what they value about Columbia Lake and what concerns they currently have with regard to the Lake. An online survey was utilized to gather information on areas of importance and concern and inquired how respondents currently utilize the Lake. Additional online engagement tools were utilized via the RDEK Engage page which provided respondents the opportunity to identify assets on a Map and to respond directly to brainstorming 'Ideas' related to the Lake.

The second round of engagement was undertaken in late summer 2020. The focus of the second round was to build off of the ideas and concerns expressed in the initial round of engagement and initiate dialogue on management options. Management options were grouped into six categories to guide responses and allow for respondents to focus on their priority areas. The six categories were:

- Boating
- In-water Structures and Lake Access
- Environmental Quality
- Foreshore and Upland Management
- Winter Use
- Stewardship & Enforcement

The feedback from the second round of engagement and contributions from the Technical Committee were utilized to refine the policies and direction of the Plan.



1.3 Jurisdictions

The responsibility for lake management rests with individual property owners, organized community groups, lake users, the RDEK, the Village of Canal Flats, First Nations, Provincial and Federal authorities across a range of jurisdictional areas and responsibilities. It is through working together within each area of responsibility, expertise and interest that the future of Columbia Lake must be managed. An overview of the range of responsibilities and jurisdictions is provided in this section.

Local Government

As local governments, the RDEK and the Village of Canal Flats have the ability to influence lake management on a number of different levels, including through:

- **DIRECT CONTROL** - zoning of the upland parcels and surface of the water under the *Local Government Act*;
- **INFLUENCE OF DECISION MAKING BY OTHERS** – providing review and comment on Provincial tenure applications for foreshore and in-water structures, such as group moorage docks; and
- **ADVOCACY ON BEHALF OF OTHERS** – supporting stewardship programs, such as water quality monitoring

These levels of influence are utilized to provide clarification on the role of the local governments in achieving the management recommendations contained within section 4 of this Plan.

Both jurisdictions have Official Community Plans (OCP) which provide guidance and direction with respect to the future vision of the Lake from a land use planning perspective. The surface water zoning regulations and OCP policies are considered as part of referral responses for Provincial tenure applications. Both the RDEK and Village of Canal Flats also participate in the Columbia Lake East Side Partnership (CLES). A collaborative partnership working towards recognition of the east side of the Lake based on indigenous cultural values and ensuring a healthy functioning ecosystem.

In addition to the joint areas of influence, each jurisdiction has unique responsibilities and relationships with other levels of government. The RDEK is the designated responsible authority with regard to the Vessel Operating Restrictions Regulation (VORR) speed limit restriction on portions of the Lake. The RDEK also has Development Permit Areas (DPAs) which requires Development Permits prior to development in order to protect Environmentally Sensitive Areas such as habitat for species at risk, wetland and riparian areas. The DPAs are identified within the Fairmont Hot Springs & Columbia Lake Area Official Community Plans.

The Village of Canal Flats is responsible for the boat launch located in Tilley Memorial Park, this is the primary public access point for motorized boats on the Lake. The Village of Canal Flats holds a licence of occupation from the Province for the portion of the boat ramp that extends into the Lake. The Columbia Lake Wildlife Management Area (WMA) extends within the boundary of the Village of Canal Flats. This overlap between the municipal boundary and the WMA requires working with the Province to recognize the restrictions of use within the designated area.

LEGISLATION

LOCAL GOVERNMENT ACT – authorizes local governments to pass bylaws to regulate development and adopt Official Community Plans

TOOLS

OFFICIAL COMMUNITY PLANS – identifies the community vision of the area and includes goals, land use policies and development permit guidelines

ZONING BYLAWS – allows for regulation of land use and placement and size of buildings and structures, including in-water structures such as mooring buoys and docks

Provincial Government

Areas of responsibility or jurisdiction over matters that are integral to future lake management for Columbia Lake are found within a range of provincial ministries, including the Ministry of Forests, Lands, Natural Resource Operations, and Rural Development (MFLRNORD), the Ministry of Indigenous Relations and Reconciliation (MIRR) and the Ministry of Environment and Climate Change Strategy (MECCS). The scope of provincial responsibility includes land use authorizations for Crown land, planning and management of Thunder Hill and Columbia Lake Provincial

Parks, habitat and ecosystem conservation, the designated Wildlife Management Area (WMA) and Ecological Reserves, and participation and leadership for the Columbia Lake East Side Partnership.

The Ministry of Forests, Lands, Natural Resource Operations, and Rural Development (MFLNRORD), is responsible for the development of Crown land policies and land use authorizations. Land use authorizations are through FrontCounter BC which is responsible for administering the *Land Act* and making decisions on the allocation of Crown land, such as group moorage applications or an expansion of the boat launch at Tilley Memorial Park. Land use authorizations or tenures include Licences of Occupation or Leases, which allow for the management of Crown land by the designated tenure holder. An application is generally required when an individual or group proposes to construct improvements or remove Crown land from public use. When applications are made for tenures the Province makes referrals to the applicable local government, consults with First Nations and provides an opportunity for public comment on the application. Current Licences of Occupation on Columbia Lake include the portion of the littoral zone fronting the Tilley Memorial Park boat launch, the former Thunderhill Park boat launch at the southwest corner of the Lake and the Columere Park Marina and swim area.

The responsibilities of the MFLNRORD also includes Ecosystem Management and the conservation and protection of the natural environment. This includes monitoring and supporting wildlife and fisheries habitat and populations. Ministry staff contribute to the upland management of the Columbia Lake East Side WMA, as shown on Schedule A, which includes land within both RDEK and Village of Canal Flats jurisdictions. In addition, BC Parks, under the Ministry of Environment and Climate Change Strategy (MECCS), is responsible for planning and management of the Thunder Hill and Columbia Lake Provincial Parks and Columbia Lake and Mt Sabine Ecological Reserves. The management of these parks and reserves recognizes the importance of these conservation lands for the health of the Columbia Lake ecosystem.

The Ministry of Indigenous Relations and Reconciliation (MIRR) leads provincial participation in the CLES Partnership. The Partnership is an opportunity to support a collaborative approach to the management of the East Side of the Lake and facilitate recognition as a Cultural Landscape as part of reconciliation and treaty processes. The protection of the Cultural Landscape recognizes the intrinsic value of the area and the importance from a cultural and traditional knowledge and history perspective for the Ktunaxa and Secwepemc First Nations. Both local governments also have staff that participate in the CLES Partnership working group.

LEGISLATION

BC WILDLIFE ACT – provides for conservation and management of wildlife populations and habitat

LAND ACT – allows for the occupation of Crown land and the issuance of tenures

WATER SUSTAINABILITY ACT – provides for the management and diversion of water uses and water rights

PARK ACT – proves for the establishment, classification and management of parks, conservancies and recreation areas

TOOLS

PARK MANAGEMENT PLANS – provide guidance on the management of parks within the BC Park system

PERMITS & LICENCES – regulate who and how resources may be utilized, e.g. fishing or hunting licences

CROWN LAND TENURES – allows private or community interests to occupy Crown land for private use

MAP RESERVES – provides an opportunity to remove Crown land from availability for disposition or issuance of a tenure

COLUMBIA LAKE PROVINCIAL PARK Est. 1998 290ha

Contributes close to 9% of the protected area representation for its specific biogeoclimatic subzone

Federal Government

The primary area of responsibility at the Federal level for Columbia Lake is through the Vessel Operating Restrictions Regulations (VORR). The VORR at Columbia Lake extends the 10 km/h speed limit beyond the 30 metres from the shore along an area designated at the south end of the Lake and along a portion of the east side of the Lake. Within these two areas, the speed limit is restricted to reduce the impact of boating activities on the shoreline and associated habitat. The speed limit restriction is also in effect at the very north end of the Lake, known as Mud Lake, and the river channel extending north to Lake Windermere. Federal jurisdiction also includes the Private Buoy Regulation under the *Canada Shipping Act*.

LEGISLATION

MIGRATORY BIRDS CONVENTION ACT – regulates activities that could harm migratory birds

SPECIES AT RISK ACT – prohibits the destruction of critical habitat for species at risk and promotes stewardship of critical habitat

CANADA SHIPPING ACT – regulates recreational boating and includes the Private Buoy Regulation

NAVIGABLE WATERS PROTECTION ACT – regulates uses and activities of water that could interfere with navigable waters.

FISHERIES ACT – regulates activities that may alter or destroy fish habitat

TOOLS

VESSEL OPERATING RESTRICTION REGULATIONS – allows for speed limit and vessel type restrictions

Community Groups & Conservation Organizations

Residents and property owners within the communities surrounding Columbia Lake play a role in the management of the Lake. Active participation by individuals and community associations in activities helps to ensure the on-going health of the Lake and monitoring activities. An important activity by community groups is the management and organization of group moorage and lake access. The Columbia Lake Stewardship Society is an active community organization dedicated to stewardship activities and education to preserve the ecological health of Columbia Lake.

Conservation lands of regional importance around Columbia Lake are owned and managed by conservation organizations and the Province. The conservation of these lands helps to ensure the protection of a healthy watershed and the retention of key habitat and connectivity for a range of species. Current conservation lands around Columbia Lake are shown on Schedule B and include:

CONSERVATION LANDS	RESPONSIBLE ORGANIZATION	LOCATION	PURPOSE
Lot 48	Nature Conservancy of Canada	Northeast	Preservation of native grasslands and contiguous wildlife corridor
Lemaster Property	The Nature Trust of BC	Southeast	Wintering range for bighorn sheep, staging area for waterfowl and habitat for range of species
Columbia Lake Ecological Reserve	BC Parks	Southeast	Protection of calcicolous vegetation, hydrology and geology as well as ecosystems representative of the Interior Douglas Fir biogeoclimatic zone
Mt Sabine Ecological Reserve	BC Parks	Southeast	Preservation of forest site representative of Montane Spruce biogeoclimatic zone
Columbia Lake Wildlife Management Area	Various Provincial Ministries	East & South	Winter range for ungulates, staging areas for waterfowl, vital habitat for range of species

1.4 Background Information & Past Studies

The management plan builds off of the previous studies, plans and policies and the engagement activities utilized to inform previous planning processes. An overview of past studies and planning documents is provided to establish the context for this Plan.

Columbia Lake Management Strategy (RDEK – 1997)

The development of a lake management strategy was led by the RDEK and adopted in August 1997. The need for the strategy was triggered by growing concern about water quality, hydrology and increasing recreational demands on the Lake generated by new and proposed development. The 1997 strategy sought to gain a clear understanding of Columbia Lake's water quality, water levels, condition of habitat, foreshore and recreational use. The strategy included management strategy recommendations and an action plan. Recommendations focused on six key areas: establishment of a citizen steering committee, water quality, water level, habitat, foreshore lease and access and boating. The strategy has been utilized by the RDEK since its adoption to provide guidance in decision making with regard to the Lake.

Village of Canal Flats OCP

The Village of Canal Flats Official Community Plan (OCP) was adopted in June 2019. The OCP was developed to guide decision making and promote the development of a sustainable, affordable and accessible community. The OCP includes policies in support of the development of this Plan, guidance to the continued provision of access to the Lake for residents and visitors and recognition of the environmental and culturally sensitive nature of Columbia Lake and its shoreline. The OCP also includes a Shoreline Development Permit Area and associated guidelines.

RDEK Fairmont Hot Springs & Columbia Lake OCP

The Fairmont Hot Springs & Columbia Lake Official Community Plan (OCP) was adopted in August 2017. The OCP was developed to guide decision making by the RDEK within the Plan area. The OCP includes policies in support of development and conservation of lands. The policies recognize the seasonal and recreational nature of the communities surrounding Columbia Lake within RDEK jurisdiction. The vision for the Plan embraced the recreational nature of the area. During the OCP planning process, the desire to protect the Lake and its natural character was identified as a priority by the community. The OCP includes a Development Permit Area for the Protection of Environmentally Sensitive Areas such as wetland and riparian areas and habitat for species at risk.

Surface Water Zoning

Under the *Local Government Act* the RDEK and Village of Canal Flats have the authority to adopt zoning regulations that regulates the permitted use of land and placement of structures. For the purposes of zoning bylaws, the definition of land extends to the surface of the water. The implementation of zoning on the surface of water allows for the regulation of the placement of structures and permitted uses. In the same way as the zoning of upland parcels provides certainty to future land use, the zoning of the surface of the water provides certainty to area residents and land owners. Water zoning is tailored to reflect adjacent land uses and ownership of the upland parcels. It is not intended to supersede riparian rights, but to establish regulations related to the number, siting and type of structures or buoys permitted.

Surface water zoning was first applied to Columbia Lake in 2007. This was the first time surface water zones were used to regulated in-water structures and mooring buoys. The surface water zoning was requested by the Columbia Lake Steering Committee as a means of regulating mooring buoys and on-water moorage through group moorage facilities. The Village of Canal Flats adopted surface water zones comparable to the RDEK regulations in 2008.

The current Upper Columbia Valley Zoning Bylaw includes three zones specific to Columbia Lake to regulate in-water structures, mooring buoys and winter fishing huts. These three zones are applicable to the portion of the Lake that is within RDEK jurisdiction. The surface water zones were amended following the introduction of surface water zoning for Lake Windermere in 2013.

The current Village of Canal Flats Zoning Bylaw includes five Water Resource zones to regulate in-water structures, recreational water activities, public access and mooring buoys. A new zoning bylaw was adopted in 2019 that allowed for the refinement of specific zoning to recognize the Village's commitment to providing opportunities for lake access. These opportunities for lake access are located within lakeside development nodes, development of private waterfront properties, and associated riparian rights.

RDEK Regional Growth Strategy

The Regional Growth Strategy (RGS) was adopted by the RDEK in 2004. The RGS is a policy document that provides high level guidance to priorities at the regional and subregional levels. At the subregional level, policies related to the Columbia Valley include:

- Protect wildlife corridors and habitat connectivity between the Columbia River wetlands and Kootenay National Park.
- Protect the Columbia River wetlands.
- Support initiatives to monitor use and manage motorized recreation on Columbia and Windermere Lakes.

RDEK Regional Sustainability Strategy

The Regional Sustainability Strategy (RSS) was adopted in October 2014. The RSS provides the RDEK with a wide ranging, long term planning tool. It equips the region with a "sustainability lens" to guide and evaluate operations and decision-making. It also provides the RDEK with a single overarching reference point for its activities, including future planning and priority setting processes. From a lake management perspective, the following RSS Vision for the Environment policy area reflects the overarching goal of this Plan:

RSS – ENVIRONMENTAL VISION

By balancing ecosystem function with natural resource management, the East Kootenay's diverse, world class environment is protected and conserved.

The RSS recognizes that the environment is a primary concern for the region's residents. The natural environment is integral to quality of life for recreational, economic and social well being purposes. Relevant RSS Objectives and Actions include:

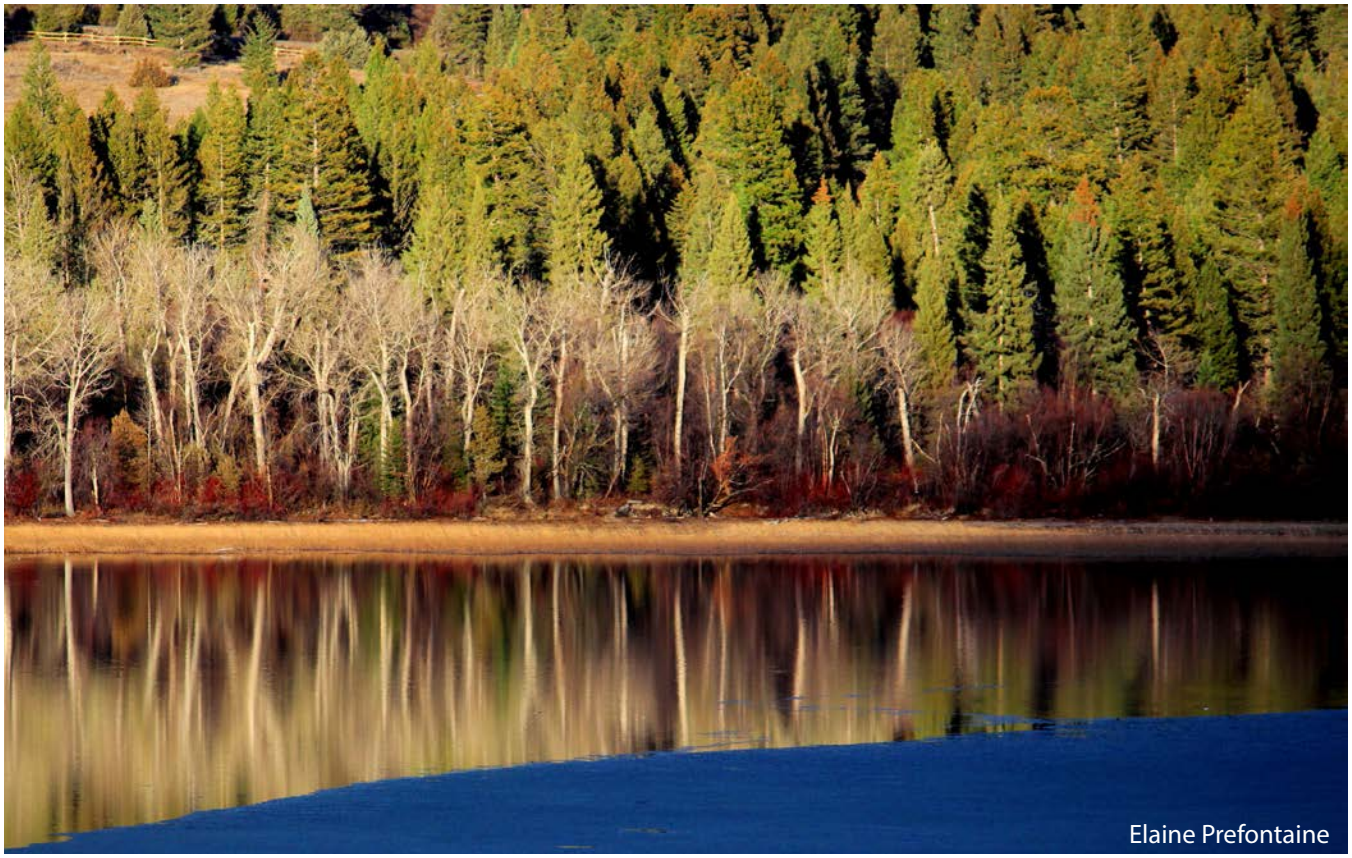
- The RDEK will consider identification and designation of Environmentally Sensitive Area Development Permits in OCPs; including such areas as rare and endangered habitat, sensitive shorelines and regionally significant ecosystem features.
- The RDEK will help curtail environmental transgressions by advocating for the improved enforcement of existing regulations by all orders of government.
- The RDEK will support land use planning on Crown land, including resource and recreation management and advocating for more local control over activities occurring in domestic watersheds.

EKILMP SHIM Process

In 2010, the East Kootenay Integrated Lake Management Partnership (EKILMP) developed management guidelines for the shoreline of Columbia Lake. EKILMP was a working group that included representation from the RDEK, Fisheries & Oceans Canada (DFO), provincial ministry staff, Wildsight, and the Canadian Columbia River Inter-Tribal Fishery Commission (CRIFC). The creation of these shoreline management guidelines was based on reports prepared utilizing Sensitive Habitat Inventory and Mapping (SHIM) protocols that were developed for lakes in the East Kootenay region. The Shoreline Guidance Document is utilized by the RDEK, Village of Canal Flats and the Provincial Government to inform decision making when applications to utilize or conserve the shoreline are being considered. The SHIM Guidance Document categorizes the shoreline of Columbia Lake based on ecological habitat values. Within each colour zone (red (highest value), orange, yellow or grey (lowest value)) the corresponding habitat value and associated level of sensitivity to development is taken into consideration to provide guidance to future use, mitigation or conservation of the shoreline. The outcomes of the SHIM process are discussed in section 2.9 and the shoreline colour zones are shown on Schedule F.

CLSS Water Monitoring

The Columbia Lake Stewardship Society (CLSS) has actively monitored water quality and prepared annual reports since 2014. In 2015, the addition of water quantity monitoring was added to measure flow of water into and out of Columbia Lake. Annual reports are prepared and posted on the CLSS website. The water quality monitoring program has evolved in response to guidance on best practices for measuring indicators of ecological lake health and new information gathered as part of the on-going monitoring program.



Elaine Prefontaine

2.0 STATE OF THE LAKE

2.1 Introduction

Columbia Lake is the headwaters of the Columbia River and wetland system. The Lake is located in the Rocky Mountain trench, to the west is the Purcell Range and the Purcell Wilderness Conservancy and to the east is the Kootenay ranges of the Rocky Mountains. The Village of Canal Flats is at the south end of the Lake on the glacial terrace of the Kootenay River. At the north end of the Lake are the Dutch Creek alluvial fan and the beginning of the Columbia River and wetland system.

The Columbia Lake Watershed is 89,130 ha and is part of the broader Columbia River Basin. Water enters the Lake from creeks, annual precipitation and groundwater contributions. The drainage basin for the Lake is relatively steep which results in small and restricted creeks flowing into the Lake. On the east side of the Lake the primary tributaries are Warspite and Lansdowne Creeks. On the west side the tributaries are Hardie, Marion and Sun Creeks. Dutch Creek is located at the north end of the Lake. The main Dutch Creek outflow has shifted across the alluvial fan and is currently connected to the Columbia River, just north of the outflow from Columbia Lake, but is considered to be hydrologically connected to the Lake through ground water during certain times of the year. Some water flow across and out of the delta created by the Dutch Creek alluvial fan is also reported to occur[1] . High volume precipitation events, particularly those that fall on a melting snowpack has the potential to dramatically increase lake levels in a short period of time. A rain event in May 2020 resulted in Dutch Creek reaching a very high level with an increase of 30 cm in a 24 hour period[2]. The Columbia Lake Stewardship Society is actively engaged in monitoring and working to gain a better understanding of the inputs and outflows of water for the Lake.

Wetlands and shallow-water wetland areas, characterized by emergent wetland vegetation, are located around the Lake. In 2009, 29% of the Lake was identified as having wetland shoretypes. Large wetland areas are located at the south and north ends of the Lake. The wetland areas provide productive habitat for migrating and breeding waterfowl and habitat for other aquatic species. The wetlands at the south end of the Lake are particularly important due to frequent winds and high wave activity on open portions of the Lake[3]. A unique habitat area is also provided by Armstrong Bay along the east shore which provides a refuge area for waterfowl and has an ecosystem not found elsewhere on the Lake. Armstrong Bay is characterized by the cool spring fed waters, steep, shaded and wind sheltered banks[4].

The Columbia River extends north from the Lake and is an internationally significant river and watershed. From its beginnings near the Village of Canal Flats, the Columbia River flows approximately 2,000 km before flowing into the Pacific Ocean in Oregon State. The Columbia River flows through the Columbia Wetlands. The Columbia Wetlands are a biodiversity hot spot, part of the Pacific Flyaway and are designated as a wetland of international importance, through the Ramsar Convention. As a wetland of international importance, conservation and maintaining its ecological integrity is targeted through local, regional and national actions and international cooperation. Work is currently underway to designate the Columbia Wetlands as an Important Bird Area, which would formally recognize the global importance of the wetlands for the conservation of bird populations[5].

2.2 First Nations

The Columbia Lake area is within the unceded territory of the Ktunaxa people and has been traditionally stewarded by the Ktunaxa. The Columbia Headwaters has very significant spiritual, cultural, economic and ecological significance for Indigenous people. Columbia Lake, Kananuk in Ktunaxa, is also culturally significant as part of the Ktunaxa Creation Story and the Ktunaxa's relationship with their traditional territory or Ktunaxa ʔamakʔis. The area surrounding Columbia Lake is within the traditional land district ʔaknuqƚuƚaḿ ʔamakʔis, the land of the Eagle. The area now identified as the Village of Canal Flats is located within the Kyawaƈ ʔamakʔis, land of the Spruce Grouse, traditional district.

The Crown land on the east side of Columbia Lake, Yak wuƚaki in Ktunaxa, is targeted for legal designation as a Ktunaxa Cultural Landscape as a component of treaty agreement between the Ktunaxa and the Province. Current and future management of the east side of the lake will recognize the traditional territory, land uses and cultural importance of the First Nations. Under the proposed Cultural Landscape designation, the primary management objectives for the East Side of Columbia Lake are to steward Ktunaxa cultural values, which are closely tied to the preservation of the areas' ecological values.

The Columbia Lake area has also been traditionally used by the Secwepemc people. The Shuswap Indian Band is also involved with on-going stewardship of the land. The Village of Canal Flats, or Lleqlléllq̓t in Secwepemctsin, and Columbia Lake hold a close connection to Secwépemc cultural heritage and history, as a place of care and

management within Shuswap Band's area of caretaker responsibility[6]. This makes taking care of the lands and waters here of the utmost importance. For Shuswap, this area has provided a space for social, cultural, and spiritual practise since time immemorial, as Secwepemc travelled through the Columbia Valley, Cyectém in Secwepemctsin, and beyond, camping and interacting with neighbours in ways of trade and gatherings. Secwepemc stories involving Grandfather Buffalo, Coyote, and Fox tell of the formation of the Columbia River, Windermere Lake, and the hoodoo formations near Fairmont Hot Springs[7].

2.3 Population

Columbia Lake has communities at the northwest corner, south end and dispersed along the west side of the Lake. Columere Park is located at the north end of the Lake. Along the western shoreline, communities include Timber Springs, Bella Vista Estates, Spirits Reach and Columbia Ridge. Adjacent to Columere Park is the community of Dutch Creek and two RV resorts, Hoodoo Mountain Resort and Dutch Creek Resort. The resort community of Fairmont Hot Springs is also located to the north of the Lake. Canal Flats is located at the south end of the Lake and is home to approximately 733 people and is the only incorporated municipality within the Columbia Lake area. The 2016 Census identified that 77% of those living in Canal Flats identified that this municipality is their place of permanent residence. Comparatively 37% of dwellings in the unincorporated areas of Columbia Lake identified as permanent residents. Both residents and visitors to these communities are anticipated to be the primary users of the lake and its amenities. Schedule B identifies development nodes and communities around the Lake.

2.4 Physical Characteristics

Columbia Lake is located at an average elevation of 809 m (2654 ft) and is considered to be a high altitude lake. The Lake is a large shallow lake and is characterized by a large littoral zone, high level of productivity and potential sensitivity to fluctuations in water levels, altered hydrology within the watershed and nutrient loading. The flushing rate or turn over of lake water for the Lake is estimated to be once per year[8]. In comparison, the turn over of Lake Windermere to the north is estimated to be 8.1 times per year. The Lake rises an average of approximately 0.9 m each year. The physical characteristics of Columbia Lake are presented in Table 1.

Table 1: Columbia Lake Physical Characteristics

SURFACE AREA	LENGTH	VOLUME	MAX DEPTH	MEAN DEPTH	SHORELINE LENGTH (PERIMETER)
25.74 km^2	13.6 km	74.87 x 106 m^3	5.2 m	2.9 m	42.9 km

2.5 Climate

The climate at the valley bottom is relatively dry as the Purcell mountain range to the west acts as a barrier to moist Pacific air. Winters are generally mild with low snowfall in the valley, but higher snowfall at higher elevation occurs in the adjacent mountain ranges. The natural hydrology of the area is strongly dominated by this winter snowfall with a large spring peak flow or freshet which contributes to the annual recharge of the lake[9]. The Rockies to the east generally block cold Arctic air flow during the winter, however when the Arctic air mass pushes to the west temperatures in the valley drop to below average. Spring and fall are generally low precipitation months with the majority of the annual precipitation falling between March and October[10]. Summers are generally characterized by warm temperatures and periodic precipitation.

Changing Climate

Climate change presents challenges for the Columbia Lake area. A report produced by Environment and Climate Change Canada titled, Canada's Changing Climate Report (2019), highlights a mosaic of historical observations and future climate projections. This report explains that there is a 99 – 100% likelihood that there will be rising temperatures in the coming decades[11]. Climate scientists have anticipated this increase by evaluating historical temperature measurements in conjunction with Greenhouse Gas (GHG) emission scenarios in order to determine projections in average annual temperatures. These climate projections illustrate three main scenarios to the future that indicate how we will likely experience living through the next 50 years.

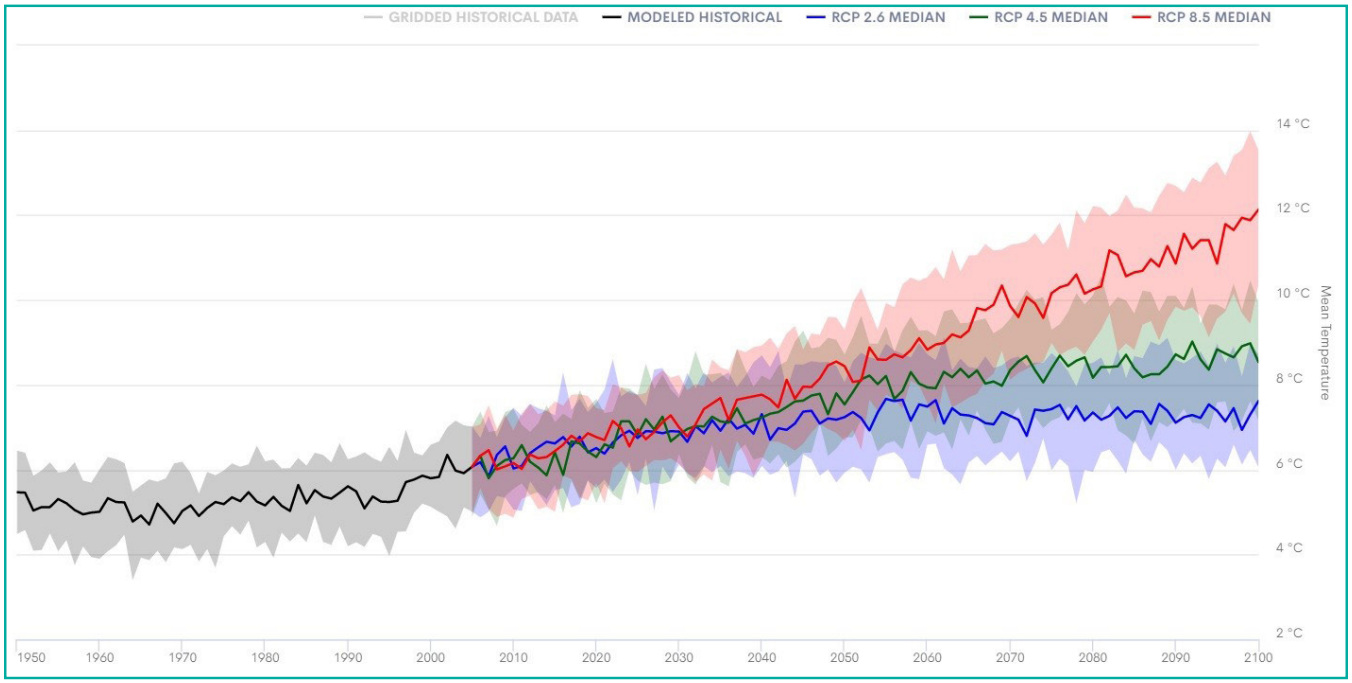
Figure 1 below displays that the future average annual temperature for the Columbia Valley can be represented by three scenarios highlighted in Red, Green, and Blue. The first scenario (illustrated with a Red line), represents a high GHG emission scenarios, where local average annual temperatures are expected to continue on an upwards trend.

The second scenario (illustrated with a Green line), shows the gradual temperature increase in a situation where GHG emissions become more moderate. The third scenario (illustrated with a Blue line), expresses how average annual temperatures might stabilize if we dramatically lower local and global GHG emissions. Lastly, the Black line, towards the left of the graph, represents historical statistical averages of average annual temperature within the Columbia Lake area.

This Climate projection uses historic weather-related data an in collaboration with 24 different climate models with GHG emission estimates to construct and image the future over a 50-year period. Supplementary GHG discharges from both anthropological and natural sources appear to be unavoidable which could also impact local weather patterns.

From a Period between 1951 to 1980, the average annual temperature relative to the Columbia Lake area was approximately 5.1 Degrees Celsius. More recently, the average annual temperature between 1981 – 2010 has increased 5.7 Degrees Celsius, which is an increase of 0.6 Degrees Celsius. This increasing temperature is an indicator that tells us our climate is changing. An increasing annual average temperature will also impact the local weather and precipitation patterns.

Figure 1: Historical data and projected average annual Temperature for Canal Flats, BC[12]



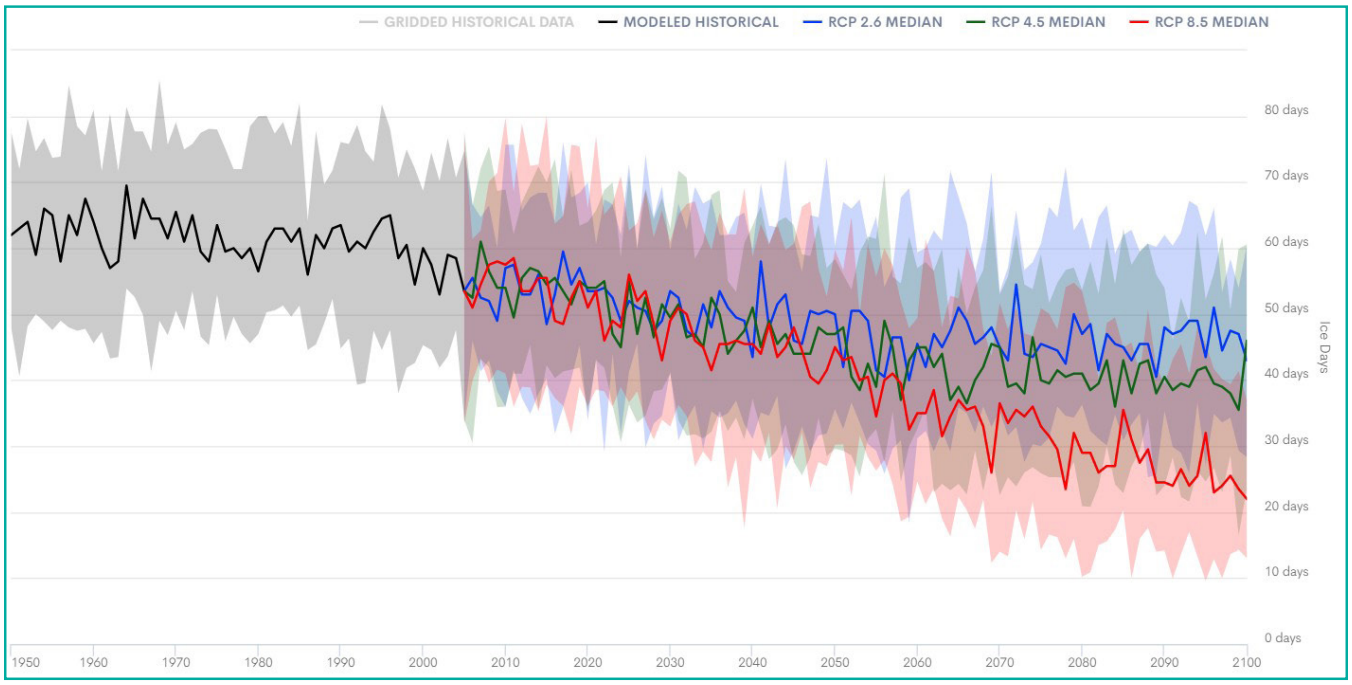
Precipitation and Local Weather

Snow (and Ice) are a natural form of water storage for the Columbia river system and its connected tributaries. Historical weather related data shows that the Columbia Lake area received an average annual amount of precipitation of 449mm[13]. Future projections expect precipitation to increase by 6%, over the next 50 years. Current observations estimate that this increase will likely occur during the Columbia Lake area's wetter seasons[14,15].

Long-term climatic projections show that the number of days where ice can form in the Columbia Valley will continue to decrease as average annual temperatures continue to increase. Figure 2 below displays the number of days where temperatures are low enough that ice can form in the Columbia Lake area. This illustrates how an increase in average annual temperature can directly impact local precipitation patterns. The Red, Green, and Blue Lines specify the projected number of days where ice can from during colder months linked to average annual temperatures from Green House Gas (GHG). The Red Line represents a High GHG emission scenario showing a dramatic decrease in the number of days where the Columbia Lake area will have ice. The Green Line represents a Moderate GHG emission scenario; the Blue Line represents a Low GHG emission scenario. The Black line, towards the left of the graph, represents historical statistical averages recoding the number of days of ice within the Columbia Lake area.

While there are many factors involved with a changing climate, there is a direct relationship to the amount of GHGs that are emitted into our atmosphere. Natural ecosystems within the Columbia Lake area can utilize some of these GHGs (such as carbon dioxide) in our atmosphere to grow and build terrestrial and aquatic plant species. However, the introduction of too much GHG gas emissions has the potential to change the functioning of the natural ecosystem. In the long term the health and well being of the natural systems with in the Lake could impact water quality.

Figure 2: Displaying the number of days where temperatures are low enough that ice can form in the Columbia Lake area[16]



2.6 Water Quality

The communities within the Columbia Lake area obtain drinking water from the Lake, local watercourses, and the surrounding aquifer. The relatively pristine nature of the drinking water within the Columbia Lake area is highly valued by residents. Maintaining the water quality of these water sources is important as it not only supports local residents but also fish and wildlife habitat. Water quality is heavily influenced by adjacent land uses. A high level of development surrounding the Lake, degradation to shoreline ecosystems, and a low flushing rate can all contribute to the potential for impact in water quality. Development without proper controls can load contaminants in to the water sources which has the potential to bring about the risk of algal blooms on the Lake. Furthermore, these activities can impact aquatic fish habitat as well as suitability for recreational uses.

The previous Columbia Lake Management Plan (1997) identifies the importance of assessing water from Columbia Lake to ensure it remains a pristine resource for the surrounding communities and the Columbia River system. Below is an excerpt of the historic water quality measurements taken from Section 2.2 within the 1997 Columbia Lake Management Plan.

1997 COLUMBIA LAKE MANAGEMENT PLAN
WATER QUALITY TESTING RESULTS

	1973 - September		1983 - June		1996 - June	
Parameter	South End	North End	South End	North End	South End	North End
Alkalinity Total mg/1	126	106	132	102	150	131
PH	8.4	8.5	8.3	8.4	8.21	8.19
Dissolved Solids Total mg/1			178	135	199	164
Turbidity	1.1 (JTU)	0.6 (JTU)	1.1 (JTU)	0.7 (JTU)	1.6 (JTU)	2.1 (JTU)
Temperature Degrees Celsius		13.5	12.3	12.1	16.3	16.3
Phosphorus Total mg/l	0.007	0.004	0.006	0.0045	0.01	0.008
Phosphorus Total Dissolved mg/l	0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Carbon Total Organic mg/l	6	5	13	3.5	1.7	2.31
Nitrogen Total mg/l	0.16	0.17			0.43	0.27
Nitrogen Nitrite/Nitrate mg/l	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01
Hardness Total Dissolved mg/l	142	118	149	117	189	155

The Columbia Lake Stewardship Society provides regular water quality reports that have been carried out and analyzed by volunteers in the community. The most recent report from 2020, indicates PH levels within the Lake fluctuate throughout the year. However, these levels tend to balance around late summer and fall. The higher PH levels that are sometimes detected during the early summer and spring could be due to snowmelt and run-off from the surrounding hills.

The Provincial Government also conducts water quality monitoring of Columbia Lake; however, the testing protocols have expanded since 1997. The water quality testing results format is different from the table that was presented in the 1997 plan, which makes a tabular comparison challenging. Appendix 2, provides the full water quality report, including highly detailed information of the compounds, elements and materials that have been observed within Columbia Lake. In summary the MECCS has found that the quality of the water within Columbia Lake is within the Health Canada drinking water quality parameters. However, it is still recommended that water be treated before it is consumed. Table 2 (page 22) compares some of the key compound materials that Health Canada assesses when testing for drinking water quality and displays where the levels are within drinking water safety standards.

2.7 Water Quantity

The Columbia Lake Management Plan area has a variety of land uses that rely on the water from Columbia Lake and the tributaries that flow into it. The Province's Water Management Branch of the MFLNRORD, issues licences to private groups and individuals that allow them to extract water from Columbia Lake and its connected water systems.

According to the Government of British Columbia's Water Management Branch[17,18], there are 83 active water licences within the immediate area of Columbia Lake (see Schedule D & E and Appendix 1 reference table). Of the active licences, 10 currently source water directly from Columbia Lake. Some of the licences within the Provincial database are listed as "inactive" denoting that a licence has been abandoned or cancelled. The RDEK has evaluated the Provincial water licence data (see Schedule D & E and Appendix 1) to review the active licences within the Columbia Lake area. The purpose of this exercise is to provide a platform for discussion concerning water use for residential, commercial & industrial, community systems, and irrigation purposes.

Table 2: Comparing drinking water quality limits that have been established by Health Canada with the latest samples from Columbia Lake.

Table 3: Water Quantity by Use

Purpose for Use of water	Maximum Water Quantity (cubic meters)
Residential Use	53,347
Commercial and Industrial Uses (including golf courses)	207,534
Community Systems	1,663,960
Irrigation / Agriculture	2,892,968

These records show the maximum quantity of water that a licence is permitted to extract from a specified water source. These permitted quantities of water differ between registered licences. Some of these licences are for private or individual use, while others are registered for agricultural, community, or commercial purposes. The total permitted quantity for water licences that draw water directly from Columbia Lake is roughly 388 thousand cubic meters per year. For comparison, the Columbia Lake Stewardship Society estimates that the total average volume of Columbia Lake is approximately 74.87 million cubic meters[19].

2.8 Habitat & Habitat Management

Lakes are complex natural ecosystems that include plants, animals, micro-organisms and physical and chemical interactions. Natural shorelines have four components: the aquatic zone, the shoreline, the riparian zone and the upland. Lakes are very susceptible to human intervention through modification of the shoreline and riparian zones and use of the aquatic and upland zones. From an environmental perspective the portion of the aquatic zone that is directly adjacent to the shoreline or foreshore is known as the littoral zone and is of particular importance for fish habitat and shoreline protection from erosion. Fish and wildlife may use one or more of the lakeshore zones during their lifecycle or during different seasons. The graphic below provides an overview of the different zones, benefits for the Lake and what species may be found that utilizes the zone as habitat.

Lakeshore Zones			
Upland	**Riparian**	**Shoreline / Foreshore**	**Aquatic**
Upland areas are the drier, terrestrial areas above the riparian buffer zone.	Riparian areas are the transition between land and water.	Lakeshore areas are the sandy shorelines and the lake beds below the present natural boundary. Can include wetland areas.	Aquatic areas include the water and all living things within it.
Benefits for the Lake			
• Habitat for terrestrial species • Trees & shrubs reduce erosion	• Improve water quality by filtering runoff & preventing contaminants & sediment from entering the Lake. • Vegetation can provide shade for the foreshore	• Spawning grounds for fish • Aquatic plants provide protection from wave action, reducing erosion	• Fish habitat • Submergent vegetation recycles nutrients & purifies water. • Habitat for aquatic species
What lives here on Columbia Lake			
Bighorn sheep Badgers Rubber Boa Deer	Bats Beavers Frogs Osprey	Muskrat Mussels Blue Heron Painted Turtles	Burbot Westslope Cutthroat Trout Bull trout

Reference: Ok Waterwise - Okanagan_lakeshore_Living_Guide_web.pdf (okwaterwise.ca)

Aquatic Zone Management

The aquatic zone includes both the deeper parts of the Lake and littoral zone or shallow-water habitats of the Lake. Columbia Lake provides habitat for a range of fish species at different life stages, which depending on the fish species, include spawning, rearing, feeding, migration and overwintering[20]. The aquatic zone also includes both emergent and submergent vegetation or aquatic plants. During the public consultation concern was stated regarding the proliferation of aquatic plants. Aquatic plants can be intensified in a shallow water environment where sunlight can penetrate to the bottom of most parts of the Lake. The vegetation, such as reed beds, can also result in conflict with recreational uses such as mooring buoys and recreational users' access to the shoreline. Destructive management options such as dredging to remove aquatic vegetation is not an intervention that is favoured by resource management professionals. Rather than allocating resources toward mapping the spatial extent of weed beds, educating motorized boat users to avoid weed beds to help mitigate spread is often a preferred approach. Aquatic vegetation, both emergent and submergent, provide valuable habitat, food resources and shelter for fish, waterfowl and aquatic species (e.g muskrats, beavers).

Fishing is a popular recreational activity on Columbia Lake year round. The Lake is known to have good to excellent habitat for a range of fish species including favoured sport fish. Native fish species and mussels are also an important traditional food source. Analysis and sampling of fish species was completed as part of the previous Lake Management Strategy and SHIM process. Targeted study of specific fish populations, e.g. Burbot, cutthroat trout, have also been completed. Fish species are generally found to be most prevalent around aquatic vegetation but it is dependent on the means of fish sampling, weather and the time of year.

Over time the fish populations on Columbia Lake have changed and have been subject to analysis and study over the years to assess the health of the Lake from an ecologic perspective. Changes in fish composition in a lake can be related to the introduction of non-native species, destruction of important spawning or rearing habitat and changes in the broader Columbia River system. For example, Burbot are currently considered to be a species of regional concern in the Columbia River system[21] and Kokanee are an important sport fishery in the region and Dutch Creek represents the uppermost distribution of Kokanee in the drainage. The northern portion of the Lake and the transition to the Columbia River are an important part of the Kokanee migration corridor to the Kinbasket Reservoir in the north.

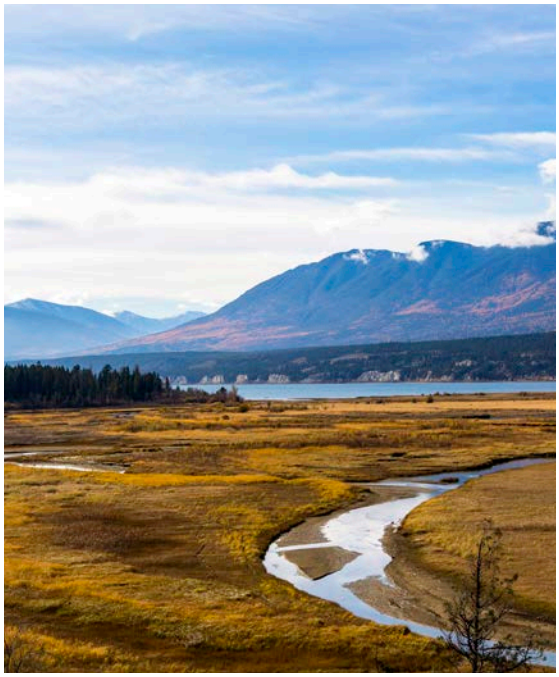
Fish Species		
Native Species	**Hatchery Production**	**Non-Native Species**
Burbot Bull Trout Kokanee Mountain Whitefish Cutthroat Trout	Rainbow Trout Kokanee	Largemouth Bass Pumpkinseed

Prior to the damming of the Columbia River over 80 years ago, Columbia Lake was home to freshwater Kokanee and anadromous salmon. The damming of the river system for power production and flood control resulted in the migratory anadromous salmon being unable to reach the headwaters of Columbia Lake. The Bringing the Salmon Home: The Columbia River Reintroduction Initiative is a partnership of the Sylix Okanagan Nation, Ktunaxa Nation, Secwepemc Nation, BC and Canadian Governments working toward reintroduction of salmon to the Columbia Basin and Columbia Lake. The partnership is committed to exploring the feasibility and options for reintroducing salmon to the Canadian side of the River. The long term vision for the partnership is to re-establish salmon for indigenous food, social and ceremonial needs and to benefit the ecosystem as a whole. The Shuswap Indian Band has been hosting a Salmon Festival to educate and celebrate the cultural and spiritual importance of Salmon in the Columbia Valley since 2011.

Shoreline & Riparian Area Management

Shoreline management is important from a range of environmental perspectives. The protection of natural shorelines is important to the maintenance of fish and wildlife habitat and a healthy lake. Alterations to the shoreline change its natural function. On Columbia Lake, the CPR line has altered the west shoreline resulting in a reduction in riparian habitat and connectivity with upland terrestrial bluffs[22]. The addition of hard structures such as docks or retaining walls can alter the impact of wave action on adjacent shorelines and can affect fish communities in both positive and negative ways. Many of the impacts of hard structures are cumulative and are linked to the removal of aquatic vegetation and natural vegetation along the shoreline.

Waterfront properties on Columbia Lake are very limited, with a small number of lakefront private residential properties in the Village of Canal Flats. Many waterfront property owners maintain a portion of shoreline for swimming and boating access that has been cleared of aquatic vegetation for aesthetic or recreational reasons[23]. In the absence of waterfront properties, upland landowners have often utilized alternate moorage opportunities via a mooring buoy located offshore. Where mooring buoys are placed the removal of aquatic vegetation, such as reeds that may tangle in boat motors, is a common occurrence. The removal of aquatic vegetation (emergent and submergent) and natural riparian vegetation along or adjacent to the shoreline impacts the shoreline's ability to provide high quality fish and wildlife habitat; provide protection from wave and wind erosion; and maintain water quality through filtering runoff from the Lake, nutrient cycling and pollutant absorption[24]. These alterations to the natural function of the shoreline have the potential to impact how the Lake can be used by humans and terrestrial and aquatic plants and animals.



Boating activities on the Lake also have the potential to negatively impact the shoreline and adjacent riparian area. For example, bank swallow colonies are found in abundance along the steep, soft banks of Columbia Lake. These soft banks are susceptible to wave action generated by boats utilizing the Lake. The VORR speed limit of 10 km/h along the east side and south end of the Lake also recognize the susceptibility of these areas to wave action and other impacts of boating.

An assessment of the ecological potential and habitat values of the shoreline of Columbia Lake was completed by the EKLIMP in 2008. The assessment followed established Shoreline Habitat Inventory Mapping (SHIM) protocols. The SHIM process is discussed in section 2.9 of this Plan.

Upland Management

Vegetation management and the use and of land in the riparian zone and upland of the Lake has the potential to impact the health and water quality of the Lake. The removal of vegetation in the riparian and upland areas around the Lake can result in increased erosion, sedimentation due to runoff into the Lake, loss of shade for the shoreline or littoral zone, and reduction in the suitability of habitat for a range of plant and wildlife species.

The east side of the Lake provides a range of important upland ecosystems and requires special consideration for upland land management. The Nature Conservancy of Canada parcel at the north end is managed in order to maintain and support an open forest and grassland ecosystem. Armstrong Bay provides unique habitat not found elsewhere on the Lake. The area has a closed canopy of old growth Douglas Fir and provides a unique cooler, sheltered and moist ecosystem[25]. The unique ecosystem characteristics around the Bay provides habitat for sheltering waterfowl, sensitive species such as mollusks, amphibians, bats and plants that thrive in this type of ecosystem. The Wildlife Management Area (WMA) extending along the east side includes extremely important winter range for ungulates and a connectivity corridor between important habitat areas north and south of the Lake. The Columbia Lake WMA includes approximately 8,576 ha and includes upland land along the east side of the Lake, the wetlands at the north and south ends of the Lake and a portion of the eastern shoreline and littoral zone extending 100 m into the Lake. The boundary of the WMA is shown on Schedule A. The WMA was formally dedicated in 1996, but had previously been long acknowledged as important and critical wildlife habitat, the area was recognized as a 'game reserve' in 1957[26].

2.9 Habitat Mapping

A key part of lake management from an ecological perspective is understanding the current state of the Lake. In order to better assess and inventory ecological attributes of lakes specific inventory protocols have been developed in British Columbia. The process was known as Sensitive Habitat Inventory Mapping or SHIM process. In 2008, EKILMP led a SHIM process for Columbia Lake. The process provided information on the ecological value ratings for fish and wildlife habitat, state of the shorelines, and lake specific Shoreline Management Guidelines for the cooperative management of the shoreline. The preliminary methodology was known as Shoreline Habitat Inventory Mapping and was comprised of three stages:

Stage 1: Foreshore inventory that documents the use of the shoreline and upland, shoreline modificiations (e.g. dock) and biophysical attributes (e.g. reed beds).

Stage 2: Fish and Wildlife Habitat Assessment which identifies key habitat areas, types of species, and assessment of values associated with habitats.

Stage 3: Development of Shoreline Management Guidelines to guide assessment of the impact of shoreline uses or alterations and provide guidance to property owners and decision makers about where alterations should be permitted.

The SHIM process also made recommendations for future actions to be taken to restore and conserve the shorelines. These recommendations were considered in developing policies within section 4 of this Plan.

A new inventory of the physical and biological features of Columbia Lake will be occurring in the summer of 2021. The new inventory will follow the updated Foreshore Inventory Management planning protocols that have been developed following detailed review and analysis of the previous SHIM protocols. A revised inventory will allow for monitoring and analysis of changes along the shoreline of the Lake. It is anticipated that reporting and new Foreshore Development Guidelines will be published by Living Lakes Canada and the consultant undertaking the inventory work in 2022. Future consideration of attributes and processes should also consider these updated documents and inventory when they are available.

Ecological Value

The SHIM process allows for a determination to be made on the current and potential ecological value of the shoreline. The suitability of habitat for fish and wildlife is determined by the level of disturbance and presence of natural features. Maintaining a range of habitat features within the lake ecosystem is important to sustaining the lakes as the suitability of habitat may change over a plant, fish, animal or organism's lifecycle. The ranking of fish and wildlife values within the SHIM process is through an Aquatic Habitat Index (AHI). The AHI estimates the environmentally sensitivity or biological value of physical characteristics of the shoreline.

The AHI for Columbia Lake completed in 2008 was based on the protocols for the SHIM process developed by EKILMP for East Kootenay Lakes in consideration of developed SHIM procedures. The AHI identifies a current ecological value and a potential ecological value for the entire lake shoreline. The current ecological value reflected the state of the foreshore at the time of the SHIM inventories. The potential ecological value reflects the removal of modifications to the shoreline and restoration of the shoreline to a more natural state[27]. In order to determine the ecological values, the shoreline was split into segments that reflected similar habitat types and characteristics. The 2009 AHI rankings for Columbia Lake are shown on the following page:

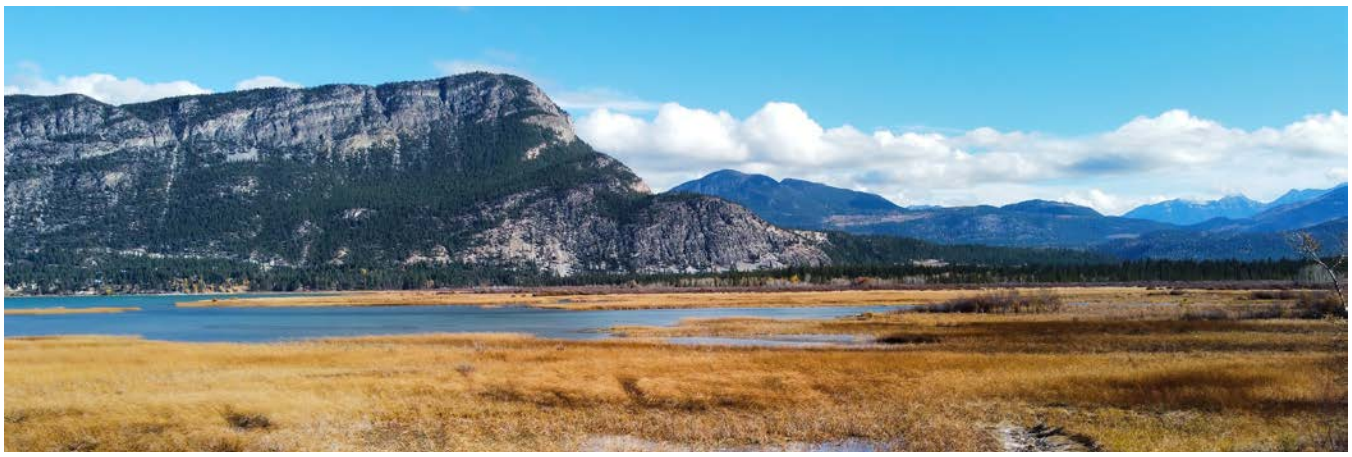


Table 4: Aquatic Habitat Index (AHI) rankings for Columbia Lake[28]

Ranking	Ecological Value (2009)		Ecological Potential	
	Shoreline length (m)	Shoreline %	Shoreline length (m)	Shoreline %
Very High	11,591	26.8	11,591	26.8
High	15,207	35.1	15,207	35.1
Moderate	1,877	4.3	15,739	36.4
Low	13,862	32.0	755	1.7
Very Low	755	1.7	0	0

Based on the criteria within the 2009 SHIM process, it was identified that a moderate percentage of 37% the Columbia Lake shoreline was disturbed[29]. These disturbed areas generally have a lower ecological value, but often present opportunities for restoration and rehabilitation of habitat. They may also be adjacent to valuable habitat in the littoral or aquatic zones such as in-lake wetlands or areas that provide breeding habitat. On Columbia Lake, the disturbed shoreline is primarily along the west side and is associated with the CPR line and associated maintenance and berming. Although, these foreshore portions of the Lake are disturbed they were identified as retaining valuable habitat through emergent vegetation and that they may serve as Burbot rearing grounds[30]. The recommended focus arising from the SHIM reporting for future shoreline management for Columbia Lake was ensuring conservation of the intact ecosystems around the remainder of the Lake to preserve a healthy and functioning shoreline environment and contiguous access between shoreline and upland terrestrial ecosystems[31]. However, ensuring that rehabilitative measures and minimizing further disturbance along the west side of the Lake are realized was also identified as key components to ensuring the health of the Lake.

Shoreline Management Guidelines

It is important to recognize that all alterations to the shoreline may require permits or other approvals. Alterations to the shoreline may be subject to the federal Fisheries Act, Canadian Environmental Assessment Act and the provincial Land Act, Water Sustainability Act, Health Act and Environmental Management Act. As part of this decision making processes, the SHIM Shoreline Management Guidelines provide guidance as to where modifications to the shoreline may be permissible based on level of impact. The Guidelines include zones from highest value habitat to lowest and management guidelines for particular uses in each zone are provided in the report. The shoreline colour zones are shown on Schedule F. These Guidelines are intended to be used by applicants and decision makers to inform discussions about where uses should be accommodated and where the shoreline should be conserved or restored.

	Shoreline Type			
	Red	**Orange**	**Yellow**	**Grey**
Ecological Value(s)	**Very High**	**High**	**Moderate**	**Low & Very Low**
Characterized By	Undisturbed shoreline, creek mouths	Relatively natural shoreline, high value habitat areas	Disturbed shoreline, but retain sensitive areas & habitat	Disturbed shoreline
Development Supported	No, except First Nations Traditional Uses	Very limited & discouraged	Yes, but should consider protection of habitat features & Best Management Practices	Yes, but should consider restoration & habitat improvement features
Conservation & Restoration Supported	Yes	Yes	Yes	Yes
% of Shoreline	26.8	35.1	4.3	34

2.10 Lake Management

Recreational Lake Use

Boating, both motorized and non-motorized, is a popular activity on Columbia Lake. The geographic location of the Lake is such that south winds are common, which is one factor that contributes to it being less popular than nearby Lake Windermere for activities like wake boarding, water skiing and wake surfing. Limited public and private access for trailered boats may also be a factor contributing to the lower recreational pressure from boating. Columbia Lake is a shallow, headwater lake with significant wildlife and habitat values. The south, east and north portions of the Lake are within a Provincial Wildlife Management Area and are subject to a 10 km/h maximum speed limit through a Federal Vessel Operations Restriction Regulation as show in Schedule G.

Winter use of Columbia Lake isn't as prevalent as some other lakes in the region, such as nearby Lake Windermere. Variable ice depth and naturally occurring soft spots or cracks could be part of the reason. Still, winter use does occur and is typically centered on skating and cross country skiing, ice fishing or occasional use of recreational vehicles on the frozen surface. Winter access to the sensitive habitat on the east side of the Lake, such as around Armstrong Bay, was cited as a concern during the consultation for the Plan.

Recreational Carrying Capacity

During the engagement process, respondents expressed concern about the potential for increased recreation on the Lake. Columbia Lake is used for a range of year round recreational purposes. Summer is the peak season for recreation with the influx of seasonal residents during the warmer months of the year. Summer recreational activities include: swimming, motorized and non-motorized boating, wake surfing, water skiing, fishing and limited beach use. Winter recreational activities include: skating, walking, cross country skiing, ice fishing, and snow shoeing. Changes in recreational use identified during the consultation process included the size, number and type of motorized boats, continued placement of mooring buoys and increased pressures on the limited access opportunities. Similar to other lakes in the region the peak season for recreational usage has shifted from a focus on July and August to stretching from May to October. Identified negative environmental impacts arising from or impacting recreational use included algal blooms, increased sedimentation in the lakes, and shoreline erosion.

The concept of recreational carrying capacity has been studied for many years. It is widely recognized that the range of recreational uses that occur on and adjacent to lakes places stress on the lakes. The carrying capacity of the lakes can be considered from a number of perspectives: the physical carrying capacity (e.g. how many boats can fit on the lake); the social carrying capacity (e.g. what level can be reached prior to impacting a user's experience), and the ecological carrying capacity (at what level is there a negative impact on the ecological integrity of the lake ecosystem)[32]. The intangible nature of the concepts means that recreational carrying capacity is not easily quantifiable. However, based on feedback received during this process it is likely that Columbia Lake has not yet exceeded its physical or social carrying capacities but that there is concern about the potential for exceeding the ecological carrying capacity.

The management recommendations within this Plan seek to balance the interests of promoting the protection and conservation of the shoreline, riparian and upland zones of the lakes with continued recreational use and management of opportunities for lake access. The development of policies related to lake management must take into account that perceptions of problems or issues related to physical or social carrying capacities may vary between individuals. In addition, the regulation of recreational use for one type of carrying capacity may have unintended impacts on the other types of carrying capacities on the lake under regulation or on nearby lakes[33].

Water Access

Compared to other lakes in the RDEK, Columbia Lake has very limited water access for recreational uses due to topography and the upland development pattern. Undeveloped portions of the shoreline along the north, east and south portions of the Lake provide very limited direct lake access. The CPR line follows the west shore of Columbia Lake, so there are few residential parcels that directly abut the Lake. Compared to other lakes of a comparable size there are relatively few residential parcels that are located with direct access to the foreshore. Most of the residential parcels with direct access to the foreshore are found within the Village of Canal Flats. Communities with legal water access, either via upland land ownership and/or by holding a legal crossing agreement with CPR have established community amenities such as storage buildings, docks, buoy fields, swim areas, a boat launch and a marina. The inability to have docks or group moorage facility by virtue of upland land ownership riparian rights or conformance with Provincial policies, has led to calls for increased access at the north end of the Lake for the launching of motorized boats.

Current public lake access points are shown on Schedule C. Opportunities to launch watercraft from public land on Columbia Lake, whether it be a trailered motor boat or a car top kayak, are limited. The only public launch for trailer vessels is located at Tilley Memorial Park in the Village of Canal Flats. From Highway 93/95, a non-motorized launch for small vessels that can be portaged a short distance can be found in the south west corner of the Lake. This non-motorized launch area is currently under tenure, managed by and within the Village of Canal Flats. Expansion of the existing boat launch to accommodate launching up to two trailered boats has been identified as a means of expanding access to the Lake.

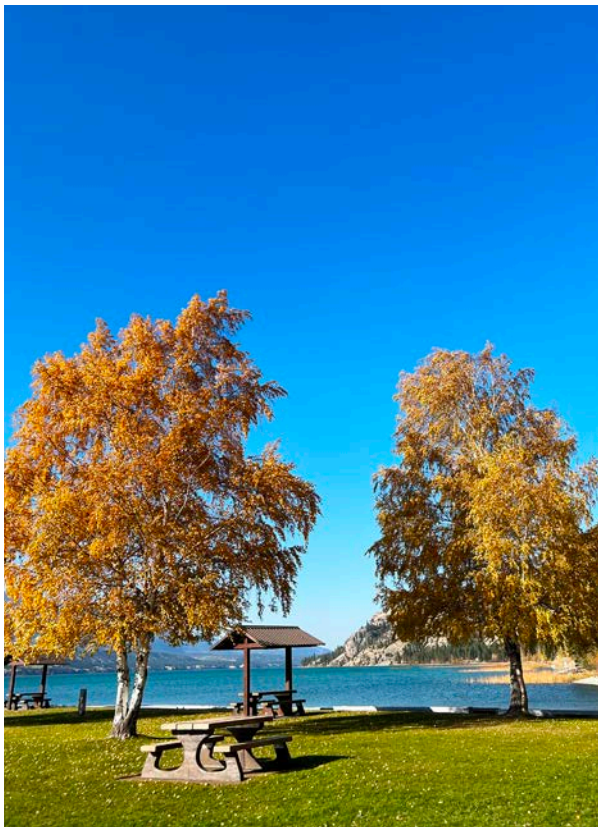
The primary factor limiting public access to the west shore of Columbia Lake is legal crossings of the railway right-of-way. In order for legal access to be utilized, a crossing agreement is required for both pedestrian or vehicle access across the CPR rail line. These crossing agreements are made with community associations for the benefit of their membership. The responsible community association that manages the legal crossing takes on responsibility and liability associated with the crossing. Historically, CPR has been hesitant to enter into crossing agreements due to on-going liability issues. Inequity between community users with membership in Community Associations with a legal crossing agreement and neighbouring community users without legal access was identified as an on-going issue and point of conflict during the consultation process.

Boat Moorage

This use of private watercraft on Columbia Lake and demand for on-water moorage is expected to increase as the communities in the immediate area continue to grow. Currently, the only group moorage facility on Columbia Lake is located at the north end of the Lake in Columere Park. The Columere Park Marina has 82 boat slips and is managed by the Columere Community Association. Within the Village of Canal Flats a tenure application to the Province for the Eagles Nest community is proposed. The application is for a group moorage dock to accommodate up to 3 boats. The Canal Flats Zoning Bylaw supports individual docks for upland parcels that directly abut the lake foreshore and limited group moorage docks in the Eagles Nest and Painted Ridge communities.

Mooring Buoys

Limited on-water moorage via group facilities or marinas and limited boat launch access has led to the utilization of anchored mooring balls or buoys. Concerns about mooring buoys on Columbia Lake is commonly expressed during discussions about lake management. In response to concern about mooring buoys, Columbia Lake was the first lake on which the RDEK introduced surface water zoning in order to restrict where on the Lake mooring buoys or other in-water structures were permissible. However, while both the RDEK and the Village of Canal Flats have surface water zoning that regulates the placement of mooring buoys, to date neither local government has had active enforcement of the regulations. Buoys are also regulated at the federal level by the Private Buoy Regulations of the Canada Shipping Act. The Private Buoy Regulations identify requirements of private buoys, including size, colour, ownership identification and placement with relation to navigation. Generally speaking, private buoys on most lakes, including Columbia Lake do not meet the requirements of these regulations.



Private mooring buoys have been placed near the shoreline as semi-permanent locations for lake users to store their boats along the western shoreline. The number of mooring buoys, installation of new buoys, confusion around transfer of buoys between property owners and impact of mooring buoys on riparian vegetation and aquatic species were all identified as concerns during the consultation phase of the plan process. In order to try to identify the number of buoys installed on the Lake and where they are located, the RDEK has recorded the number of private mooring buoys, this was completed through an on-water inventory in 2010 and 2020 in order to maintain a record of buoys in use and determine over time the level of compliance with the zoning bylaw. An overview of the inventory data is presented in Table 5 on the following page:

Table 5: Buoy Inventory Summary

Approximate Location	Inventory Year	
	2010	2020
Columere Park	8	0
Timber Springs / Bella Vista Estates	11	13
Springwater Hill	2	1
Columbia Estates	1	8
Spirits Reach	0	1
Columbia Ridge Estates - North	21	25
Columbia Ridge Estates - South	8	10
Columbia Lake Total within RDEK Jurisdiction	53	58

As the initial inventory was conducted in 2010 and the applicable Surface Water Zoning that regulates the placement of buoys was introduced in 2007, the inventory data may not accurately reflect the number or placement of buoys that would have legal non-conforming or grandfathered status under the *Local Government Act*. However, the inventories serve as a means of monitoring on-going on-water moorage of boats and the level of compliance with existing regulatory measures such as the zoning provisions. The inventory data was used to help inform guidance on policy and direction with respect to mooring buoys on Columbia Lake within this Plan.

Riparian Rights

Within British Columbia riparian (shoreline) rights are primarily established through common law, although the extent of riparian rights has been refined through case law within the court system. Landowners who own land that fronts directly onto water are considered to have riparian rights. Based on common law the riparian rights and privileges are: protection of property from erosion, entitlement to land that has naturally and slowly accreted to the upland by natural processes, and unrestricted access to and from every part of the water frontage. The construction of improvements to access the water or the land is not a riparian right and is subject to the applicable policies and regulations.

Land that is below the natural boundary of a waterfront parcel is considered to be Crown land and the public is entitled to use and walk along the land unimpeded. This area is referred to as the Crown foreshore. Riparian rights do not allow property owners to prevent access along the foreshore. However, access to Crown foreshore is considered a privilege or bare licence and the Crown cannot guarantee access due to the assignment of riparian rights. For the public, the rights that exist under common law are the right to land boats and to embark on foreshore in cases of emergency and the right of navigation, anchoring, mooring, and fishing over those lands covered by water. Balancing the riparian rights of waterfront property owners and public use of the foreshore is considered by the Province in its administration of Crown land tenures. The ability to make application for Crown land tenures is one example of riparian rights or privileges.

Development of the foreshore in accordance with riparian rights granted by virtue of being the upland landowner does not absolve the landowner from gaining the consent of the Crown, via the Province or from complying with Crown land policies. For example, a marina that is adjacent to private land must be granted a crown land tenure. Alternatively, the development use must comply with a provincial policy that allows for limited development as long as it applies with the applicable policy. Generally, the ability to apply for tenure or development under a Provincial policy are limited to the upland land owner or riparian right holder. On Columbia Lake, survey lots between the railway line and the Lake mean that CPR is the upland land owner. Use of these lands by other persons requires a crossing agreement and if application to the Province for approvals is required, then consent to apply from CPR will also be required as part of the application process.

Crown Tenures

The development of upland infrastructure for recreation purposes such as docks or boat launches requires either a tenure or compliance with the applicable Provincial policy. Group moorage facilities and boat launches require a tenure in the form of a licence of occupation or a lease. Individual docks, where the land is directly on the lake and

is owned privately are permitted under a 'General Permission'. These docks do not require a tenure as long as they meet the Provincial requirements regarding size and location. Individual docks that do not meet the requirements of the 'General Permission' or overlap with an area of special interest (e.g. known archaeological sites) may apply to the Province for a 'Specific Permission'. The proposed recreational use must comply with the applicable zoning bylaw and applicable Official Community Plan policies. As there is surface water zoning on the entire lake that means that in-water structures must also conform to uses permitted in the applicable zone.

Currently the number of active tenures on the Lake is very limited and includes one group moorage facility (marina) and two boat launches (Tilley Memorial Park and former Thunder Hill Provincial Park). The Village of Canal Flats has postponed application for a group moorage facility adjacent to the Eagle's Nest community and the Timber Springs Community Association postponed making application pending the outcome of this process.

Tenure Purpose	Location
Columere Park Marina & Swim Area	North
Canal Flats Non-Motorized Launch	Southwest Corner
Tillley Memorial Park Motorized Launch	Southeast Corner

Applications for Crown land tenure for portions of a lake are limited to applicants who are upland land owners or those who have permission from the upland landowner. The very limited extent of private land holdings adjacent to Columbia Lake is directly related to the limited number of tenures currently issued by the Province. As well, a significant percentage of the Crown land surrounding the Lake, including lands on the east side and within the the Village of Canal Flats boundary are under an Order in Council (OiC) Section 15 Map Reserve that limits the acceptance or issuance of tenures by the Province. The Map Reserve aligns with the boundary of the WMA, and was in place prior to incorporation. Crown land that is within an area identified for Conservation purposes and subject to an OiC Section 15 Map Reserve is considered to not be eligible for disposition or assignment through issuance of a tenure. A Notation of Interest has also been submitted for Crown lands on the east side of the Lake in recognition of the on-going collaborative work to identify these lands as a Cultural Landscape. An amendment to the OiC Section 15 Map Reserve is required in order for the Province to approve application for tenures for Crown land. As the current Map Reserve overlaps with lands under the Village of Canal Flats jurisdiction, an amendment will be required in order for development or disposition of Crown land within the overlap areas. The amendment process can take a number of years and will require cooperation between the Village of Canal Flats and the Province to determine the best path forward.

The Columbia Lake area also has a number of Crown land parcels that have been designated for recreational uses via designation as Use, Recreation and Enjoyment of the Public Reserves (UREP). The UREPs are also established under OiC Section 15 Map Reserves, however they are for the purpose of designating lands for public use and recreation. Crown land parcels around Columbia Lake designated as UREPs include a parcel north of Armstrong Bay, a parcel south of Columbia Ridge Estates and a parcel to the west of the community of Dutch Creek. The UREP parcels are shown on Schedule B of this Plan.

3.0 SUMMARIES

People who participated in the public engagement process reflected a variety of personal interests about the Lake. These interests could often be divergent: for example, in the first round of engagement there were respondents who identified a desire to limit motorized vessels on the Lake and respondents who expressed no desire to limit motorized opportunities. Regardless of differing interests, common values emerged. These common values centred on the relatively pristine nature of Columbia Lake, the low recreational pressure compared to other lakes in the region, and a general desire to preserve the largely undeveloped east side of the Lake for both ecological and cultural reasons. Similarly, common areas of concern were shared by many participants and the Technical Committee. A broad summary of the assets and concerns identified during this process are identified in this section.

3.1 Assets

The consultation conducted during this process highlighted the features and attributes of Columbia Lake that are valued and contribute to the unique sense of place for the Columbia Lake area. The assets are those qualities that the Plan will seek to support and nurture through the management recommendations.

Community

A strong sense of community was communicated during the consultation phases of the planning process. Columbia Lake is perceived to offer a unique lakeside living and visiting opportunity. The desire for retention of these unique characteristics were frequent observations by those who participated in the consultation processes.

Cultural

Columbia Lake and the Columbia headwaters are an important area for Indigenous people. The Columbia headwaters are symbolic of the Ktunaxa's relationship to their homeland - Ktunaxa ʔamakʔis. Columbia Lake is central to the Ktunaxa Creation Story. The numerous cultural features along the shoreline of Columbia Lake are evidence of thousands of years of use and occupation by Indigenous people, and the lake and surrounding area are of special spiritual significance to the Ktuxaxa people as the site of their creation. The Shuswap Indian Band also has a long oral history which speaks of plant collection, hunting, fishing and cultural traditions taking place along Columbia Lake's waters and has high cultural significance for the Shuswap. Salmon reintroduction into the Columbia River system is one of Shuswap Band's top priorities, as salmon is tied to Secwepemc culture through the development of fishing technologies, subsistence, relationships, story, and ceremony.

On-going initiatives such as partnerships working toward the designation of the Columbia Lake East Side as a Cultural Landscape and reintroduction of salmon to the Columbia River drainage system are occurring across all levels of government, including indigenous, municipal, provincial and in some cases federal. Initiatives such as these present opportunities for moving forward on the path to reconciliation, supporting Indigenous governance of lands according to Indigenous laws and practices and recognizing the cultural importance of the Columbia Lake area to the Ktunaxa and Secwepemc people. Management principles must be rooted in the Indigenous values associated with Columbia Lake area and support a collaborative framework for advancing these initiatives.

Natural Environment

The natural environment of the Columbia Lake area is highly valued. Columbia Lake possesses good water quality, abundant natural spaces, diverse habitats and ecosystems. The importance of these natural features both at the Columbia Lake watershed level and the site specific attribute level was highlighted during this process. Unique ecosystems and habitats are found around Columbia Lake itself such as Armstrong Bay, the Dutch Creek alluvial fan and the wetlands at the south end of the Lake. Preservation of the natural environment and opportunities for ensuring that the high ecological value of the Lake and the surrounding area was identified as a very important component of lake management.

Recreation

The range of recreational activities that the Lake provides ranging from passive activities such as wildlife or bird watching to active activities such as non-motorized or motorized boating were identified as key assets during the process. Recreational activities are a key draw for people wishing to reside or visit the Columbia Lake area.

Stewardship

Community associations and the Columbia Lake Stewardship Society (CLSS) currently support education, outreach and monitoring of the Lake. The water quality monitoring program conducted by CLSS provides valuable information about lake health on an annual basis.

3.2 Concerns

The concerns identified below are areas where the Plan can propose options to proactively address and provide guidance to the two local governments, provincial decision makers and the community. Common themes or areas of concern were evident through the consultation phases and discussion that led to the development of this Plan.

Community

The potential for overdevelopment of upland parcels was cited as a concern during the process. Development rates have been slow but steady in recent years and the continual introduction of new upland parcels and associated residents increases demands for access to the Lake and a corresponding increase in the number of recreational users. There is a potential for exceeding the social and/or recreational carrying capacity of both limited foreshore day use facilities and the Lake itself. The public consultation identified a mix of perspectives with regard to capacity. Not surprisingly publicly managed facilities were cited as having the potential to be more frequently overcrowded than privately managed facilities. The perception of overcrowding on the Lake itself was most frequent during summer months and on weekends, when the population of the communities surrounding the Lake are likely to be at its highest.

Natural Environment

Changes to the natural environment, habitat being negatively impacted or degraded, changes to present fish and wildlife populations were commonly cited as concerns during consultation processes. Impacts of human use of the Lake for recreational purposes were identified to be of specific concern as it was perceived that this use has the potential to impact the suitability of natural habitats for waterfowl and aquatic species. Over time changes to habitat may result in changes in the diversity of species that live in or utilize the Lake. Potential conflict between aquatic features such as reed beds was also identified. Reed beds may provide valuable habitat for waterfowl or aquatic species, but are a nuisance for boaters. From a habitat management perspective, the overlap of the Wildlife Management Area (WMA) with the southern and eastern portions of the Lake present both an opportunity for conservation of these important natural environments and potential conflict with lake users. The need for public education around management measures for natural habitats and species was identified as a key management issue for the future.

Recreation

The Lake is not as busy as many lakes of comparable size and development. The unique development characteristics of the Lake, prominence of the railway line along the west shore, frequent wind and limited access points all contribute to the current levels of use and inhibit the ability to use the Lake. Balancing the accommodation of recreational uses on the Lake with demands for recreation and other lake assets and attributes was identified as very important for ensuring future satisfaction for recreational users.

The limited provision of access points was commonly cited as a concern. The limited number of access points and associated infrastructure mean that recreational use is concentrated in these areas. Examples cited included inequity for legal access across the railway line due to limited access to crossing agreements, the lack of a public boat launch for motorized or trailered boats at the north end of the Lake and overcrowding at Tilley Memorial Park day use facilities.

The use and moorage of motorized boats continues to be an area of concern on the Lake. Surface water zoning regulations introduced in 2007/8 have potentially acted as a deterrent for some lake users, resulting in fewer mooring buoys being installed on the Lake. However, mooring buoys continue to be present along the western shoreline of the Lake. In the absence of effective management and tracking and enforcement of bylaws the proliferation of buoys is anticipated to continue. As part of the consultation process, concerns were raised about a continuous increase in mooring buoys if options for future moorage and cooperative versus regulatory management of buoys are not identified as part of the Plan.

Regulation

With the scope of this Plan being to guide local government planning and decision making, it is important to recognize that local government bylaw and regulatory enforcement is a finite resource, funded by taxpayers of a given jurisdiction. When dealing with Columbia Lake, local government jurisdiction is limited and Provincial and Federal governments are responsible for many aspects of the Lake. To reduce the burden to all levels of government, education about the current regulations and stewardship principles is preferred over those that require dedicated resources on an on-going basis such regulatory measures that require enforcement action. For example, in general people that participated in the public engagement process identified a preference in adhering to existing regulations, such as the 10 km/h speed limit. On-going voluntary compliance and education about why these types of restrictions are in place was the preferred path forward.

4.0 MANAGEMENT RECOMMENDATIONS

The Plan for Columbia Lake is intended to be used by both the RDEK and the Village of Canal Flats to guide local government decision making, planning and referral responses related to Columbia Lake. Zoning and long-range planning for the lake and upland areas may not always align between jurisdictions, but best practices for recreational lake use, the VORR and Provincial WMA provide a management framework and regulations for the Lake that apply regardless of local government jurisdiction. The structure of the management recommendations is comprised of seven topic areas, which were informed through the public engagement process for the plan.

- Boating
- Moorage & Lake Access
- Columbia Lake East Side
- Foreshore & Upland Management
- Winter Use
- Stewardship & Conservation
- First Nations Initiatives

4.1 Boating

4.1.1 As the responsible local authority under the VORR, the RDEK is encouraged to maintain the speed limit buoys that demarcate the border of the WMA.

4.1.2 An application for a Vessel Operation Restriction Regulation to prohibit watercraft from Armstrong Bay is supported subject to:

(i) clear identification of the restriction(s) being requested;

(ii) demonstration of comprehensive consultation with the affected communities and recreational users; and

(iii) identification of majority support from the community residents surrounding the Lake to pursue the new boating restriction.

4.1.3 The installation of educational signage explaining the importance of aquatic and terrestrial values assosciated with the Lake and maintaining distance from birds during the breeding bird window (April – August) at access points and community facilities is supported.

4.1.4 Encourage a voluntary 'no wake' area within 100m of the shoreline around the Lake.

4.1.5 Encourage towing (e.g. tubing, skiing, wake boarding) to take place in the middle of the Lake, travelling in a north/south direction or within designated areas such as slalom skiing on established ski course. If a slalom ski course is established, only one such course should be accommodated and it should be located in recognition of prevailing winds on the Lake.

4.1.6 Promote lower impact water-based activities such as wildlife viewing, angling, swimming and wind and paddle sports.

4.1.7 Rental businesses and community associations that provide personal watercraft are encouraged to provide non-motorized options.

4.1.8 Best management practices for fueling boats should be observed at all times. On water fueling of boats on Columbia Lake is discouraged.

4.2 Moorage & Lake Access

4.2.1 Surface water zoning to regulate the placement of docks and in-water structures, such as mooring buoys, on the Lake should be maintained by both the RDEK and the Village of Canal Flats.

Marinas

4.2.2 No tenure applications for commercial for profit purposes for private marina use including overnight moorage are supported in either local government jurisdiction.

4.2.3 New marinas or small group moorage facilities for on-water boat storage are not supported within RDEK jurisdiction.

4.2.4 The maintenance and renewal of the established tenure for the group moorage facility located at Columere Park is supported.

4.2.5 New small group moorage facilities, including a dock and overnight moorage, are supported for the Village of Canal Flats' Eagle's Nest and Painted Ridge subdivisions. Management of the facilities for communal use for the benefit of upland landowners within the associated community is encouraged.

Mooring Buoys

4.2.6 The placement and use of all private buoys are encouraged to conform to the Private Buoy Regulation.

4.2.7 The placement of new mooring buoys is generally not supported, except as may be accommodated by the applicable surface water zoning.

4.2.8 When mooring buoys are utilized for moorage, best practices such as the use of rope instead of chain to minimize scour of the bed of the Lake are encouraged.

4.2.9 Community buoy fields are encouraged to maintain or reduce the existing number of buoys as recorded in the RDEK 2020 buoy inventory.

4.2.10 When mooring buoys are managed by a community association for communal use, the Community Association is encouraged to manage existing mooring buoys in a way that maximizes their use amongst the greatest number of community members without adding additional buoys.

4.2.11 The creation of a new zoning designation that would support the placement and use of mooring buoys for overnight moorage managed for communal use by a Community Association is generally supported, subject to:

(i) where access to the foreshore requires crossing the railway, that the rezoning application is made by a community association who holds a Private Crossing Agreement in good standing with Canadian Pacific Railway, which authorizes pedestrian crossing of the railway for community association members;

(ii) development of a management policy by the Community Association that accommodates shared use or rotating communal use by members of the Community Association; and

(iii) clear identification of the number of buoys permitted in the designated area.

Docks

4.2.12 Waterfront property owners are encouraged to comply with the requirements of the Provincial 'General Permission' related to dock size and placement.

4.2.13 Applications for Provincial 'Specific Permissions' to accommodate private moorage for waterfront property owners who are unable to comply with the requirements of the 'General Permission' will be considered in relation to:

(i) site specific restraints that require the structure or improvement that necessitates the Specific Permission; and

(ii) demonstration of the mitigation of potential impacts on neighbouring property owners and lake users; and

(iii) the proposed integration of natural shoreline restoration and enhancement where possible.

4.2.14 Application for a Crown land tenure, lease or licence of occupation, to accommodate a day use dock facility for communal use by community association members is generally supported subject to:

(i) where access to the foreshore requires crossing the railway, that the application is made by a community association who holds a Private Crossing Agreement in good standing with Canadian Pacific Railway, which authorizes pedestrian crossing of the railway for community association members;

(ii) the dock is intended for day use purposes of loading and offloading only and must be clearly signed to denote 'day use only';

(iii) no overnight moorage of motorized or non-motorized watercraft shall be permitted; and

(iv) rezoning of the applicable portion of the Lake to accommodate the community day use facility.

4.2.15 Applications to amend the RDEK surface water zoning to accommodate day use dock facilities managed by community associations under a tenure agreement with the Province shall generally be supported. Adoption of the amending bylaw shall be contingent on the applicable tenure being granted by the Province.

Access

4.2.16 Maps and educational signage that show public access points around the Lake are encouraged.

4.2.17 Options for upgrading the Tilley Memorial Park boat launch ramp and associated infrastructure to allow launching or trailering of two boats should be explored. Required tenure approvals from the Province to accommodate these upgrades should be supported by the RDEK and Village of Canal Flats.

4.2.18 Maintaining a tiered fee structure for the Tilley Memorial Park boat launch is supported. A tiered fee structure allows for recognition that the operation of the boat launch is funded through Village of Canal Flats taxation for the benefit of al users.

4.2.19 The non-motorized boat launch at the southwest corner of the Lake currently under tenure by the Village of Canal Flats should be maintained. However, additional educational information and signage about boating and recreational use in the wetlands should be considered.

4.2.20 Public access is preferred over private access. Creation of new access for public use, even in private developments, is preferred over an increase in the number of private access points.

4.2.21 Utilization of public access points for community use, such as small group moorage facilities in the Village of Canal Flats should ensure that broader public use of the Lake access is not alienated.

4.2.22 Integration of a motorized boat launch within Columbia Lake Provincial Park is not supported. Alternatively, formalization of access points, with appropriate signage, infrastructure and associated parking for non-motorized watercraft should be considered past the outflow from Columbia Lake along the river channel.

4.2.23 Provision of access and designation of access around the Lake including along the east side, for the purpose of Traditional use or management of the foreshore or Lake by First Nations is supported.

4.2.24 Amenity contributions to support existing public lake accesses are encouraged for developments occurring around the Lake.

4.3 Columbia Lake East Side

4.3.1 Continued participation in the Columbia Lake East Side Partnership (CLES) by the RDEK and the Village of Canal Flats is supported.

4.3.2 Future land use designations, zoning and referral responses related to the east side of Columbia Lake should uphold the highest regard for conserving and enhancing the natural ecosystem.

4.4 Foreshore & Upland Management

4.4.1 Within the Village of Canal Flats Shoreline Development Permit Area, the Shoreline Development Permit guidelines should be updated to reflect the upcoming Foreshore Development Guidelines based on the 2021 field work and updated Foreshore Inventory Mapping Protocols (FIMP) Guidelines developed for Living Lakes Canada.

4.4.2 A Shoreline Development Permit Area should be developed for the portion of Columbia Lake under RDEK jurisdiction. The Development Permit Area should incorporate guidelines that align with the upcoming Foreshore Development Guidelines based on the 2021 field work and updated FIMP Guidelines developed for Living Lakes Canada.

4.4.3 The retention of and active management of upland conservation properties to maintain healthy ecosystems around the Lake is encouraged.

4.4.4 New developments upland from the Lake should be serviced by a municipal or community sewer system

rather than individual on-site sewage systems.

4.4.5 Property owners are encouraged to maintain natural vegetation within the upland zone of the Lake. Within a minimum of 30 m upland of the natural boundary of the Lake, the retention of native vegetation, including grasses, shrubs and trees is encouraged.

4.4.6 Waterfront property owners are encouraged to rehabilitate disturbed shorelines through replacement of non-native vegetation with native species, allowing for natural accumulation of woody debris and removal of hard structures such as docks and retaining walls.

4.4.7 The retention of natural vegetation and control of invasive plant species along the shoreline is encouraged. The control of invasive weed species must be in accordance with the Weed Control Act.

4.4.8 Property owners on the waterfront are encouraged to minimize the amount of lighting along the shoreline and on waterfront structures, such as docks. Shoreline lighting has the potential to be reflected off the surface of the water and has a negative impact on the aquatic life, which is accustomed to the natural cycle of daylight and dark.

4.4.9 Amendments to the Order in Council (OiC) Map Reserve for the WMA to include the portion of the Map Reserve that overlaps with land above the foreshore within the jurisdiction of the Village of Canal Flats is supported.

4.5 Winter Use

4.5.1 Individual docks should be removed in the winter months and located on the private upland foreshore.

4.5.2 Educational maps providing information on public access points to the Lake should note where winter public access points are located.

4.5.3 Access to the east side of the Lake during the winter, especially by motorized vehicles is not supported.

4.5.4 The use of any motorized vehicles on the frozen surface of Columbia Lake is discouraged.

4.5.5 Responsible winter fishing practices such as removal of garbage, huts or other associated materials is encouraged.

4.6 Stewardship & Conservation

4.6.1 A community led annual lakeshore clean up day is encouraged.

4.6.2 Education about the rationale for the existing speed limit restriction of 10 km/h in the Wildlife Management Area along the east side and south end of the Lake is encouraged.

4.6.3 Opportunities to expand education around the importance of 'clean, drain, dry' for boats coming into Columbia Lake is encouraged.

4.6.4 Boat owners and operators who utilize their vessels in other bodies of water are encouraged to follow the best practices established by the Invasive Mussel Defence Program to ensure that contamination of local water bodies does not occur.

4.6.5 Ensuring that there is access to a boat cleaning station enroute to Tilley Memorial Park for boat users accessing Columbia Lake from out of area or out of Province is encouraged.

4.6.6 Expansion of the Columbia Lake Stewardship Society's water quality monitoring program to include locations and parameters to monitor for potential septic system impacts is supported.

4.6.7 Options for secure long range funding in support of community led water quality monitoring programs should be explored.

4.6.8 Collaboration with responsible agencies or authorities for inspection of culverts or drainage features that connect the highway to the Lake, specifically in the south west is encouraged. The inspection will inform future management options with respect to managing drainage and associated materials into the Lake.

4.6.9 Initiatives by the Columbia Lake Stewardship Society or other community organizations to develop an appropriate monitoring protocol for coal dust from rail cars is supported.

4.6.10 In order to establish baseline data and ongoing trends Columbia Lake Stewardship Society (CLSS) is

encouraged to continue monitoring parameters such as water temperature and ice on and ice off dates.

4.6.11 Education initiatives for boaters that focuses on the importance of reed and aquatic vegetation beds and minimizing disturbance to these beds in order to mitigate their spread is supported.

4.6.12 Education on the importance of managing wake, speed and noise related to motorized watercraft for both aquatic and terrestrial species is encouraged. For example, boating can negatively impact both spawning and rearing areas in the Lake and impact the craggy cliffs north of the Village of Canal Flats that is important escape terrain for Big Horn Sheep

4.6.13 The on-going education campaigns of the CLSS and opportunities to expand public education related to best practices for using Columbia Lake is supported.

4.7 First Nations Initiatives

4.7.1 Include First Nations place names and history in signage and interpretive information for Columbia Lake where possible. Consult and collaborate with the Ktunaxa first nation and Shuswap Indian Band for integration of Indigenous values, laws, perspectives and practices.

4.7.2 The importance of the Burbot population to First Nations people is recognized. The RDEK and Village of Canal Flats will support further studies into the Burbot population in Columbia Lake, including options to enhance the population through habitat improvements or the feasibility of a stocking program.

4.7.3 The importance of the reintroduction of salmon to the Columbia River Basin and Columbia Lake is recognized. Where practical the initiative, to which both the Ktunaxa nation and Shuswap Indian Band are signatories should be supported by both the RDEK and Village of Canal Flats.

5.0 IMPLEMENTATION

As discussed within this Plan direct local government jurisdiction over lake management is somewhat limited due to jurisdiction, available funding mechanisms and capacity. In order for Plan implementation to be successful, the local governments must continue to work cooperatively and collaboratively with each other, local organizations, provincial and federal agencies, the Ktunaxa nation and the Shuswap Indian Band. When possible, new opportunities for dialogue and partnership between levels of government and agencies and organizations should be explored and capitalized on. Each local government management will need to exercise their powers and utilize varying degrees of influence on decision making. The recommendations in this Plan cover three levels of influence. The three levels are:

- Matters within the scope of local government regulatory jurisdiction.
- Matters that are not regulated but can be influenced by the local government.
- Matters that are not within local government jurisdiction or sphere of influence, but of public importance.

Each of these levels of influence will need to be utilized to ensure that the recommendations found within this Plan are implemented.

5.1 Priority Actions

Establishing priority actions for the local governments provides an opportunity to recognize management recommendations that were recurring issues or ideas that were identified during the Plan development. The identification of these actions can provide guidance to staff and elected officials on areas where resources, funding or support should be directed. The icons found next to the priority actions below are used to indicate the level of influence for each management recommendation:

- R – Regulatory
- I – Influenced by local government
- A – Public Importance but no local government control

Icon	Priority Action	#	Partners
A	Voluntary no-wake within 100m of shoreline	4.1.4	Public
A	Promote low impact water-based activities	4.1.6	Public/CLSS
I	No support for commercial (for profit) marina tenure	4.2.2	Province
R	New mooring buoys not supported	4.2.7	Public
A	Encouraging best practices for existing mooring buoys	4.2.8	Public CLSS
A R	Encouraging communal and cooperative management of mooring buoys	4.2.10	Community Associations
A	Continued local government staff participation in the Columbia Lake East Side Partnership	4.3.1	Province Ktunaxa nation Shuswap Indian Band
R	Update to the Village of Canal Flats Shoreline Development Permit Area guidelines when updated Foreshore Development Guidelines (FDG) are available	4.4.1	Living Lakes Canada
R	Development of a Shoreline Development Permit Area for shoreline under RDEK jurisdiction	4.4.2	Living Lakes Canada
A	Retention of natural vegetation within 30 m upland of the natural boundary of the Lake	4.4.5	Public
A	Removal of individual docks in the winter and storage on upland private property	4.5.1	Public Province

A	Restricted winter access to shoreline and upland on the east side of the Lake	4.5.3	Nature Conservancy of Canada Province Ktunaxa nation Shuswap Indian Band
A	Active education about the existing speed limit restriction in the Wildlife Management Area (WMA)	4.6.2	Province CLSS Community Associations
I A	Explore options for long range funding for water quality monitoring program	4.6.7	CLSS
A	Support for current and new education on best practices for lake use	4.6.14	CLSS
I A	Inclusion of First Nations place names and history in signage and interpretive information	4.7.1	Ktunaxa nation Shuswap Indian Band

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APPENDIX 1

Introduction

The Water Use Table featured below provides a list of the water sources with the associated licence and permissions for how water is used by an individual licence. This table can be used as a reference when reviewing the map within Schedule D. The first column on the far right hand side provides a list of map reference numbers that are linked to the map within Schedule D. An overview regarding the magnitude of water use within the Columbia Valley has been provided on the map within Schedule E. The maps within Schedule D and E can be reviewed together to provide a complete picture of water use within the Columbia Lake area.

Description

Within the Columbia Lake area, water has been licenced for domestic, irrigation, commercial, local waterworks providers, golf courses, livestock, reservoirs (which includes conservation), and land improvement project uses. Each licence also has a maximum permitted quantity that allows for reasonable amounts of water to be withdrawn for identified land use. For example, within the Columbia Lake area, the largest permitted quantity of water for a domestic use is less than 6000 cubic meters per year. However, this maximum permitted quantity varies greatly on a case-to-case basis. This basis can be determined by the number of dwelling units tied to a licence, a strata, or even the location of the residence and its relationship with onsite agricultural practices (where irrigation will also be listed as a use on a licence). There are duplicates of the water licences within the Provincial Water Licence Record Table, to reflect one licence has two separate permitted quantities for different purposes within one issued licence. Furthermore, all of the Water rights and licence data that is displayed within this section is publicly available on the Province's website through the IMAP system and Water Management Branch.

PROVINCIAL WATER LICENCE RECORD TABLE

Displayed in Cubic Meters Per Year.

Table data has been modified to display annual water quantities where as the original dataset displays a variation on annual and daily registered water quantities. There are a significant number of decimal places as most of these licences were issued when gallons and acre feet were the standard unit of volume measurement.

Map Reference Number (the numbers below are labelled on the Water use map)	**Source Name**	**Purpose of Use**	**Permitted Quantity (m^3/year)**
1	**Battistella Spring**	Domestic	1659.32285
2	**Beardsley Springs**	Commercial	4977.96855
3	**Beardsley Springs**	Domestic	829.66325
4	**Beardsley Springs**	Irrigation	1079.295
5	**Beardsley Springs**	Waterworks - Local Provider	2986.78113
6	**Beardsley Springs**	Waterworks - Local Provider	12527.88752
7	**Beardsley Springs**	Waterworks - Local Provider	8296.61425
8	**Belcher Brook**	Domestic	829.66325
9	**Belcher Brook**	Domestic	829.66325
10	**Belcher Brook**	Domestic	829.66325
11	**Belcher Brook**	Golf Course	1233.48
12	**Columbia Lake**	Domestic	829.66325
13	**Columbia Lake**	Domestic	829.66325
14	**Columbia Lake**	Domestic	1659.32285
15	**Columbia Lake**	Domestic	1659.32285
16	**Columbia Lake**	Irrigation	15418.5
17	**Columbia Lake**	Irrigation	15418.5
18	**Columbia Lake**	Irrigation	30840
19	**Columbia Lake**	Waterworks - Local Provider	43142.3941
20	**Columbia Lake**	Waterworks - Local Provider	101467.5923
21	**Columbia Lake**	Waterworks - Local Provider	89603.4339
22	**Columbia Lake**	Waterworks - Local Provider	54757.65405
23	**Columbia Lake**	Waterworks - Local Provider	5807.62998
24	**Columbia Lake**	Waterworks - Local Provider	27378.82703
25	**Coy Creek**	Commercial	2488.9788
26	**Coy Creek**	Domestic	829.66325
27	**Coy Creek**	Domestic	5807.6318
28	**Coy Creek**	Irrigation	30837
29	**Coy Creek**	Livestock	4148.30895
30	**Downey Pond**	Golf Course	3762.114
31	**Downey Pond**	Irrigation	2738.3256
32	**Downey Pond**	Irrigation	11989.4256
33	**Dutch Creek**	Domestic	829.66325
34	**Dutch Creek**	Golf Course	122114.52

Map Reference Number (the numbers below are labelled on the Water use map)	Source Name	Purpose of Use	Permitted Quantity (m^3/year)
35	**Dutch Creek**	Irrigation	616740
36	**Dutch Creek**	Irrigation	18502.2
37	**Dutch Creek**	Irrigation	12334.8
38	**Dutch Creek**	Irrigation	1233.48
39	**Dutch Creek**	Waterworks - Local Provider	45631.37838
40	**Filmer Spring**	Livestock	829.66325
41	**Frocklage Reservoir**	Reservoir	111000
42	**Geary Brook**	Land Improvement	16593.2285
43	**Geary Creek**	Domestic	829.66325
44	**Geary Creek**	Irrigation	2466.96
45	**Geary Spring**	Commercial	4977.96855
46	**Geary Spring**	Commercial	8296.61425
47	**Geary Spring**	Domestic	1659.32285
48	**Hardie Creek**	Irrigation	6167.4
49	**Hardie Creek**	Irrigation	55506.6
50	**Lansdowne Creek**	Domestic	4977.96855
51	**Lansdowne Creek**	Irrigation	308370
52	**Leslie Brook**	Domestic	829.66325
53	**Leslie Brook**	Irrigation	81656.376
54	**Maartman Brook**	Commercial	4977.96855
55	**Major Creek**	Domestic	2488.9861
56	**Major Creek**	Domestic	829.66325
57	**Major Creek**	Irrigation	5674.008
58	**Marion Creek**	Domestic	3318.6457
59	**Marion Creek**	Domestic	3318.6457
60	**Marion Creek**	Irrigation	357894.222
61	**Marion Creek**	Irrigation	357894.222
62	**Marion Creek**	Irrigation	148017.6
63	**Marion Creek**	Irrigation	148017.6
64	**Marion Creek**	Irrigation	158502.18
65	**Marion Creek**	Irrigation	158502.18
66	**Marion Creek**	Reservoir	34537.44
67	**Marion Creek**	Reservoir	493392
68	**Marion Creek**	Reservoir	493392
69	**Nelson Brook**	Domestic	829.66325
70	**Nelson Brook**	Irrigation	6167.4
71	**Paxton Creek**	Irrigation	15418.5
72	**Paxton Creek**	Livestock	3318.6457
73	**Prust Creek**	Domestic	1659.32285
74	**Prust Creek**	Irrigation	11101.32

Map Reference Number (the numbers below are labelled on the Water use map)	Source Name	Purpose of Use	Permitted Quantity (m^3/year)
75	**Prust Creek**	Irrigation	30837
76	**Prust Creek**	Irrigation	30837
77	**Pye Creek**	Golf Course	4933.92
78	**Pye Creek**	Land Improvement	8296.61425
79	**Pye Creek**	Waterworks - Local Provider	29038.14988
80	**Smith Brook**	Irrigation	4625.55
81	**South Hardie Creek**	Domestic	829.66325
82	**South Hardie Creek**	Irrigation	37004.4
83	**Sun Creek**	Domestic	1659.32285
84	**Sun Creek**	Domestic	829.66325
85	**Sun Creek**	Domestic	912.6095
86	**Sun Creek**	Irrigation	20660.79
87	**Sun Creek**	Irrigation	2775.33
88	**Sun Creek**	Irrigation	5417
89	**Sun Creek**	Irrigation	1539
90	**Taylor Springs**	Irrigation	148017.6
91	**Taylor Springs**	Reservoir	111000
92	**Tulloch Brook**	Domestic	3318.58
93	**Tulloch Brook**	Domestic	829.645
94	**Tulloch Brook**	Domestic	165.929
95	**Tulloch Brook**	Irrigation	2709
96	**Tulloch Brook**	Irrigation	769
97	**Tulloch Spring**	Irrigation	15418.5
98	**Walter Brook**	Domestic	829.66325
99	**Walter Brook**	Domestic	1659.32285
100	**Water Spring**	Domestic	829.66325
101	**Water Spring**	Domestic	829.66325
102	**Water Spring**	Domestic	829.66325
103	**Water Spring**	Irrigation	829.66325
104	**Water Spring**	Irrigation	829.66325
105	**Water Spring**	Irrigation	829.66325
106	**Watercress Brook**	Domestic	829.66325
107	**Watercress Brook**	Domestic	829.66325
108	**Watercress Brook**	Irrigation	3083.7
109	**Watercress Brook**	Land Improvement	24889.84275

APPENDIX 2

The latest water quality test results at Columbia Lake (BC Ministry of Environment)

Sample ID: 0200434

Sample Date: 2021/04/27

Sample location: Mid Lake (see map below)

Retrieved from : Surface Water Quality Monitoring Sites (arcgis.com), Copyright © 2021, Province of British Columbia. All rights reserved.

Parameter	Sample Type	Result	Unit	Depth (m)
Hardness Total (Total)	Fresh Water	164	mg/L	3.2
Beryllium Total	Fresh Water	0.00001	mg/L	3.2
Magnesium Total	Fresh Water	19	mg/L	3.2
Silver Total	Fresh Water	0.000005	mg/L	1
Specific Conductivity-Field	Fresh Water	350	uS/cm	1
Temperature-Field	Fresh Water	10.6	C	1
Uranium Total	Fresh Water	0.000882	mg/L	1
Vanadium Total	Fresh Water	0.0002	mg/L	3.2
Nitrogen Organic-Total	Fresh Water	0.189	mg/L	1
Nitrogen Ammonia Total	Fresh Water	0.005	mg/L	1
Nitrogen Ammonia Total	Fresh Water	0.005	mg/L	3.2
Calcium Total	Fresh Water	34.5	mg/L	3.2
Cadmium Total	Fresh Water	0.000005	mg/L	3.2
Carbon Dissolved Organic	Fresh Water	1.97	mg/L	1
Boron Total	Fresh Water	0.0057	mg/L	1
Potassium Total	Fresh Water	0.808	mg/L	1
Vanadium Total	Fresh Water	0.0002	mg/L	1
Turbidity	Fresh Water	0.55	NTU	1
Carbon Total Organic	Fresh Water	2.08	mg/L	1
Nitrogen Kjel.Tot(N)	Fresh Water	0.194	mg/L	1
Aluminum Total	Fresh Water	0.00207	mg/L	3.2
Arsenic Total	Fresh Water	0.000653	mg/L	3.2
Cobalt Total	Fresh Water	0.0000315	mg/L	3.2

Parameter	Sample Type	Result	Unit	Depth (m)
Copper Total	Fresh Water	0.000131	mg/L	3.2
Selenium Total	Fresh Water	0.000051	mg/L	3.2
Tin Total	Fresh Water	0.00005	mg/L	3.2
Nitrogen Organic-Total	Fresh Water	0.184	mg/L	3.2
Cobalt Total	Fresh Water	0.0000325	mg/L	1
Zinc Total	Fresh Water	0.00032	mg/L	3.2
Hardness Total (Total)	Fresh Water	168	mg/L	1
Boron Total	Fresh Water	0.0052	mg/L	3.2
Chromium Total	Fresh Water	0.0001	mg/L	3.2
Molybdenum Total	Fresh Water	0.000544	mg/L	3.2
Phosphorus Total	Fresh Water	0.0041	mg/L	3.2
Nitrate(NO3) + Nitrite(NO2) Dissolved	Fresh Water	0.0032	mg/L	1
Arsenic Total	Fresh Water	0.000671	mg/L	1
Copper Total	Fresh Water	0.000146	mg/L	1
Iron Total	Fresh Water	0.0098	mg/L	1
Selenium Total	Fresh Water	0.00005	mg/L	1
Strontium Total	Fresh Water	0.223	mg/L	1
Thallium Total	Fresh Water	0.000002	mg/L	1
pH	Fresh Water	8.37	pH units	1
Potassium Total	Fresh Water	0.79	mg/L	3.2
Manganese Total	Fresh Water	0.00932	mg/L	3.2
Nitrate (NO3) Dissolved	Fresh Water	0.003	mg/L	1
Phosphorus Ort.Dis-P	Fresh Water	0.001	mg/L	1

Parameter	Sample Type	Result	Unit	Depth (m)
Aluminum Total	Fresh Water	0.00206	mg/L	1
Bismuth Total	Fresh Water	0.000005	mg/L	1
Cadmium Total	Fresh Water	0.000005	mg/L	1
Chromium Total	Fresh Water	0.0001	mg/L	1
Dissolved Oxygen-Field	Fresh Water	10.45	mg/L	1
Lithium Total	Fresh Water	0.00302	mg/L	1
Magnesium Total	Fresh Water	19.6	mg/L	1
Phosphorus Total Dissolved	Fresh Water	0.002	mg/L	1
Lead Total	Fresh Water	0.0000297	mg/L	1
Tin Total	Fresh Water	0.00005	mg/L	1
Uranium Total	Fresh Water	0.000898	mg/L	3.2
Nitrogen Total	Fresh Water	0.194	mg/L	1
Turbidity	Fresh Water	0.45	NTU	3.2
Nitrogen Kjel.Tot(N)	Fresh Water	0.189	mg/L	3.2
Nitrate (NO3) Dissolved	Fresh Water	0.003	mg/L	3.2
Barium Total	Fresh Water	0.0783	mg/L	3.2
Lithium Total	Fresh Water	0.00294	mg/L	3.2
Phosphorus Total Dissolved	Fresh Water	0.002	mg/L	3.2
Chlorophyll A	Fresh Water	0.000649	mg/L	1
Sulfate Dissolved	Fresh Water	32	mg/L	1
Molybdenum Total	Fresh Water	0.000546	mg/L	1
Zinc Total	Fresh Water	0.00083	mg/L	1
Specific Conductance	Fresh Water	345	uS/cm	3.2

Parameter	Sample Type	Result	Unit	Depth (m)
Carbon Total Organic	Fresh Water	1.96	mg/L	3.2
Chloride Dissolved	Fresh Water	5.82	mg/L	3.2
Nitrate(NO3) + Nitrite(NO2) Dissolved	Fresh Water	0.0032	mg/L	3.2
Nitrogen - Nitrite Dissolved (NO2)	Fresh Water	0.001	mg/L	3.2
Sulfate Dissolved	Fresh Water	32	mg/L	3.2
Silver Total	Fresh Water	0.000005	mg/L	3.2
Bismuth Total	Fresh Water	0.000005	mg/L	3.2
Nickel Total	Fresh Water	0.000061	mg/L	3.2
Silicon Total	Fresh Water	2.18	mg/L	3.2
Strontium Total	Fresh Water	0.22	mg/L	3.2
Thallium Total	Fresh Water	0.000002	mg/L	3.2
Manganese Total	Fresh Water	0.00943	mg/L	1
Nickel Total	Fresh Water	0.000073	mg/L	1
Phosphorus Total	Fresh Water	0.0045	mg/L	1
pH-Field	Fresh Water	8.58	pH units	1
Antimony Total	Fresh Water	0.000058	mg/L	1
Extinction Depth	Fresh Water	4.2	m	1
pH	Fresh Water	8.38	pH units	3.2
Nitrogen Total	Fresh Water	0.189	mg/L	3.2
Carbon Dissolved Organic	Fresh Water	2.15	mg/L	3.2
Phosphorus Ort.Dis-P	Fresh Water	0.001	mg/L	3.2
Silica Reactive Diss	Fresh Water	4.4	mg/L	3.2
Iron Total	Fresh Water	0.0088	mg/L	3.2

Parameter	Sample Type	Result	Unit	Depth (m)
Sodium Total	Fresh Water	5.78	mg/L	3.2
Lead Total	Fresh Water	0.0000289	mg/L	3.2
Antimony Total	Fresh Water	0.000058	mg/L	3.2
Total Nitrogen NO2 + NO3	Fresh Water	0	mg/L	3.2
Chloride Dissolved	Fresh Water	5.72	mg/L	1
Nitrogen - Nitrite Dissolved (NO2)	Fresh Water	0.001	mg/L	1
Silica Reactive Diss	Fresh Water	4.59	mg/L	1
Barium Total	Fresh Water	0.0778	mg/L	1
Beryllium Total	Fresh Water	0.00001	mg/L	1
Calcium Total	Fresh Water	34.9	mg/L	1
Sodium Total	Fresh Water	5.93	mg/L	1
Silicon Total	Fresh Water	2.21	mg/L	1
Total Nitrogen NO2 + NO3	Fresh Water	0	mg/L	1
Specific Conductance	Fresh Water	345	uS/cm	1