BAYNES LAKE, ELKO AND AREA

ENVIRONMENTAL SCREENING REPORT

Prepared for:
Collective for Lower Elk Aquifer Restoration
(CLEAR)

Prepared by:
Hailey Wynnyk, BIT,
Environmental Consultant

July 2023

Executive summary

The Collective for Lower Elk Aquifer Restoration (CLEAR) is a registered BC society (January 2023) consisting of local volunteers in the South Country. The Environmental Screening Report intends to review available information concerning aquifers (groundwater), and surface water quality and quantity; aquatic biota, reptiles and amphibians, and; birds that rely on aquatic and semi-aquatic habitats for nesting and rearing. The study area is defined by the ancient Elk River drainage bed that underlies the communities of Elko and Baynes Lake, and Kikomun Provincial Park. It is bounded by Kikomun Creek to the north, the Elk River near Elko to the east, Waldo Cove to the south, and Koocanusa Reservoir to the west (See Figure 1).

This report supports the urgent need to restore the connection between the Elk River and aquifers in the study area and protect the diversity of aquatic and semi-aquatic habitats and species that rely on that connection.

CLEAR is working to restore sufficient Elk River water flows to recharge the aquifers. Baynes Lake, Elko and the area historically experience low water when the aquifer recharge inlets along the Elk River right channel are not inundated by river water. The Elk River used to flow downstream in this channel. The channel has been dry for some time except for when the Elko dam headpond is kept at the 917 m level. Construction and operation of the dam could be a major impact on the natural course of the Elk River above the aquifer recharge inlets (sinkholes), preventing it from flowing into the river right over the inlets. It is clear; however, that when the dam headpond is at 917 m, river water backs into the river's right channel, inundates the aquifer recharge inlets and surface and groundwater levels increase.

BC Hydro stopped producing electricity at the dam in 2014. Since then, Baynes Lake’s water level has been down over 2 m. Lakes within Kikomun Creek Provincial Park have also been visibly down (e.g., Surveyors) or reduced to small puddles (e.g., Stink). Domestic wells have also been affected.

Past studies on the connection between the Elk River and the aquifers have been limited and inconclusive. However, a recent geological analysis by John Hodgins and Alanna Ferguson in 2020 demonstrates there is a connection between the Elk River and the kettle ponds, lakes, and groundwater in the study area. Water testing and monitoring by Teck Resources supports that conclusion (2022).

Restoring aquifer water recharge is critical to restoring and protecting the wide diversity of habitats for fauna and flora. Of note are the Western Painted Turtle, Western Toad,

Columbia Spotted Frog, the Great Blue Heron, Sora bird, benthic invertebrates, and cattails. These are known to be present in the study area, are indicators of wetland and riparian health, and are vital to the ecosystem and food chain. The area is within the traditional lands of the Yaq̓it ʔa· knuqƛi' it First Nations and includes sites, plants, and animals that are culturally important to them. Water restoration is also of utmost importance to residents, ranchers, small businesses, and tourists.

There is no or limited documented information on the health of the indicator species specific to the study area. Except for a recent two-year Western Painted Turtle study at Baynes Lake, available information to date is mostly based on local knowledge. The success of aquifer restoration could be, in part, evaluated using indicator species.

Recommendations

This report recommends:

1. BC Hydro:
    a. Maintain the Elko dam at 917 metres now to restore water, reverse habitat damage already done and protect it going forward; and.
    b. Participate as a partner with the community to implement the recommendations in this report.
2. Establishing a long-term, systematic ground and surface water quality and quantity monitoring program with community involvement and incorporating existing or planned monitoring by others;
3. Systematically gathering the data needed to establish the correlation over time between ground and surface water with Elk River volume above and below the aquifer recharge inlets, air temperatures, precipitation, head pond level, snowpack, upstream events, and other relevant factors;
4. Determining groundwater travel times and routes from the Elk River aquifer recharge inlet area until it appears as surface water in the study area;
5. Classifying riparian and wetland areas to determine location, size, and composition (past, present and at risk if water is not restored);
6. Establishing a riparian and wetland habitat monitoring program;
7. Establishing:
    a. A comprehensive list of indicator species to use in environmental restoration and monitoring (past, present and at risk if water is not restored); and
    b. An indicator species monitoring program which includes numbers, locations, breeding habits, travel patterns, and overwintering.
8. Investigating environmental restoration options;

9. Establishing a water use plan with South Country communities; and
10. These recommendations be implemented in collaboration with CLEAR, Elk River Alliance, Living Lakes Canada, Baynes Lake Community Society, BC Parks, BC Hydro and other industries in the area.

Acknowledgements

CLEAR acknowledges several individuals who provided invaluable direction and support in completing the Environmental Screening Report. It turned out to be a bigger-than-anticipated project for a newly formed volunteer community stewardship group. We are pleased to finally make it public.

Thank you goes out to Dr. Stella Swanson, Director, Elk River Alliance for the initial advice to do this report as well as the ongoing review of drafts and direction. Dr. Mary Louise Polzin contributed many volunteer hours providing research and advice, reviewing drafts, and technical editing. And for connecting us to Darcy Hlushak at VAST Resource Solutions Inc. who prepared the GIS maps in the report. Dr. Stewart Rood for reviewing key information and wording. And for researching, compiling, and presenting to CLEAR relevant studies done to date. John Hodgins for reviewing the geology sections to ensure we were accurately representing his and Alanna Ferguson's geology research and findings.

Funding for the project was provided by the Regional District of East Kootenay (RDEK). Thank you to Director Stan Doehle, Area B, (RDEK) for your support and guidance for this Report. Also, thank you to the Baynes Lake Community Society for your continued support for CLEAR including the use of the community hall.

Table of Contents

List of Figures

List of Tables

List of Appendices

Introduction

Purpose

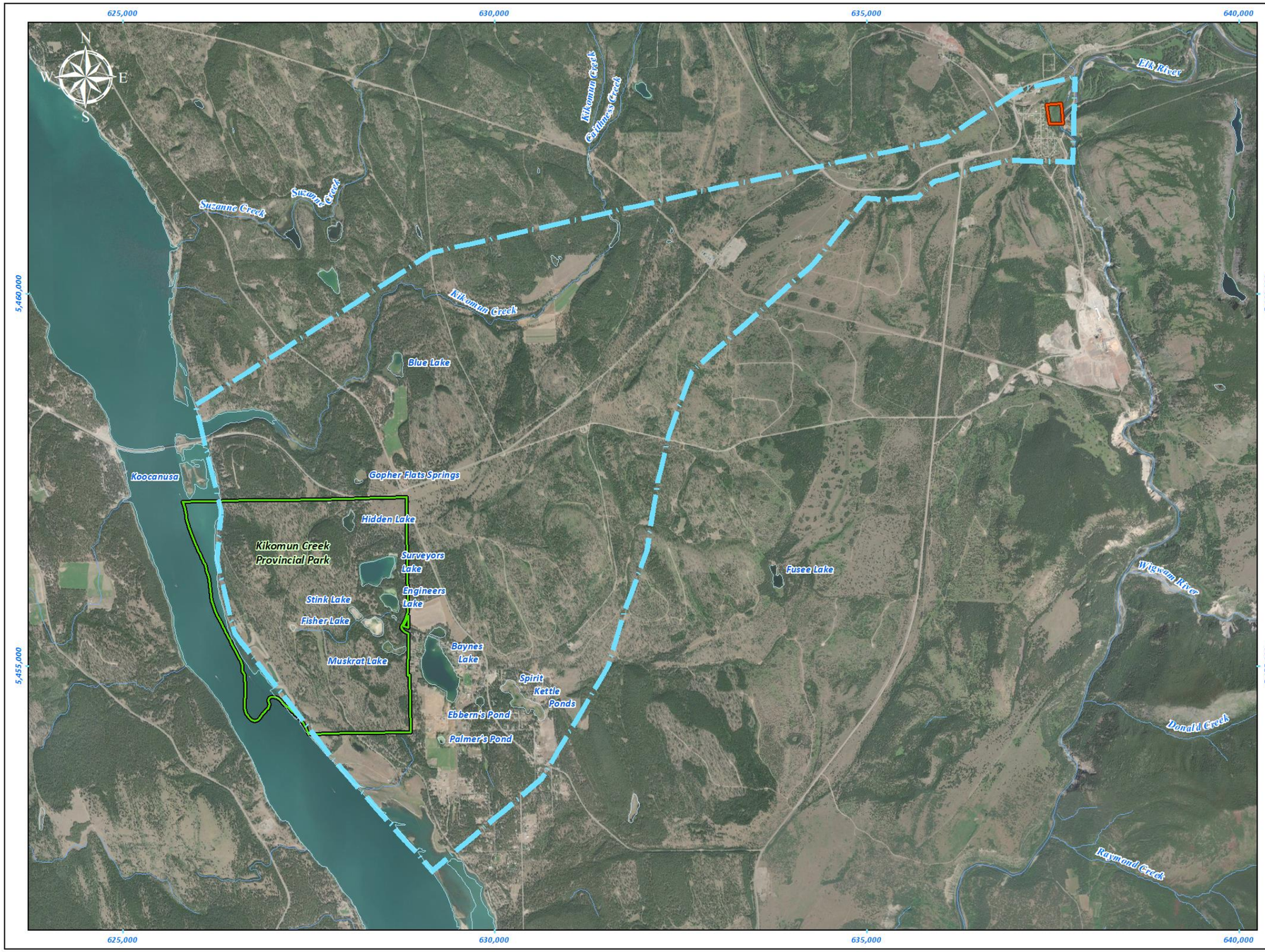
The purpose of this report is to:

- Gather and assess available known information on key relevant events leading up to the Baynes Lake, Elko and area low water and environmental crisis;
- Provide an initial environmental qualitative assessment of the impacts on water level, water quality, domestic wells, and aquatic and semi-aquatic ecosystems and species; and
- Identify recommendations to restore, preserve and protect water resources and the habitats that depend on them.

Background

In the southeastern corner of British Columbia (BC), the 220-kilometre (km) long Elk River flows through the Elk Valley before connecting with the Kootenay River (Figure 1). Lake Koocanusa was created from the damming of the Kootenay River near Libby Montana, USA to create the Koocanusa reservoir, at the south end of the Rocky Mountain Trench. In 1925, East Kootenay Power Company built a hydroelectric dam on the Elk River (BC Hydro 2016). The dam is located in Elko, BC, 16 km upstream from the Elk River confluence with Lake Koocanusa (BC Hydro 2005a). In 1968, BC Hydro acquired responsibility for the dam from the East Kootenay Power Company and continued the operation until it deferred the re-development of Elko Dam in 2016 (BC Hydro 2016, Mitha 2020). When the headwater pond immediately upstream of the Elko Dam is kept at the 917 metre level, it is the source of water recharge to the aquifer recharge inlets (sinkholes) that fill three aquifers in the Baynes Lake and Elko area (Figure 2). These aquifers are identified as 1057, 519, and 520 (Doehle et al. 2020 and Associated Environmental 2021). The aquifers provide groundwater resources for the communities of Baynes Lake and Elko, Kikomun Creek Provincial Park and kettle ponds, lakes, and streams in the area (Associated Environmental 2021). Connections between the Elk River and the aquifers are indicated by elevated selenium concentrations (relative to baseline) in groundwater and surface water quality samples gathered by Associated Environmental in 2021. Further water sampling by Teck Resources in 2022 showed enrichment of selenium in groundwater wells and springs outflows, demonstrating that water from the Elk River contributes to the study area aquifer.

In 2020, John Hodgins and Alanna Ferguson mapped the ancient paleo Elko River drainage system that underlies the study area by analyzing geological research by Clague (1974) and Price (1966) and conducting water boreholes and outcrop examinations (Hodgins, 2020).



PROJECT

CLEAR

TITLE

Overview Map

LEGEND

TYPE

- Ancient Elk River Drainage Basin
- Sinkhole Area
- Kikomun Creek Provincial Park

MAP INFORMATION

1. MAP DATUM/PROJECTION: NAD 1983 UTM ZONE 11N.
2. THIS FIGURE IS PRODUCED AT A NOMINAL SCALE OF 1:50,000 FOR 11x17 (TABLOID) PAPER. ACTUAL SCALE MAY DIFFER ACCORDING TO CHANGES IN PRINTER SETTINGS OR PRINTED PAPER SIZE.

DESIGN	*DH*	**DATE**	*2017-Jun-07*
DRAWING	*MLP*	**DATE**	*2023-Mar-23*
REVIEW	*MLP*	**DATE**	*2023-Mar-23*
MXD ID	*OVERVIEW*		

1:50,000

0 0.5 1 1.5 2 2.5

Kilometers

DATA SOURCES

Base Maps provided by ArcGIS License
Stream Network - GeoBC Freshwater Atlas
Waterbody Labels provided by CLEAR

OVERVIEW MAP

Figure 1: Map of Study Area - Elko to Baynes Lake, B. C. Key surface water bodies in and near the ancient Elk River drainage bed (Hodgins et al. 2020). Sinkhole Area is the Aquifer Recharge Inlets.

PROJECT
CLEAR

TITLE
Sinkhole Locations

LEGEND

SINKHOLE

MAP INFORMATION

1. MAP DATUM/PROJECTION: NAD 1983 UTM ZONE 11N.
2. THIS FIGURE IS PRODUCED AT A NOMINAL SCALE OF 1:2,000 FOR 11x17 (TABLOID) PAPER. ACTUAL SCALE MAY DIFFER ACCORDING TO CHANGES IN PRINTER SETTINGS OR PRINTED PAPER SIZE.

DESIGN	*DH*	**DATE**	*2017-Jun-07*
DRAWING	*MLP*	**DATE**	*2023-Mar-20*
REVIEW	*MLP*	**DATE**	*2023-Mar-20*
MXD ID	*SINKHOLE*		

1:2,000

0 25 50 75 100

Meters

DATA SOURCES

Base Maps provided by ArcGIS License

OVERVIEW MAP

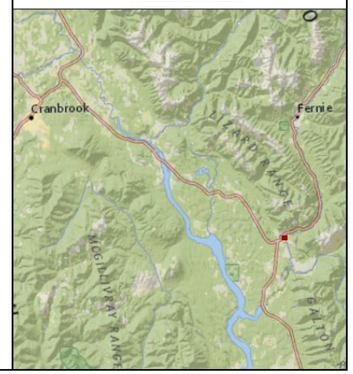


Figure 2: A closeup of the sinkholes (aquifer recharge inlets) from Figure 1. Sinkhole locations are from BC Hydro 2010 report.

The BCHydro dam at Elko was built in 1925 by East Kootenay Light and Power. BC Hydro bought it in 1968 and the dam produced electricity until 2014. Dams change multiple factors of a river system: sediment load, flow rate, etc. Local knowledge says that over the years East Kootenay Light and Power took several actions to divert water from the aquifer recharge inlets to maximize water flowing over the hydro dam to produce electricity. These actions included attempting to plug the aquifer recharge inlets with large items (e.g., old appliances). In the mid-1960s, a resident[1] observed a dirt berm being pushed up to block the river from reaching the aquifer recharge inlets.

Residents began to express concern about decreased water levels and in 1986 BC Hydro modified its dam operations and increased water levels in the head pond by 1 meter to provide adequate water to the aquifers (BC Hydro 2005b). In 2009, BC Hydro assisted in removing a portion of the berm and was ordered to maintain the water level required for a full pool in the head pond (Crawley 2020). This action returned water to the aquifer recharge inlets (Figure 3) and aquifers. Community water was restored for a short period.

In 2014-2016 BC Hydro studied options to redevelop the dam and once again produce electricity but decided against it. At that time, communities requested the head pond level be kept at 917 m (the level BC Hydro kept it at to produce electricity) so that there would be sufficient water to reach the aquifer recharge inlets and recharge the aquifers. However, BC Hydro decided to operate the head pond at the minimum water license level of 912.8 m (Mitha 2020). BC Hydro did later install flashboards on the dam to raise the level of the head pond to allow water to reach the aquifer recharge inlets. In October 2017, the flashboards were removed and BC Hydro stated that there is no safe way to re-install the flashboards without entirely rebuilding the dam structure (Crawley 2020).

As a result, there is little to no water in the side channel of the river where the aquifer recharge inlets are except during high-flow freshets in spring. Vegetation in the area of the aquifer recharge inlets has begun to take over, in turn, restricting water going into the aquifers.

[1] Dennis WIlkinson, oral interview, November, 2021.

Figure 3: The aquifer recharge inlets along a back channel of the Elk River, below the steep bank at Elko, BC.
The back channel would have previously been a riverside channel and the small cottonwood trees and alder and willow shrubs indicate relatively recent abandonment. The Elko Sinkholes (SH) (aquifer recharge inlets) are along a back channel of the Elk River, below the steep bank at Elko, BC. Rood, 2022.

By 2020 the water levels of Baynes Lake and Spirit Kettle Ponds dropped significantly. (Doehle et al. 2020). Figure 4 (A and B) shows the difference in Baynes Lake and Figure 5 (A and B) shows Spirit Kettle Ponds water levels between 2017 and 2020.

The decrease in water levels in the Baynes Lake area has affected residents' water wells and caused extensive habitat destruction for many species, such as the Western Painted Turtle. The Intermountain-Rocky Mountain population of the Western Painted Turtle is listed as of concern specifically due to extensive habitat loss and proliferation of roads (COSEWIC 2006).

The area’s resources are valued and cherished by both the community and tourists. The area is within the traditional lands of the Yaq̓it ʔa ·knuqłi' it First Nations and includes sites, plants, and animals that are culturally important to them. Places such as Kikomun Creek Provincial Park, which is known for its kettle lakes (Surveyors, Engineers, Stink,

Fisher, Muskrat, and Hidden) require adequate groundwater refill from the aquifers to sustain the area's diverse fish and wildlife populations, and wetland and riparian areas.

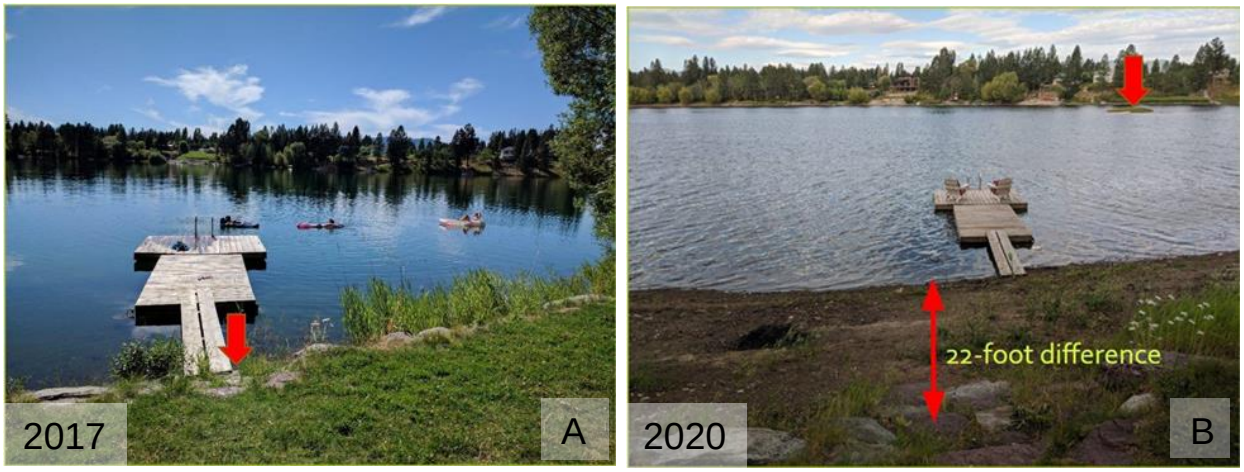


Figure 4: Dave Hunt's dock on Baynes Lake, 2017 (A) and in 2020 (B).
There is approximately a 6.7 m (22 ft) difference between where the dock was in 2017 compared to 2020. The arrow in the top right side of photo (B) shows an island that was not there in 2017.

Figure 5: Spirit Kettle Ponds (also called Doehle Ponds) water levels in 2017 (A) and the water level in 2020 (B).

Scope of Environmental Screening Assessment

This environmental screening report is based on assessing available baseline information from a scientific and community knowledge perspective. The study area is delineated in Figure 1 as the ancient Elk River drainage bed (Hodgins, 2020). Unfortunately, data regarding the aquifer and the affected environment within the study area is insufficient to support a quantitative assessment. Therefore, a qualitative evaluation was used to provide context for the environmental indicators' species included in this report. Groundwater and surface water levels, and water quality data were gathered and examined for correlations between the aquifer and kettle ponds, lakes and streams. The presence/absence over time of aquatic and semi-aquatic species which are expected to utilize the ponds, lakes, streams, riparian and wetlands affected by the low water levels was noted, where possible. This included reptiles, amphibians, fish, semi-aquatic birds and mammals and aquatic riparian plant species which can be used as indicators of the effects of declining water levels due to their sensitivity and ecological, cultural, and social importance.

This report provides a basis for recommendations on how to move forward based on current and available information. Engaging the community and partners regarding the findings of this report will start conversations and increase awareness of the situation.

Information Sources

This document contains a collection of information from various sources, including peer-reviewed articles, grey literature, community experiences and indigenous knowledge. Peer-reviewed literature has been critically assessed by experts ("peers" of the authors) with considerable subject knowledge as part of the formal peer review process. The "peers" will have read the article in its entirety, considering the research question, literature review, methods, findings, and evaluate the finds to assess the validity and originality of what the authors claim to be "original research." Peer-reviewed literature is a scholarly quality assurance procedure for an article.

This report's primary source of information comes from "grey literature," Grey literature is information produced outside established publications and traditional channels. Grey literature includes reports, policy literature, working papers, newsletters, official government documents, speeches, community plans and other types of information conducted by designated environmental consultants and professionals from companies which have studied specific topics of concern. Grey literature provides the bulk of the published information specific to the study area's low water crisis.

Community and Indigenous Knowledge

Community/local knowledge refers to the understanding and skills developed by individuals and people specific to the place where they live. Indigenous knowledge refers to the understandings, skills and philosophies developed by society with long histories of interaction with their natural surrounding (IPCC 2023). Both forms of knowledge provide a better understanding of the historical and current status of the environment.

Description of the Environment

The study area (Figure 1) is located in the Rocky Mountain Trench, Southeast of Cranbrook, BC and Southwest of Fernie, BC, in the Kootenay Region of southeastern British Columbia. The area is located within the Interior Douglas-fir (IDF) biogeoclimatic zone, characterized by hot, very dry summers and cool winters with little snowfall (Braumandl and Curran 1992). The forests predominantly consist of Douglas fir (*Pseudotsuga menziesii*), lodgepole pine (*Pinus contorta*) and Ponderosa Pine (*Pinus ponderosa*) (Braumandl and Curran 1992, Meidinger and Pojar 1991). The IDF climate of the trench separates the Rocky Mountains on its east from the Columbian Mountains and the Cassiar Mountain on its west. The main controlling factor is the rain shadow created on the leeward side of topographic barriers (the Coast, Cascade, and Columbia mountains) to the Pacific easterly flowing air (Meidinger and Pojar 1991). The average temperature in the area is below 0°C for 2-5 months of the year and above 10°C for 3-5 months. Mean annual precipitation ranges from 300 to 750 mm, with 20-50 % of the precipitation falling as snow. The majority of rainfall occurs in the late spring, early summer and later fall periods, and growing season moisture deficits are common (Meidinger and Pojar 1991).

The most common sub-zones of the IDF biogeoclimatic zone are the "Kootenay Dry Mild Interior Douglas-fir Variant (IDFdm2)" and "Kootenay Very Dry Very Hot Interior Douglass-fir Variant (IDFxx2)", which was formerly mapped as "Kootenay Dry Hot Ponderosa Pine Variant (PPdh2)" (Ross 2005). The Kootenay Dry Mild Interior Douglas-fir variant (IDFdm2) is characterized by hot, very dry summers and cool winters with light snowfall. Soils generally dry out for periods during the summer. Snowpack is usually very shallow and has short durations, allowing the ground to freeze to a shallow depth. The Kootenay Very Dry, Very Hot Interior Douglas-fir variant (IDFxx2) is characterized by very hot, dry summers and mild winters with very little snowfall. Snow accumulations in this sub-zone are insignificant and of very short duration (Braumandl and Curran 1992).

Kikomun Creek Park was established in 1972, size-682 ha and borders 4 km along Lake Koocanusa. It expanded in 1978 after acquiring further private land eastward that included Surveyors Lake and four smaller kettle lakes.

Kikomun is a Class A BC Park that today protects and manages a rare open forest/grassland ecosystem in the East Kootenay Rocky Mountain Trench. Because of its open, relatively flat nature, most of this ecosystem type in the East Kootenay region is degraded due to railways, highways, cattle ranching, hay production, private acreages, urban development, and golf courses.

Over half of Kikomun's habitats are rated rare or endangered by the BC Conservation Data Centre, validating that the park is a biodiversity 'hot spot 'due to its intersection of two biogeoclimatic zones (Interior Douglas Fir (IDF) and Ponderosa Pine (PP)) as well as abundant aquatic features (lakes, wetlands and streams) situated in a hot dry environment (email from Lee-Anne Walker June 12, 2023). For additional information see Appendix C.

Waterbodies

The study area has a variety of streams, rivers, lakes, and kettle ponds that occupy the landscape, as shown in Figure 1. The larger waterbodies within the study area are Baynes Lake and Surveyors Lake. Baynes Lake comprises a north and south section due to the separation from the old Canadian Northern Railway line. Although the names of some water bodies in the study area are titled 'lakes[2],' they are technically kettle ponds. Kettle ponds[3] are a depression in the earth's surface left by glaciers that melted in that location (Menin 2021). Following the glacier receding, the groundwater table fills the depression with water, establishing lakes, wetlands, riparian areas, or as the name states, ponds. Kikomun Creek Provincial Park has several kettle ponds: Hidden, Engineers, Stink, Fishers, and Muskrat Lake surrounding the larger Surveyors Lake (BC Parks 2014). Outside the Provincial Park, kettle ponds are in several Baynes Lake private properties (e.g., Spirit, Ebberns, and Palmer). In addition, Fussee Lake (Figure 1) is an isolated kettle pond outside of the study area thereby providing a reference lake (not connected to the Elk River) for a comprehensive study design and monitoring plan.

As shown in Figure 1 and Figure 2, water channels and streams are scarce around the Highway 3 and 93 intersections. Kikomun Creek is the major moving water body that snakes through the study area's northwest section. It originates outside the study area

[2] If the Kettle is fed by surface or underground rivers or streams, it becomes a kettle lake.
[3] If the kettle receives its water from precipitation, the groundwater table, or a combination of the two, it is termed a kettle pond or kettle wetland, if vegetated.

but is supplemented by Kikomun Springs near the TC Energy compressor station on Kikomun Road, and Gopher Springs/Creek below the bridge crossing Baynes Lake-Jaffray Road. Kikomun Creek also appears to be supplemented by another system of springs and a small stream downstream of Gopher Springs/Creek. This second system feeding Kikomun Creek appears to be fed by Hidden Lake in Kikomun Creek Provincial Park. There could be other such spring/creek systems fed by the aquifers. The identification and status of all water bodies need to be fully established and defined in future studies.

Water Use

Domestic Wells and Licenses (*Water Sustainability Act*)

The study area has private domestic groundwater-supplied wells around residential and agricultural areas. There are approximately 260 wells within the study area (Province of BC 2023b). The *Water Sustainability Act* (WSA) was enacted on February 29th, 2016, to ensure a sustainable supply of fresh, clean water that meets the needs of B.C. residents today and in the future (Province of BC 2014: Appendix A). During its implementation, groundwater licenses were established to provide new tools and updates to B.C.'s strategy for protecting, managing, and using water efficiently. Domestic groundwater uses (wells) are exempt from licensing, including household water, fire prevention, private lawns, garden watering (up to 1,000 m^2), and domestic animals. Agricultural use and exceedances of the terms require a registered groundwater license under the WSA (Province of BC 2023c). The B.C. government encourages domestic groundwater well owners to register their wells for free to make their water usage documented under the WSA (Province of BC 2014: Appendix A).

Fire Protection

The Elk Valley South Country Fire & Rescue Services has a designated well for fire protection. The fire hydrant has been reported to have low water resources and no longer provides water (Associated Environmental 2021, Doehle 2020).

Ongoing sustainable water use

The Baynes Lake Official Community Plan has established policies that correspond to the conservation and protection of water resources. The policies include the encouragement to maintain and upgrade on-site septic systems (Section 8.3. (8)), as well as for property owners adjacent to waterbodies or watercourses to protect and conserve the natural riparian vegetation (Section 10.3. (7)). Water conservation is encouraged through the use

of low volume fixtures (Section 10.3. (4)). Development in the community plan area must consider the impact on groundwater resources (Section 10.3. (6).) (RDEK 2011).

Land Use

Residential

The Regional District of East Kootenay conducted a Census in 2016 and 2021 and is categorized by Unincorporated Electoral Areas. The study area is within Unincorporated Electoral Area B, which includes the communities of Jaffray, Wardner, Caven Creek Road, Tie Lake, Rosen Lake, Baynes Lake, Koocanusa Landing, Dorr, Newgate, Burton Lake, Elko, Wigwam, and Grasmere (RDEK 2021a). The report indicated a population increase of approximately 6.6% over the next five years. In 2016, the information provided a census population of 1979 for the unincorporated electoral Area B, whereas in 2021, the census population was 2107 (RDEK 2021c).

The area is known for being a vacation retreat due to its beauty and quietness, resulting in the population drastically increasing during the summer months. The 2021 Census provided the percentage of Dwelling units occupied by usual residents to be 68.3%, with the remaining 31.7% being non-residential seasonal visitors (RDEK 2021b).

The increasing residential and visitor numbers impact groundwater due to increased domestic water usage. Clearing land for development causes more surface water runoff and evaporation and decreased infiltration to the ground and groundwater recharge (Associated Environmental 2021).

Agriculture and Forestry

Agriculture and forestry have been essential in the Baynes Lake and South Country area. Currently, agriculture activities in the Baynes Lake Community Plan area include ranching, tree farming, and small-scale food production (RDEK 2011). Farming operations are encouraged to explore alternative grazing practices to minimize adverse effects on plan area water resources and riparian areas (RDEK 2011).

Cattle ranching continues in the study area but at a reduced level than in past decades. The remaining ranchers in Baynes Lake grow hay for their cattle and put them on leased grazing land. The Baynes Lake ranchers' experience is that the kettle ponds used by cattle in the past when out on pasture from spring through fall are now dried up or not lasting the entire season. Range cattle are forced to fewer water sources, resulting in overgrazing of some areas, and shared use of diminishing water resources with wildlife which are also being forced to the same water sources.

Lastly, the location ranchers grow hay in the summer to feed cattle during the winter months and rely on drawing water from the surface water and aquifers with licensed wells and irrigation intake. If aquifer water levels become too low or depleted, the food and water resources become threatened, in addition to the livelihood of the ranchers.

Tourism/Recreation

The South Country is known for its growing attraction to tourists with, for example, the Jaffray Baynes Lake Farmers Market, fishing, Kikomun Creek Provincial Park and Lake Koocanusa. The Baynes Lake market takes place each Saturday throughout the summer and produces an influx of tourists to the heart of the community. Fishing in both summer and winter is another attraction to the community as Baynes Lake provides easy access and opportunities for Rainbow Trout (*Oncorhynchus mykiss*), Largemouth Bass (*Micropterus salmoides*) and Yellow Perch (*Perca flavescens)* (Harasuik). In 2022 Baynes Lake was stocked with Westslope Cutthroat Trout, Rainbow Trout and Kokanee. Lastly, Kikomun Creek Provincial Park provides camping near Surveyors Lake and along Lake Koocanusa, and park trails winding by kettle ponds and wetlands with opportunities for wildlife viewing (BC Parks 2014).

Indigenous Land Use

The study area is on the traditional land of the Ktunaxa people, whose land extends over 70,000 square kilometres within the Kootenay region of BC and areas of Alberta, Montana, Washington and Idaho. The Ktunaxa people travelled within the territory according to the season and availability of food. The Ktunaxa nation is made up of four British Columbia bands. The Yaq̓it ʔa· knuqƛi' it (Tobacco Plains Band) live immediately south of the study area. Today the the Yaq̓it ʔa· knuqƛi' it Reserve comprises 10,600 acres surrounding Grasmere in southeastern BC (Figure 6).

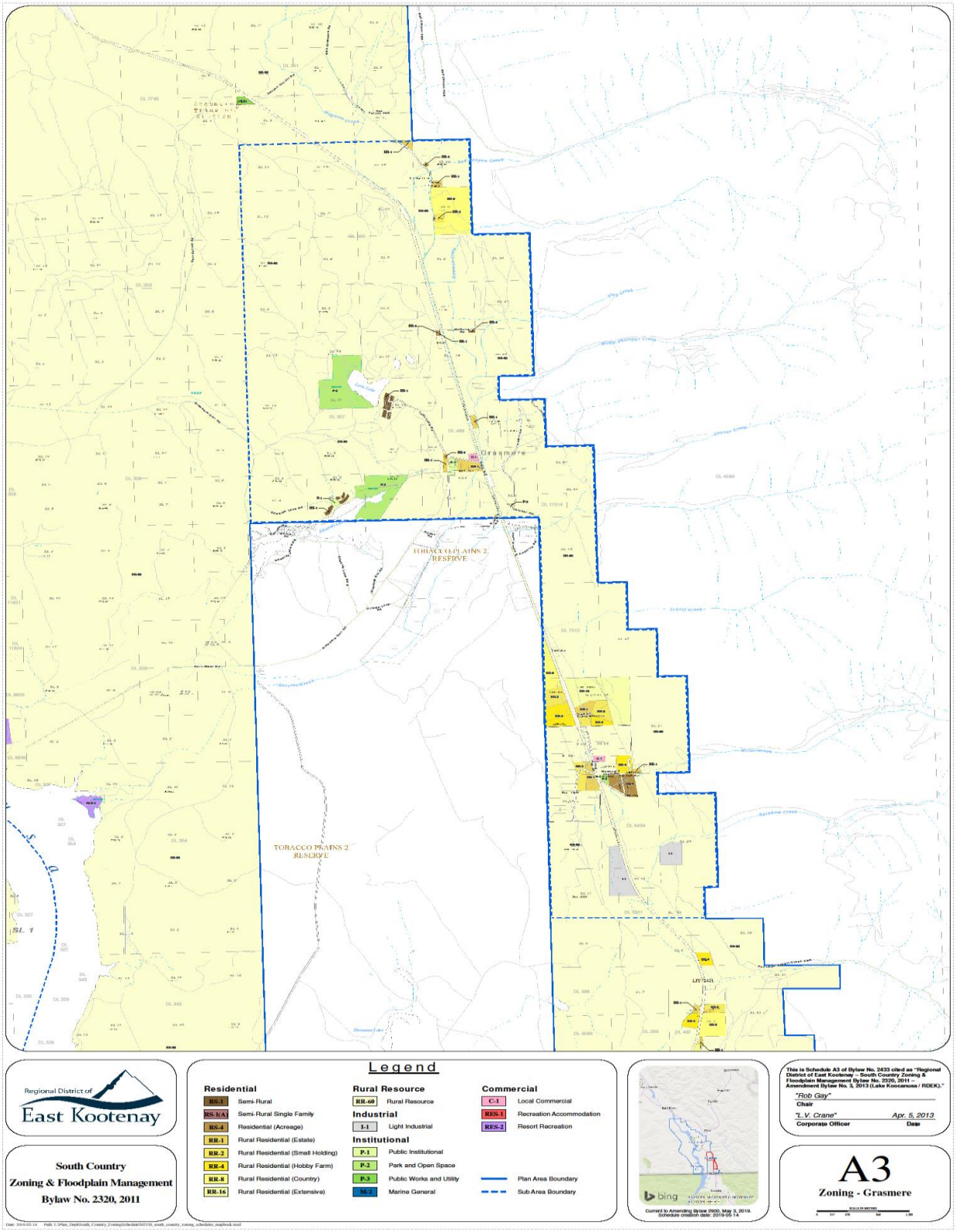


Figure 6: South Country, Yaq̓it ʔa· knuqɬi' it (Tobacco Plains) First Nations Map.

Ground and Surface Water: Sources & Connections

Ground and surface water in the study area and its connection to the Elk River have been studied over the past several decades. While the connection to the Elk River is recently substantiated, there is a lack of understanding of how water flows through the system, starting with entry into the aquifer recharge inlets, travel times and paths through the aquifers, and where it appears as surface water.

CLEAR, with the Regional District of East Kootenay, is working with professional geology and hydrology expertise to determine the workings of the aquifer system.

Previous Technical Studies

Most recently, the connection between the Elk River and ground and surface water in the study area was substantiated by geological analysis by John Hodgin and Alana Ferguson. Their findings are supported by selenium testing (Colleen Mooney, “CLEAR Request for Water Sampling Data” received by Karen Bergman, March 13, 2023).

Since the 1970s, more than 20 known and publicly available technical studies related to the connection between the Elk River and the study area aquifers have been conducted. A review of these studies (see Appendix B) by Dr. Stewart Rood yielded these findings:

- Selenium is an excellent marker to determine that the Elk River is the source of ground and surface water in the study area, and is at least as good as injecting an isotope into the aquifer recharge inlets. Note: Nitrate and other credible markers should also be monitored;
- Domestic well water levels correspond with levels of regional ponds and lakes and vary seasonally and across years;
- There is correspondence between groundwater (or lake levels), Elk River flow and head pond level;
- Kwong (1985) concluded that water wells must be influenced by factors other than precipitation alone. For example, 1982-84 was a very wet interval but there was no corresponding rise in well water levels; and
- Aerial photographs confirm the drying of kettle lakes from 2015-2021 in the study area.

In a presentation to CLEAR in February 2023, Rood concluded that water correlation studies to date have been limited and inconclusive because the studies have not been long enough. There is a lag (or travel) time between Elk River water flowing down the aquifer recharge inlets, into the aquifer, and resurfacing in lakes, springs, and creeks. Preliminary, estimated lag times are between 100 days and seven years depending on

the aquifer. These estimates are based on hypothetical or assumed parameters due to knowledge gaps (Associated Environmental, 2021).

Dr. Stewart Rood's recommendations are:

- Long-term monitoring of Elk River water levels flows and quality; lake water levels and quality, and; spring and creek flow water flow and quality in the study area;
- Document the chronologies between the above, precipitation and temperature;
- Obtain the twenty–plus aerial photographs of the study area taken since 1945. A comparison to bathymetric charts could be undertaken to determine past lake levels; and
- Assess the hydrogeology by:
    - Tracking the Kikomun and Gopher Flats springs; and
    - A better understanding of the geology/stratigraphy (i.e., rock layers underlying the study area).

Elko and Baynes Aquifers

The Groundwater Wells and Aquifer (GWELL) (ENVb 2014) database identified three mapped aquifers within the boundaries of the study area. Aquifer 1057 underlies Elko, and Aquifers 519 and 520 underlie Baynes Lake (Figure 7).

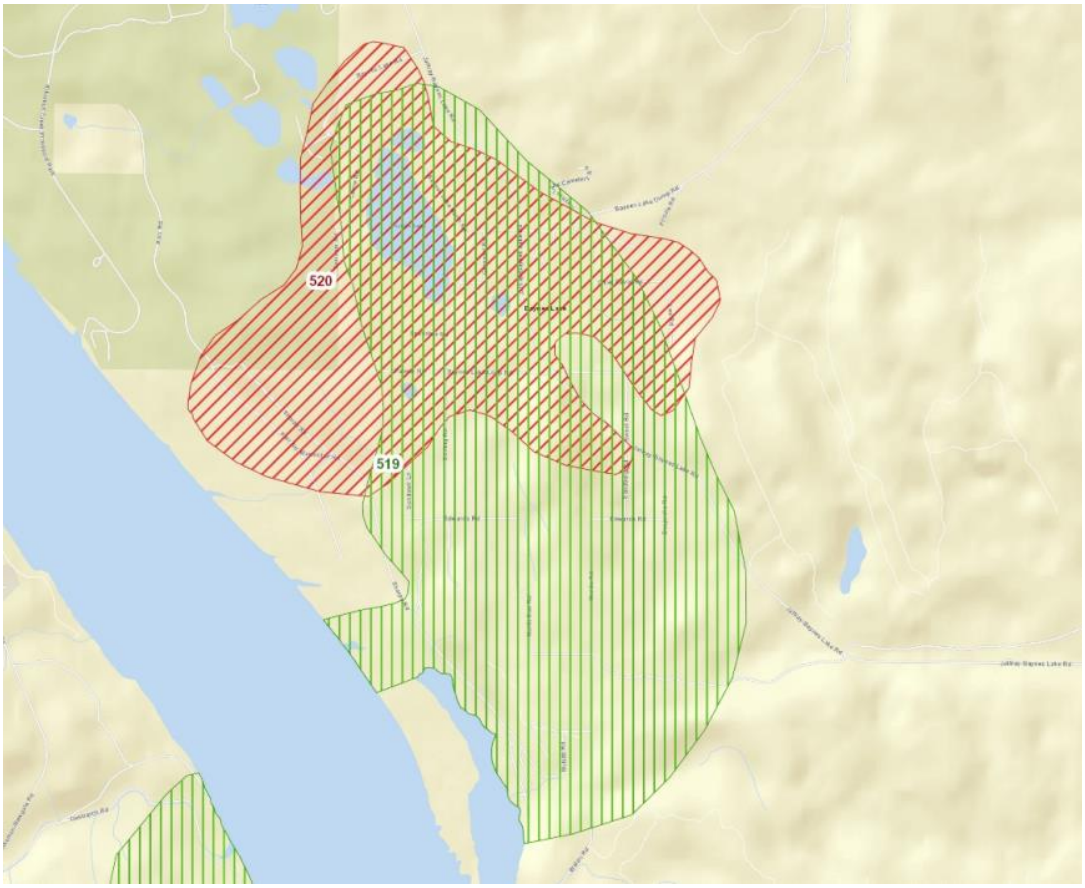


Figure 7: Approximate shallower aquifer 520 (Green) locations and deeper aquifer 519 (Red) in the Baynes Lake Area (Province of BC 2023b).

In 2021, Associated Environmental studied groundwater travel times between the Elk River and the three aquifers. The results generated groundwater travel time estimates on the order of 100 days for the Elk River to Kikomun Creek Springs, 1 to 5 years to the shallow Aquifer 520, and 3 to 7 years to the deeper Aquifer 519. Note these travel time estimates are preliminary, as the parameters are hypothetical or assumed due to the number of knowledge gaps.

Figure 8 depicts a generalized schematic of an aquifer system and is not representative of the Elko and Baynes Lake aquifers.

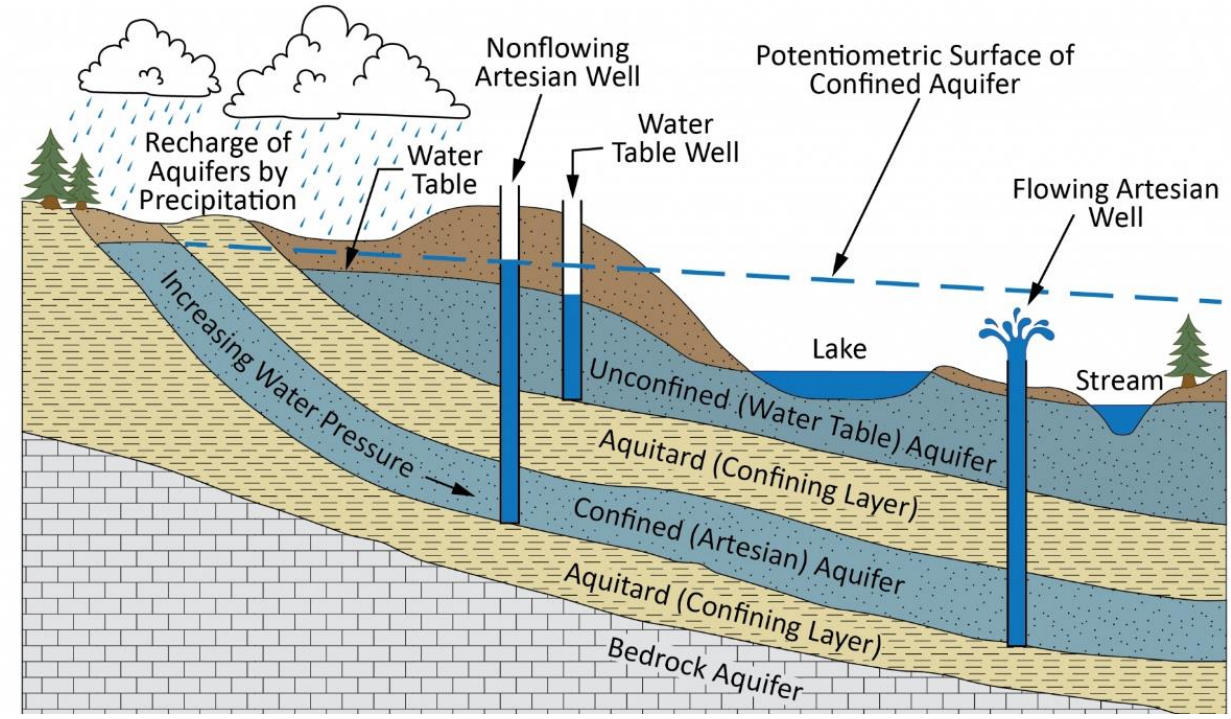


Figure 8: Schematic of theoretical groundwater and surface water connections (Government of Utah).

Wells

The Associated Environmental report in 2021 showed registered groundwater wells registered to specific aquifers and wells not correlated to an aquifer (Table 1) (Associated Environmental 2021). The report also found no artesian wells[4] or monitoring wells installed within the identified aquifers. This information allows for comparing the total of wells associated with the aquifers with the documented 14 wells with low water levels, recharge, or recovery issues, including the Baynes Lake Fire Department dry well. The list was created in 2020, with the majority of the listed wells within 50 feet of the surface, correlating to the depth of the shallower aquifer 520. At the time of 2020, approximately 21% of the wells in the area are identified as having water resource issues and have anticipated increasing with the decreasing aquifer levels (Doehle 2023).

Table 1: Study area aquifers registered/reported wells compared with wells in the vicinity but not correlated.

Aquifer ID	Registered/reported	Within the vicinity but not correlated.
519	89	33
520	68	25
1057	25	5

[4] Well for which water flows under natural pressure without pumping.

Water Quality Provides the Evidence

Groundwater Water Quality

Metallurgical coal mining in the upper Elk Valley over many decades has resulted in selenium from mine waste leaching into the Elk River at a faster and more concentrated rate than it would otherwise. The water containing selenium concentrations travels through the Elk River, accessing the aquifer recharge inlets and seeping into the three aquifers. Both groundwater and surface water quality samples show elevated selenium concentrations compared to background levels. This provides further evidence of a connection between the Elk River and the three aquifers; otherwise, there would only be low background levels of selenium in the results, which was not the case (ENV 2014).

The selenium concentrations in the Elk River below the coal mines are above the BC water quality guideline for protecting aquatic life. Selenium concentrations in some groundwater wells close to the mines are elevated and, in some cases, exceed the BC drinking water quality guidelines. Tech continues to invest in stabilizing and reversing the trend of selenium, calcite, and other constituents according to its provincially approved 2014 Elk Valley Water Quality Plan. [5]

In 2021, Associated Environmental collected 15 water quality samples, of which 11 were groundwater samples. Selenium concentrations were highest in the Elk River, Elko Community Well, Kikomun Springs, and Gopher Flats Spring ranging from 0.00387 mg/L to 0.004 mg/L of total selenium. Saunders Road well, Virtue Water well (407 Baynes Lake Rd N), Compressor Station well, Baynes Lake Senior Housing, and Hodgins well (805 Sterling Rd) ranged from 0.00095 mg/L to 0.0017 mg/L of total selenium. All concentrations were below the British Columbia Drinking Water Quality Guidelines (BCWQG) of <0.01 mg/L for safe consumption (Province of BC 2014). The data indicates that the aquifer has been freshly recharged from a source (the Elk River), and there is no drastic difference in the chemical composition among the locations (Baynes Lake and the Elk River), supporting they are connected (Associated Environmental 2021). More investigation to understand the geology is required to assess the selenium concentrations for the area further (ENVa 2014).

[5] https://www.teck.com/sustainability/sustainability-topics/water/water-quality-in-the-elk-valley/22bb6730962c0c21 accessed April 15, 2023.

Surface Water Quality

Four surface water quality samples were collected simultaneously with the groundwater quality samples. The Elk River (0.0091 mg/L), Kikomun Springs (0.00467 mg/L), and Gopher Flat Spring (0.00387 mg/L) presented selenium concentration that was below the BCDWQG in late summer and fall of 2020. The results found that Baynes Lake was the only sampling location that indicated low selenium levels below the analytical detection limit (<0.00050 mg/L) (Associated Environmental 2021). Because of the low selenium levels, Associated Environmental proposed that Baynes Lake is likely groundwater spring fed. The lake's low selenium concentrations could result from the source spring water having a long flow path in the aquifer compared to the other sample locations with greater selenium concentrations (Associated Environmental 2021). This supports the conclusion that the aquifer is connected from the Elk River to Baynes Lake and other local water bodies.

Aquatic/Terrestrial Interface (Riparian)

The aquatic and terrestrial interface (riparian) area is a key feature of the surface water bodies in the study area. They provide a habitat for a diverse range of plant and animal species and are foundational to the food chain. There is no specific and relevant information for the study area. This is a knowledge gap requiring systematic research over time.

Description of Species

Habitat Requirements for Indicator Species.

Individual species require specific resources from the environment to survive and reproduce (forests, riparian areas, wetlands, water resources etc.). The study area is a "Kootenay Dry Mild Interior Douglas-fir Variant (IDFdm2)" and "Kootenay Very Dry Very Hot Interior Douglas-fir Variant (IDFxx2)", and as the names suggest it gets very hot in the summer, making finding the resources in the habitat challenging.

Critical habitat is the specific area within the geographical area occupied by the species at the time of listing[6] that contains physical or biological features essential to the conservation of the species, which may require special management considerations or protection. The critical habitat for each listed species has been documented and outlined

[6] Based on their conservation status rank, each species and ecosystem is assigned to a list that helps set conservation priorities and provide a simplified view of the status of species and ecosystems.

in each species' Recovery Strategy or Action Plan posed by the federal Species At-Risk Registry[7].

Indicator Species

An indicator species is an animal or plant whose presence, absence or abundance reflects the condition of a particular habitat.

Indicators are often at the community level because the species' well-being reflects the health of their specific habitat. It is important to note that there is no existing data to tell us the past or current abundance, health, or other characteristics of indicator species in the study area. Data collected using scientific methodology is needed to support community-level metrics such as species richness and abundance, that can be used to monitor the quality and quantity of habitat.

Below are suggested species based on local knowledge and discussion with biologists familiar with the area. Included are species listed as Species of Special Concern in the Federal *Species at Risk Act* and by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (e.g., Western Painted Turtle and Western Toad). Others are included because they are good indicators of wetland and riparian health (e.g., Columbia Spotted Frog, Pacific Tree Frog, Sora bird, benthic invertebrates), or of traditional importance to Yaq̓it ʔa· knuqɬi' it (e.g., Bull Trout, Burbot, Westslope Cutthroat Trout). The Great Blue Heron is included as a species of Special Concern under BC legislation and an iconic symbol of wetland conservation and environmental quality. Finally, “Riparian and Wetland Areas” are included as a critical habitat to monitor.

[7]https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html

Western Painted Turtle

Photo from: https://kootenayconservation.ca/western-painted-turtle-conservation/

Ecological Importance

An important role in the food web of lakes, ponds, and riparian zones Reservoir of genetic variation for future adaptation to changing climate.

Cultural/Social Importance

One of only two indigenous species of turtle west of Ontario. Traditional importance to Yaq̓it ʔa· knuqƛi' it.

Economic Importance

Tourism – iconic species.

Sensitivity to Water Levels and Riparian Declines

Water level fluctuations cause high rates of mortality: E.g., a 70% decline in a small lake that dried up for two years.

Rarity/Status

Species of Special Concern, Committee on the Status of Endangered Wildlife in Canada (COSEWIC) because “the number of turtles is likely small and declining and because of extensive loss of wetland habitats and proliferation of roads.” Listed as of Special Concern in Canada on Schedule 1 of the Species at Risk Act. In BC, ranked imperilled/vulnerable by the B.C. Conservation Data Centre and is on the provincial Blue List.[8]

Effects Already Documented

Yes – although population-level effects are difficult to determine.

[8] See BC Species at Risk ratings: https://www.env.gov.bc.ca/atrisk/help/list.htm

WESTERN TOAD

(From USGS/Chris Brown accessed May 7, 2023)

Ecological Importance

The Western Toad contributes significantly to ecological processes over a wide range of wetlands and terrestrial habitats. Eggs, tadpoles, and metamorphs are preyed on by a variety of aquatic invertebrates, fish, birds, reptiles, mammals, and other amphibian species. Tadpoles consume algae and detritus. The sheer volume of tadpoles and metamorphs at some breeding sites ensures that their conversion of biomass is significant, and the dispersal of metamorphs represents a significant transfer of energy from aquatic to terrestrial systems. Adults and juveniles consume invertebrates, many of which are insect pests and are in turn preyed on by birds, mammals, and reptiles.

Photo from: https://www.nps.gov/samo/learn/nature/westerntoad.htm

Cultural/Social Importance

Symbol of wetland and riparian conservation.

Economic Importance

N/A

Sensitivity to Water Levels and Riparian Declines

Susceptible to the wetland and riparian loss. Breed in aquatic habitats.

Rarity/Status

Species of Special Concern, by COSEWIC and under the federal *Species at Risk Act*. Population declines and population extirpations (i.e., wiped out) in the southern part of its range in British Columbia.

Effects Already Documented

Unknown for the study area.

Columbia Spotted Frog

Ecological Importance

An important role in the food web – consume algae, organic debris, insect larvae, and molluscs; consumed by dragonfly larvae, diving beetles, garter snakes, birds, snakes, and fish.

Cultural/Social Importance

A familiar resident of lakes, ponds, slow-moving streams, and wetlands.

Economic Importance

Indirect via food for herons, trout, raccoons, garter snakes, and bullfrogs.

Sensitivity to Water Levels and Riparian Declines

Water bodies that are deep enough not to freeze to the bottom are required for overwintering adults, juveniles and possibly larvae. Because it takes several years to reach reproductive age, it may be susceptible to population disturbance.

Rarity/Status

Yellow-Listed in BC (not at risk).

Effects Already Documented

Unknown.

Photo from: https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/wildlife-wildlife-habitat/amphibians-reptiles-and-turtles/photos/frogs/columbia-spotted/columbiaspottedfrog_jhobbs.jpg

Pacific Treefrog (*Hylla Regilla*)

Photo from: https://www.pexels.com/photo/pacific-tree-frog-on-green-leaf-11675473/

Ecological Importance

As insectivorous animals, they help control insect pests. They are food for snakes, bullfrogs, and many birds and mammals. Tadpoles are eaten by larger frogs and fish.

Cultural/Social Importance

Symbol of wetland and riparian conservation.

Economic Importance

N/A

Sensitivity to Water Levels and Riparian Declines

Susceptible to wetland and riparian losses.

Rarity/Status

Abundant in BC but unknown in the study area. Yellow-Listed in BC.

Effects Already Documented

Unknown.

SORA (*Porzana carolina*)

Ecological Importance

Feed on wetland plants and invertebrates. Nest in shallow wetlands.

Cultural/Social Importance

Symbol of wetland and riparian conservation.

Economic Importance

Not available.

Sensitivity to Water Levels and Riparian Declines

Highly sensitive to loss of wetlands and riparian habitat that includes cattails.

Rarity/Status

Yellow-listed, fairly abundant, and widespread over approximately ¾ of BC.

Breeds in the study area. Home range size averaged 0.19 ha during brood-rearing. (Johnson and Dinsmore 1985). Winters in Arizona. Lives amongst cattails. Unknown numbers in the study area.

Effects Already Documented

No documentation.

Photo from: E-Fauna BC photo gallery by Ian Routley (Photo ID #9598)

Great Blue Heron

Ecological Importance

Predator to fish, amphibians, reptiles, small mammals, insects, and other birds.

Cultural/Social Importance

Iconic species. Symbol of wetland conservation and environmental quality.

Economic Importance

N/A

Sensitivity to Water Levels and Riparian Declines

High via loss of foraging habitat.

Rarity/Status

Blue-listed BC (i.e., of Special Concern). Also listed as a Species of Special Concern under the *Federal Wildlife Act*.[9] Particularly sensitive or vulnerable to human activities or natural events.

Effects Already Documented

Declining in Columbia Basin but unknown in South Country.

Photo from: https://www.vancouverislandfreedaily.com/news/starvation-claims-great-blue-heron-in-crofton/

[9] https://www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding/listing-process/wildlife-schedule-1.html

Burbot

Ecological Importance

They are the top predator, an important role in the food web of lakes, ponds, and riparian zones. Spawn under the ice in streams and lakes.

Cultural/Social Importance

Traditional importance to Yaq̓it ʔa· knuqɬi' it.

Economic Importance

Is the only freshwater cod species.

Sensitivity to Water Levels and Riparian Declines

Water level fluctuations cause high rates of mortality. Not great swimmers and can become stranded when water levels decline.

Rarity/Status

Yellow-Listed in BC.

Effects Already Documented

Unknown.

Photo from: https://www.gofishbc.com/Blog/Conservation/Burbot-in-B-C.aspx

Bull Trout

Photo from: http://www.fishingwithrod.com/blog/2014/08/25/skagit-river-underwater-photography/140819-1/

Ecological Importance

Top predator. Primarily other fish.

Cultural/Social Importance

Traditional importance to Yaq̓it ʔa· knuqɬi' it.

Economic Importance

Recreational angling.

Sensitivity to Water Levels and Riparian Declines

Sensitive to habitat change in general, including changes in flow patterns, water depth, temperature, dissolved oxygen.

Rarity/Status

Listed as “threatened”[10] under *Canada’s Species at Risk Act*. Blue-Listed, as a species of “special concern” throughout its western North American range.

Effects Already Documented

No specific data from the study area.

[10] A threatened species is defined under Canada’s *Endangered Species Act* as "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range."

Westslope Cutthroat Trout

Photo from: https://wdfw.wa.gov/species-habitats/species/oncorhynchus-clarkii-lewisi

Ecological Importance

Preys on aquatic and terrestrial insects.

Cultural/Social Importance

Traditional importance to Yaq̓it ʔa· knuqƛi' it. Pure strain is iconic in the Kootenays.

Economic Importance

Recreational angling including fly fishing businesses.

Sensitivity to Water Levels and Riparian Declines

Sensitive to changes in flow amounts and patterns, temperature, and dissolved oxygen.

Rarity/Status

Blue-Listed (i.e., Special Concern) in BC.

Effects Already Documented

No specific data for the study area.

Benthic Invertebrates

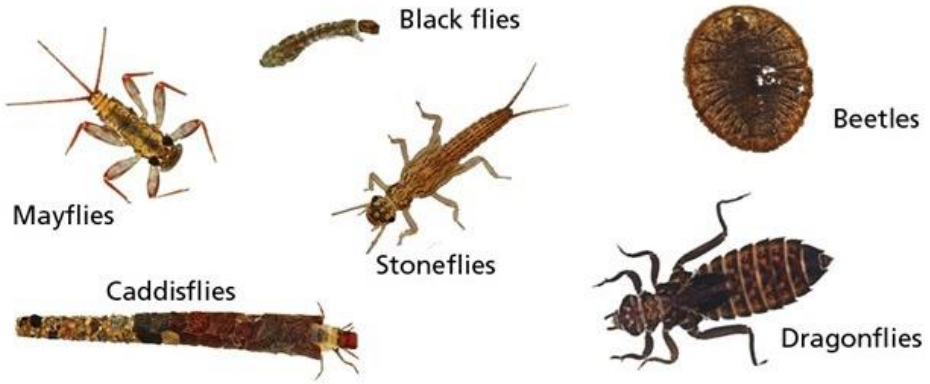


Photo from: https://www.nps.gov/articles/ooo/macroinvertebrate_community_frsp.htm

Ecological Importance

Key/critical component of aquatic food webs.

Cultural/Social Importance

Under-appreciated except by fly fishers and biologists.

Economic Importance

Indirect importance via food for fish species, birds, reptiles, and amphibians.

Sensitivity to Water Levels and Riparian Declines

Diversity declines with chronic low water.

Rarity/Status

Specific species within the community can become rare (e.g., molluscs).

Effects Already Documented

No data for the study area.

Riparian and Wetland Areas

Ecological Importance

Key/critical components of aquatic habitat and food webs. Especially important to biodiversity. Considered to be one of the most productive ecosystems on earth.

Cultural/Social Importance

The importance of riparian and wetland habitats is recognized by user groups e.g., bird watchers, hunters, and fishers. Yaq̓it ʔa· knuqɬi' it had many uses for cattails.

Economic Importance

Indirect importance due to the provision of habitat, primary production, oxygen production and water purification. Importance of users that rely on the riparian and wetland habitat e.g., photographers, bird waters.

Sensitivity to Water Levels and Riparian Declines

Changes in water level will change community composition and thus habitat.

Rarity/Status

The small lakes, ponds, and wetlands within the study area have not been classified as per the Wetlands of BC: A Guide to Identification (MacKenzie and Moran 2004). Some of the small lakes, ponds, and wetlands in the study area have common cattails (*Typha latifolia*) which is a Yellow Listed species. Common cattail Marsh (*Typha latifolia* Marsh) is a Wm05 Blue-Listed marsh (B.C. Conservation Data Centre. 2023. BC Species and Ecosystems Explorer. B.C. Ministry of Environ. Victoria, B.C. Available: https://a100.gov.bc.ca/pub/eswp/ (accessed Mar 24, 2023). The presence of some common cattails in a marsh does not mean it is classified as a Wm05 marsh.

Classification of the study area wetlands is a data gap. This information would help in the environmental health assessment of the water features.

Effects Already Documented

No data for the study area.

Story of Stink Lake

(Submitted by Baynes Lake resident, Karen Bergman)

Stink Lake in Kikomun Provincial Park represents the story of other kettle ponds and lakes in the study area that have dried or are drying up. The tree-lined path beside Stink Lake is a small section of many kilometres of a path winding throughout the Provincial Park

and is popular with walkers, runners, cyclists, cross-country skiers, and snowshoers of all ages, from the local area and visitors to Kikomun Park. It is a gut punch to many of us to see a once thriving Stink Lake reduced to a few puddles and the fish, birds and turtles gone from this location.

The following pictures of Stink Lake were taken when the aquifer water was more plentiful around 2017. Figure 9 (A) shows about 30 Western Painted Turtles basking on the log in the lake. Turtles are cold-blooded and use the heat of the sun to maintain their body temperature for survival in the summer. In 2022, the lake slowly dwindled week by week to a few puddles and by late summer the turtle log was empty (Figure 9 B). Gone, also, were the hawks (including osprey), and the bald eagles that were often seen soaring over the lake hunting. Also gone were the red-winged blackbirds whose habitat was the cattails standing in the water at the west end of the lake (Figure 10).

The Stink Lake option for many species is gone. It will not be an option again unless the lake water is restored in time for the habitat to come back as it was until recently. The loss of Stink Lake and other habitats like it forces species to fewer and fewer spots, increasing the risk of spreading disease and easier predation. The concentration into fewer areas and fewer separate populations decreases the genetic variation amongst the species which means less resilience to adapt to change.

Figure 9: Stink Lake, 2017 with over 30 turtles basking on a log.
Note cattails in the riparian area at the west end of the lake (A). Photo (B) Stink Lake, fall 2022, reduced to puddles. Turtle log and riparian area dry.

Figure 10: Stink Lake, 2017. The riparian area at the west end of the lake with cattails and Red Wing Blackbirds.

Story of Saffron – Western Painted Turtle

(Submitted by local resident and Western Painted Turtle Project Volunteer Manager, Kymme Paul)

Saffron is a 10-year-old Western Painted Turtle. Despite her many life challenges, she has thrived in Baynes Lake. When she hatched in the fall, she was one of about 12 eggs in her underground, on-land nest where she stayed another 8 months with her tiny siblings. Her nest was one of the lucky ones not to be dug up by a skunk. Turtle eggs are notoriously raided by skunks.

Saffron emerged from her nest in the spring of 2012 to a sometimes sunny, sometimes rainy environment filled with bugs to eat and ground cover to hide her from predators. When she and her family emerged, she was the size of a looney coin. Female turtles do not stay with their hatchlings. Saffron and her siblings were on their own to avoid predators such as birds and humans. Saffron also had to find water to bask and feed as she grew. Each winter, Saffron swam to the bottom of a pond to safely wait out the winter in the water below the surface ice.

In summer 2022, as a mature turtle, Saffron crosses between several kettle ponds, looking for food, mates, good nesting sites and possible new over-wintering locations. One of her main ponds, Spirit Pond, has all but dried up. Residents say Spirit Pond used to be filled with turtles. However, in the last few years, the pond has dried up and is now a series of very shallow small ponds. There have been fewer sightings of turtles.

Saffron's travel routes include crossing Jaffray-Baynes Lake Road, a busy road which was built when the Libby Dam created the Koocanusa Reservoir. This new road replaced an old road flooded to create the Reservoir. Over a dozen turtles are killed annually by vehicle-turtle collisions on Jaffray-Baynes Lake Road.

In 2021, Saffron was caught by research students who attached a transmitter to her shell. The researchers followed her all summer using an antenna and receiver to track her movements and see if she would become pregnant and dig a nesting site. Saffron made the researchers hustle with her antics to avoid being caught periodically to assess her condition.

In the fall of 2021, Saffron was nowhere to be found. Leaving the transmitter on Saffron might pose a risk to her and the researchers did not want to end the research season without finding her. They canoed in the deeper ponds and walked across fields and wetlands looking for her, holding aloft the tracking antenna and watching the receiver for a signal from Saffron's transmitter. Saffron eluded them.

Fearing the worst, the researchers left for the winter. In the spring of 2022, two new researchers started to capture pregnant female turtles and attach transmitters for tracking. One day, a researcher saw a turtle cross the road with something on its shell. A transmitter? Yes! She suspected this might be Saffron but to be sure she needed to access the computer at camp.

She gently placed Saffron in a pillowcase to transport Saffron to camp. Saffron found a small hole in the pillowcase and poked her head out to glare at the researcher. Back at camp, there was a celebration as the new researchers contacted the researchers from the previous year.

Saffron still lives in Baynes Lake. Her story represents the survival challenges Western Painted Turtles face: predation by skunks, hazardous road crossings, and loss of aquatic and semi-aquatic habitat for food and overwintering. The map below (Figure 11) shows repeated return trips to a dried-up Spirit Pond that the turtle "remembers" as a previous thriving habitat for her. Western Painted Turtles are classified under Federal and BC Provincial legislation as a Species of Concern. See more information on their status in the Indicator Species section above.

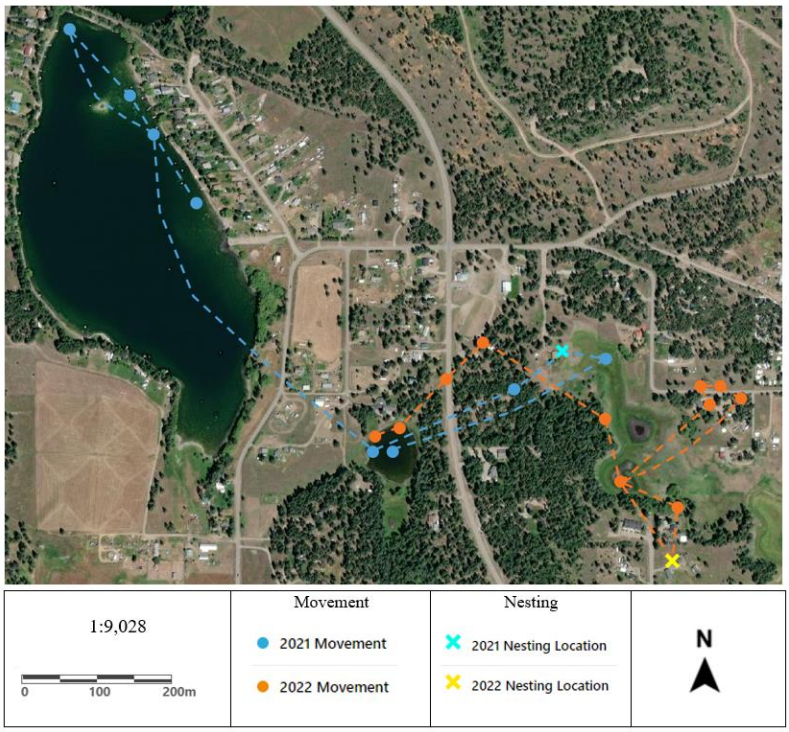


Figure 11: Movement and nesting information for a Western Painted Turtle tracked in 2021 and 2022. Baynes Lake is the body of water on the left-hand side of the map. Spirit Pond is to the right. Western Painted Turtle Project, 2022.

Conclusions

The findings in this report support the connection between the kettle ponds, lakes and streams with the Elk River based on the geology, selenium concentration present in groundwater and surface water samples, and local knowledge in the study area. This information will be used to support the restoration of the aquifer.

The indicator species included in this report present a large area of interest that is not very well known and, to date, depends mostly on local knowledge. Finalizing the indicator species list, establishing baseline data for them and ongoing monitoring are critical to determining the success of efforts to restore aquifer water in the study area.

Recommendations

This report recommends:

1. BC Hydro:
    a. Maintain the Elko dam at 917 m now to restore water, reverse habitat damage already done and protect it going forward; and

   b. Participate as a partner with the community to implement the recommendations in this report.
2. Establishing a long-term, systematic ground and surface water quality and quantity monitoring program with community involvement and incorporating existing or planned monitoring by others;
3. Systematically gathering the data needed to establish the correlation over time between ground and surface water with Elk River volume above and below the a, air temperatures, precipitation, head pond level, snowpack, upstream events, and other relevant factors;
4. Determining groundwater travel times and routes from the Elk River aquifer recharge inlet area until it appears as surface water in the study area;
5. Classifying riparian and wetland areas to determine location, size, and composition (past, present and at risk if water is not restored);
6. Establishing:
   a. A riparian and wetland habitat monitoring program;
   b. A finalized list of indicator species (starting with the list in this report) to use in environmental restoration and monitoring (past, present and at risk if water is not restored);
   c. A water use plan throughout the study area; and
   d. An indicator species monitoring program which includes numbers, locations, breeding habits, travel patterns, and overwintering.
7. Investigating environmental restoration options;
8. These recommendations be implemented in collaboration with CLEAR, Elk River Alliance, Living Lakes Canada, Baynes Lake Community Society, BC Parks, BC Hydro and other industries in the area.

Closure

The conclusions and recommendations in this report represent the best judgement of the author based on her review of available existing information and consultation with advisors and CLEAR.

CLEAR advises that the persons signing this report have the relevant combination of formal education, training, skills, and demonstrable experience and are familiar with completing the scope of work identified in this report.

CLEAR appreciates the author's dedication and work in preparing this report.

CLEAR will use this report to provide further evidence of the urgent need to restore water to the aquifer in the study area. We will use this evidence to persuade decision-makers to act and to access funding and other resources to restore and protect the water and environment for generations to come.

Authored by:

Hailey Wynnyk, BIT
Environmental Consultant

Reviewed by:

(Hard copy is stamped/signed)

Mary Louise Polzin, PhD., RPBio.
Sr. Ecologist/Riparian Specialist

Karen Bergman, B. Sc., MBA
CLEAR co-chair

References

Associated Environmental. 2021. Regional District of East Kootenay: Baynes Lake and Elko Aquifer Restoration.

BC Hydro. 2005a. Elko Project Water Use Plan: Monitoring Program Terms of Reference: ELKM-3 Sidechannel Sinkhole Monitoring Study.

BC Hydro. 2005b. Elko Project Water Use Plan; [accessed 2023 Jan 14] from https://www.bchydro.com/content/dam/hydro/medialib/internet/documents/environment/pdf/wup_elko_water_use_plan_pdf.pdf.

BC Hydro. 2009. Elko Water Use Plan Monitoring Program: Identifying the possible effects of Elko Dam headpond operations on groundwater levels in the Baynes Lake community.

BC Hydro. 2010. Elko Water Use Plan: Side channel sinkhole monitoring study. Implementation Year 1. Reference: ELKMON-3. Identifying the possible effects of Elko Dam headpond operations on groundwater levels in the Baynes Lake community.

BC Hydro. 2016. Elko Redevelopment Project Fact Sheet; [accessed 2023 Jan 14] from:https://columbiapower.org/wp-content/uploads/2016/03/2016-03 09_ElkoFactSheet_V5.pdf.

BC Parks. 2014. Kikomun Creek Management Plan.

Braumandl, T. and M. Curran (Eds.) 1992. Field Guide for Site Identification and Interpretation for the Nelson Forest Region. Ministry of Forest, Victoria, BC.

Clague, J.J. 1973. Late Cenozoic Geology of the Southern Rocky Mountain Trench, British Columbia. Unpublished thesis. Department of Geological Sciences, University of British Columbia.

COSEWIC. 2006. COSEWIC assessment and status report of the Western Painted Turtle (*Chrysemys picta bellii*) Pacific Coast population, Intermountain-Rocky Mountain population and Prairie/West Boreal – Canadian Shield population) in Canada Committee on the Status of Endangered Wildlife in Canada, Ottawa.

Crawley T. 2020 August 11. Officials raise alarm over water, environmental 'crisis' in Baynes Lake area. Cranbrook Daily Townsman. [accessed 2023 Jan 15] from: https://www.cranbrooktownsman.com/news/officials-raise-alarm-over-water-environmental-crisis-in-baynes-lake-area/.

Doehle, S. 2021. List of Compromised Wells – South Country.

[ENV] Province of British Columbia Ministry of Environment and Climate Change Strategy. 1992. Baynes Lake Groundwater Monitoring Program. 1992 September 2.

[ENVa] Province of British Columbia Ministry of Environment and Climate Change Strategy. 2014. Companion Document to Ambient Water Quality Guideline for Selenium Update. [accessed 2023 March 1] from:

https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/bc_moe_se_wqg_companion_document.pdf.

[ENVb] Province of British Columbia. 2014. Groundwater Wells and Aquifers. [accessed 2023 March 3] from: https://apps.nrs.gov.bc.ca/gwells/aquifers/.

Fish Stocking Report by Freshwater Fish Societies of BC. 2023 (accessed 2023 May 1, from) https://www.gofishbc.com/Stocked-Fish/Detailed-Report.aspx?wbid=00379BULL&waterbody=BAYNES

Government of Utah. Groundwater & Aquifers [image]. Utah Geological Survey. [accessed 2023 Feb 8] from https://geology.utah.gov/water/groundwater/groundwater-aquifers/

Harasiuk C. Fishing Baynes Lake, BC. BCfishin.com; [accessed 2023 Feb 11] from: https://www.bcfishn.com/fishing-baynes-lake-bc/.

Hodgins, J., Doehle S., Hunt D., 2020. Water Supply and Environmental Crisis Presentation.

[ipcc] The Intergovernmental Panel on Climate Change. FAQs Chapter 7. [accessed 2023 March 19] from https://www.ipcc.ch/srccl/faqs/faqs-chapter-7/.

Johanson, D. 1976. Groundwater Investigation – Baynes Lake. Water Management Branch Memorandum Report, Ministry of Environment. Victoria, B.C.File No. 0340508.

Johnson, R. R., and J. J. Dinsmore. 1985. Brood rearing and post-breeding habitat use by Virginia Rails and Soras. Wilson Bulletin 97:551-554.

Kwong, J. 1985. Memo: Groundwater Levels – Baynes Lake. Groundwater Section – Water Management Branch.

MacKenzie, W.H. and J.R. Moran. 2004. Wetlands of British Columbia: a guide to identification. Res. Br., B.C. Min. For., Victoria, B.C. Land Manage. Handb. No. 52.

Meidinger, D. and J. Pojar (Eds.) 1991. Ecosystems of British Columbia. Ministry of Forests – Research Branch, Victoria, BC.

Menin, L.S. 2021. Comparing Physiochemical Characteristics and Microbial Diversity between Kettle and Non-kettle Ponds in Massachusetts. Clark University, Worcester, Massachusetts.

Mitha C. 2020. BC Hydro: September 3rd Letter regarding the operation of BC Hydro's Elko Dam and water levels in the Baynes Lake area.

Province of British Columbia. 2014. Water Sustainability Act. 3rd edition. [accessed 2023 Feb 8] from: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/14015

Province of British Columbia. 2023a. Water License Search. [accessed 2023 February 24].

Province of British Columbia. 2023b. BC Water Resource Atlas. [accessed 2023 February 24].

Province of British Columbia. 2023c. Licensing Groundwater in BC. [accessed 2023 Feb 06] from: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/laws-rules/gw_licensing_brochure.pdf.

Province of British Columbia. 2023d. Western Painted Turtle Survival Monitoring-Baynes Lake-Elk Valley-Kootenay Region (Accessed 2023 May 14) from: http://a100.gov.bc.ca/pub/siwe/details.do?projectId=5942&pagerOffset=0.

[RDEK] Regional District of East Kootenay. 2011. Baynes Lake Official Community Plan Bylaw NO. 2319. Cranbrook, BC. [accessed 2023 Feb 10] from: https://www.rdek.bc.ca/.

[RDEK] Regional District of East Kootenay. 2021a. 2021 Census – Percentage of Dwelling Units Occupied by Usual Residents. Cranbrook, BC. [accessed 2023 Feb 8] from: https://www.rdek.bc.ca/web/pdf/2021_census/2021Censu-Percentageof_DwellingUnitsOccupiedbyUsualResidents.pdf.

[RDEK] Regional District of East Kootenay. 2021b. 2021 CENSUS Population & Dwelling count. Cranbrook, BC. [accessed 2023 Feb 8] from: https://www.rdek.bc.ca/web/pdf/2021_census/2021_CensusPopulationDwellingCount.pdf.

[RDEK] Regional District of East Kootenay. 2021c. 2021 Population Change between 2021 and 2016 Census Years. Cranbrook, BC. [accessed 2023 Feb 8] from: https://www.rdek.bc.ca/web/pdf/2021_census/PopulationChangebetween_2021and2016Census_years.pdf.

Rood, Stewart, 2023. Technical Reports-Elko Sinkholes and the Baynes Lake/Kikomun Aquifer.

Rood, Stewart, 2023. Lower Elk Aquifer, Presentation to CLEAR Society. (PDF) The Lower Elk Aquifer -Studies and Status (researchgate.net).

Ross T.J. 2005. A Comparison of Three Residual Distributions of Conifers for Enhancing Ungulate Forage and Timber Values. The Rocky Mountain Trench Natural Resources Society, Kimberly, BC.

Walker, Lee-Anne. 2017. Kikomun Creek Provincial Park Interpretative Plan 2017. Prepared for: Marika Welsh.

Appendix A: Water Sustainability Act

The provincial government is responsible for all surface and groundwater throughout the province. The provincial *Water Sustainability Act* (WSA) enables the province to protect the quality of water, fish and wildlife habitat, and the rights of licensed water users.

Under Section 11 of the WSA, any activities that result in "changes in or about a stream" require Notification or Approval. Under the WSA, a stream is defined as:

a natural watercourse, including a natural glacier course, or a natural body of water, whether or not the stream channel of the stream has been modified, or

a natural source of water supply, including, without limitation, a lake, pond, river, creek, spring, ravine, gulch, wetland or glacier, whether or not usually containing water, including ice, but does not include an aquifer.

Any construction that may impact any stream or its banks will require an application under Section 11 of the WSA.

Under Sections 7 and 9 of the WSA, any activities that result in the diversion or storage of surface or groundwater require a Water Licence application. If a Water Licence is required for the aquifer restoration project, the licence would also include approval for the construction of the preferred option and its associated features, such as diversion canals, waterline installation, pumping infrastructure, channelling, and future maintenance of the option and its infrastructure.

Section 11 and Water Licence applications are processed through FrontCounter BC and the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNR). Section 11 Notification applications take 45 days to process, and Section 11 Approval applications typically take 140 days to process once either application has been vetted and accepted by FrontCounter BC. Water Licence applications are also vetted through FrontCounter BC before being passed onto the appropriate water officers at FLNR. Water Licence applications can take one year or more to process.

Appendix B: Technical Reports-Elko Aquifer Recharge Inlets and the Baynes Lake/Kikomun Aquifer

Technical Reports – Elko Aquifer Recharge Inlets & the Baynes Lake/Kikomun Aquifer Stewart Rood, University of Lethbridge, (rood@uleth.ca)

April 2023 (slightly revised from November 2022)

Searchable archives: Aquatic Report Catalogue (gov.bc.ca)

https://a100.gov.bc.ca/pub/acat/public/welcome.do

Clague, J.J. (1973). Late Cenozoic Geology of the Southern Rocky Mountain Trench, British Columbia. Ph. D. Thesis. Department of Geological

Sciences, University of British Columbia.

https://open.library.ubc.ca/soa/cIRcle/collections/ubctheses/831/items/1.0052380?o=0

Description: This extensive report analyzes the geology and post-glacial (pre)history of the region. It recognizes the extensive permeable outwash gravels that extend from Elko southwest to the Baynes Lake/Kikomun area and the Kootenay River valley. (Important Fig. 48 is in the Doehle, Hunt & Hodgins presentation). The conference paper below followed from the thesis.

Clague, J. J. (1975). Sedimentology and paleohydrology of late Wisconsinan outwash, Rocky Mountain trench, southeastern British Columbia.

https://archives.datapages.com/data/sepm_sp/SP23/Sedimentology_and_Paleohydrology.htm first page only, paywall version: https://pubs.geoscienceworld.org/books/book/1075/chapterabstract/10545870/Sedimentology-and-Paleohydrology-of-Late?redirectedFrom=fulltext

Foweraker, J.C. (1974) Report: Notes on a Preliminary Groundwater Assessment For the East Kootenay Valley (Libby Reservoir). Technical report – status unclear.

https://a100.gov.bc.ca/pub/acat/documents/r4670/497_1143138543306_4798d26280c04e69989a e5eff515e10f.pdf

Description: This report analyzed the geology and prospective water sources along the Kootenay River/Koocanusa Reservoir, primarily from the USA border north to the Elk River. There is some reference to the valley north of the Elk River and relating to the Elko outwash.

Description: (following) Multiple reports in 1976 investigated the suitability of the Baynes Lake aquifer for domestic wells. These recognized spatial variation in groundwater, and temporal variation, seasonally and across years. Water quality and well types were considered, and depths are provided for some regional wells.

Hodge, W.S. (1976) Baynes Lake Field Investigations. Memorandum to A.P. Kohut, Water Investigations Branch.

https://a100.gov.bc.ca/pub/acat/documents/r4673/500_1143138666380_4798d26280c04e69989a e5eff515e10f.pdf

1

Johanson, D. (1976). Groundwater Investigation – Baynes Lake. BC MOE, Water Investigations Branch. Report.

https://a100.gov.bc.ca/pub/acat/documents/r4675/502_1143138746961_4798d26280c04e69989a e5eff515e10f.pdf

Description: This report concluded that the groundwater (well) levels in the Baynes Lake area were similar to the lake levels, indicating a common aquifer. Den Bisen (2009) refers to this report as recognizing concern for declining groundwater due to Elko Dam, but this is unclear.

Kohut, A.P. (1976) Groundwater Investigation – Baynes Lake. Water Management Branch Memorandum Report to J.C. Foweraker, Gov't of BC.

https://a100.gov.bc.ca/pub/acat/documents/r4674/501_1143138718918_4798d26280c04e69989a e5eff515e10f.pdf

Moncur, M.C. (1976) Baynes Lake Domestic Water Supplies.

https://a100.gov.bc.ca/pub/acat/documents/r4676/503_1143138801030_4798d26280c04e69989a e5eff515e10f.pdf

Kwong, J. (1985) Groundwater Levels – Baynes Lake Area. Memorandum to A.P. Kohut, Water Management Branch, BC Min. Environment.

https://a100.gov.bc.ca/pub/acat/documents/r4672/499_1143138602546_4798d26280c04e69989a e5eff515e10f.pdf

Description: This study followed reports of groundwater decline in the Baynes Lake area, despite a wet interval. Possible groundwater recharge from the Elk River in the Elko Dam area was recognized. Uncertainties and complexities were recognized, and further investigation and monitoring were recommended.

Dyck, J.H. (1985) Water Supply Problem – Baynes Lake Area. Memo to Mr. and Mrs. J. Knight, Fernie BC. Min. Env. This memo is included as Appendix 1 in Boyer (1992) (below).

Description: Some discussion of the situation and little support for the removal of the 'plug' in BC Hydro's dam at Elko. Alternate water sources are considered.

Boyer, D. (1992). Baynes Lake Groundwater Monitoring Program. BC MoE, Water Management Branch.

https://a100.gov.bc.ca/pub/acat/documents/r4671/498_1143138577285_4798d26280c04e69989a e5eff515e10f.pdf

Description: This study monitored groundwater (wells) and levels of Baynes and Fusee Lakes, and the Elk River from 1986-1989. Levels in two groundwater wells are 'recharged by local melting snow and could be influenced by the Elk River' (Table 2). There was limited correspondence between the groundwater wells and lake levels, but the water was sufficient through the interval. Data are provided.

2

Robertson Environmental Services Ltd. (2002). Elko Water Use Plan Wildlife Overview. Prepared for BC Hydro Water use Planning, Burnaby, BC.

Pandion Ecological Consultants Ltd. (2005). Wildlife & Land Use Management Plan for the BC Hydro Elko Properties. Prepared for BC Hydro, Castlegar, BC.

(These two reports are cited in den Biesen (2009), but a source link was not located.)

Description: Wildlife habitat and use of the area. Recontouring would slightly impact wildlife habitat. Reconnection of the side channel could benefit fish, by reducing stranding.

Staniaszek, P. (1992). Stable isotope composition of dissolved sulphate and carbonate in selected natural systems. The University of Calgary. (online – auto download)

Description – limited data on the chemistry and isotopic composition of Baynes, Surveyors and Koocanusa – from 1989. (p. 105, 106).

BC Hydro (2005) Elko Project Water Use Plan Monitoring Program Terms of Reference ELKMON-3 Sidechannel Sinkhole Monitoring Study. (subsequent study following) https://www.bchydro.com/content/dam/hydro/medialib/internet/documents/planning_regulatory/ wup/southern_interior/2011q2/elkmon-3_20110510.pdf

den Biesen, D. (2009). 'Side Channel Sinkhole Monitoring Study' (finalized 2010) - Apr 2006 – Dec 2008.

https://www.bchydro.com/content/dam/BCHydro/customer

portal/documents/corporate/environment-sustainability/water-use-planning/southern interior/elkmon-3-yr1-2009-07-01.pdf

Description: This substantial technical report reviews the system and then assessed Elko reservoir levels and Baynes/Kikomun area lake levels from 2006 to 2008. This investigated correspondence that would support the Elko sinkholes as important water sources for groundwater recharge in the Baynes Lake/Kikomun area. It also considered mitigation options. The outcomes were ambiguous, partly because the study occurred in a wet interval.

Elko Water Use Planning (bchydro.com)

Description: Multiple reports related to the Elko Dam and operations, including annual reports from 2007 to 2012. Related reports, for example,

Quamme, D., Bio, R. P., & Boulanger, J. (2009). Elko Dam Headpond Drawdown Environmental Monitoring 2001-2006.

BC Hydro> Water Licence Requirements> Elko River Water Use Plan> ELKMON-2 Elko Dam Headpond Drawdown Environmental Monitoring dated April 2009. (cbwaterhub.ca)

Description: A study of sediment and fish stranding.

3

Less directly related.

Multiple reports of fish salvage from the Elko headpond.

https://a100.gov.bc.ca/pub/acat/public/search.do

(search 'Elko')

Elk R discharge Phillips Bridge – monthly data sheets 1924-1947.

https://a100.gov.bc.ca/pub/acat/documents/r41513/Monthly_Drainage_Elk_River_1391 7075582 84_1704807249.pdf

Multiple inventories of fish at Surveyors Lake – 1950s.

https://a100.gov.bc.ca/pub/acat/public/search.do

Inventory of Kikomun, Gold, Sand creeks – A. Martin (1974).

https://a100.gov.bc.ca/pub/acat/documents/r1065/20_1076110080886_24b6529e94c8 4c8bbd5a8 f18bf2d9c79.pdf

St. Clair, R. C., & Gregory, P. T. (1990). Factors affecting the northern range limit of painted turtles (*Chrysemys picta*): winter acidosis or freezing? Copeia, 1083-1089. https://www.jstor.org/stable/1446492

Heidt, K. & H.Tepper (2008) Kootenay Fisheries – Field Report – Baynes Lake. (Min. of Environment).

https://a100.gov.bc.ca/pub/acat/documents/r16759/FieldReport_1250635128549_a618 385da426 dbc4cc77fc24386495126cc7a8de9f9f5b1908dd14a23899851c.pdf

Description: Inventory of fish in Baynes Lake.

Appendix C: Walk About Interpretations

This appendix is a report provided by the author Lee-Anne Walker. The report is provided in a file separate from the Environmental Screening Report.

Kikomun Creek Provincial Park Interpretive Plan 2017

Prepared for: Marika Welsh
East Kootenay South Area Supervisor, BC Parks

Prepared by: Lee-Anne Walker, BA Heritage Interpretation/MA Environment and Management
Walk About Interpretation
1883 Dicken Road
Fernie, BC V0B 1M5

December 11, 2017

Kikomun Creek Provincial Park Interpretation Plan 2017 1