Baptiste and Island Lakes

Watershed Management Plan

Baptiste and Island Lakes Stewardship Society

May, 2019

Baptiste and Island Lakes Stewardship Society

The Baptiste and Island Lakes Stewardship Society is a registered, non-profit society with the goal to *devise methods to preserve and protect the health of Baptiste and Island Lakes, while meeting the needs of all stakeholders within both watersheds*. The society works collaboratively with seven municipalities, (Athabasca County and the Summer Villages of Sunset Beach, South Baptiste, West Baptiste, Whispering Hills, Island Lake and Island Lake South), as well as numerous volunteers, partner organizations and stakeholders.

For more information or to become a member, contact:
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Acknowledgements

On behalf of the BAILS Board of Directors, we would like to thank a number of agencies and individuals for supporting this initiative. First, we would like to acknowledge Alberta Community Partnership for a $25,000 Inter-municipal Collaboration Grant to undertake this work. We also greatly appreciate the time and dedication of members of the Steering and Technical Committees (see a list in Appendix 1) and their supporting organizations. We note that, over the last several decades, there have been a number of studies and monitoring initiatives carried out on both Baptiste and Island lakes by academia, government and non-government agencies. Our work builds on those that came before us. More recently, we are grateful to the North Saskatchewan Watershed Alliance (Breda Muldoon, Dave Trew and Petra Rowell) for their guidance, technical and secretariat support. Finally, we thank all the individuals who attended outreach events, reviewed drafts, conducted additional research or analysis, collected samples, cooked hotdogs or otherwise lent a hand. As the saying goes, it takes a village!

Photos for this report were contributed by Wendy Appleby, Kendra Gilbert, Dennis Irving, Petra Rowell and Dave Trew.

Executive Summary

Baptiste and Island Lakes are two moderate-sized lakes located 16 km west of Athabasca, in central Alberta. Prized for fishing, boating and other outdoor pursuits, both lakes enjoy an active recreational community made up of permanent and seasonal residents, and casual day-users.

Although naturally rich in nutrients that can lead to mid-to late summer algal blooms (including blue-green algae or cyanobacteria), the health of both lakes is affected by the activities that surround them. Recreational activities on the lake can disturb fish and other wildlife. Lakeshore development can degrade shorelines (riparian areas) and affect water quality. Land use activities in the uplands, like agriculture and forestry, can affect runoff, bringing sediment and nutrients into the lakes via tributary streams. Taken together, the cumulative impacts of these activities, combined with climate variability or change, can impair recreational use, as well as lead to irreversible declines in water quality and lake health.

To manage these pressures, the Baptiste and Island Lakes Stewardship Society (BAILS), a group of Summer Village and County councillors and interested volunteers, formed in 2014 with the intent to undertake lake research and stewardship actions. Through their work, the need for a lake watershed management plan was identified, hence this document.

The *Baptiste and Island Lakes Watershed Management Plan* is the result of several years of work to fill data gaps, engage communities and stakeholders around both lakes, and identify actions that BAILS and its partners can undertake to protect lake health. The audience for this plan includes provincial and municipal decision-makers; lake, Indigenous and other communities; as well as landowners, lake users, industry and others who can use the plan to inform decisions and encourage stewardship actions that support the health of the Baptiste and Island Lakes watersheds.

While the plan identifies a long-term vision and goals, an accompanying action plan focusses in on what can be done in the next five years, at which point the plan should be re-visited to ensure the vision and goals are still relevant and achievable. The plan focuses on eight key topics, providing a review of what is known about each topic, what the issues are, and what can be done about these issues, as summarized briefly below:

- *A Watershed Approach*: Lake management is fragmented among several jurisdictions. However, all those with a mandate for some aspect of lake management can be brought together using a watershed approach. BAILS has initiated this process by first identifying all of the stakeholders in the Baptiste and Island lake watersheds; and second by engaging these stakeholders in discussions about lake health. Future work in this area should focus on continuing to engage decision-makers, stakeholders and others interested parties in acknowledgement and implementation of the Watershed Management Plan.

- *Stewardship:* To be successful, lake watershed management must include individual lake users as stewards of these resources. However, coordinating stewardship activities takes time and money. BAILS has been innovative in finding both financial and in-kind support in the past and will need to continue to do so in order to build capacity for stewardship initiatives in the future.
- *Knowledge:* Understanding the current state of health of Baptiste and Island lakes is key to managing these resources. Long term data collection and assessing trends is also important. BAILS has been active in finding answers about various aspects of lake health. This work should continue such that data gaps are filled, information is communicated to all who live, work or play in the watershed, and this in turn, builds knowledge and informs decision-making.
- *Lake Levels*: Like most lakes in Alberta, water levels on Baptiste and Island lakes fluctuate (as much as a meter and a half) seasonally and from year to year. Near-shore property owners and other lake users need to understand this variability, and be adaptive to it. Additionally, lake levels can be affected by human activities. Therefore, planning and development processes, as well as compliance and enforcement, must allow room for the lake's natural functions, via the use of environmental reserves, building setbacks, riparian stewardship, etc. Finally, we need to make sure that human activities are not influencing natural water levels around the lake (via impervious surfaces, culverts or other infrastructure) or near the streams flowing in and out of the lakes (via clearings, crossings, and other disturbances).
- *Water Quality*: Baptiste and Island lakes are both naturally nutrient rich, and Baptiste Lake is prone to blue-green algae (cyanobacteria) blooms. These conditions have been present for at least the last 200 years, though increases were seen during the settlement and land clearing period at the turn of the 20th century and again during the intensification of agriculture in the 1970s. More recently, nutrient levels have been relatively stable, probably as a result of improved septic management and the implementation of forestry beneficial management practices (e.g. stream buffers). To ensure additional nutrients are not added to Baptiste and Island lakes, BAILS can encourage residents, agriculture and industry to maintain healthy shorelines (riparian areas) along the lake as well as for streams that drain into the lake. The County and Summer Villages can look at policies and bylaws to reduce impervious surfaces and manage run-off appropriately. Similarly, BAILS should reach out to the agricultural community to ensure there is capacity to implement beneficial management practices that limit nutrients from entering streams and lakeshores (e.g., off-stream livestock watering).
- *Aquatic Ecosystem Health*: When engaged, lake users stated the importance of maintaining a healthy fishery and having opportunities to appreciate nature. While fisheries management is largely the responsibility of the Provincial Government, BAILS can work to protect these values by encouraging lake users to follow fishing and boating regulations. They can also build local knowledge and appreciation for local plants and animals as well as their habitat needs (e.g., the food and shelter required for healthy fish populations). Equally important, BAILS can educate lake users about invasive species that could threaten lake health.

- *Land Use*: While focus in the past has largely been on activities near the lake, this watershed management plan recognizes the need to understand the cumulative effects of various land uses found throughout the watershed that may in turn impact runoff and receiving waterbodies, and hence lake health. This includes recreation, lake and country residential development, agriculture, transportation and utilities, and industry (forestry, oil and gas, seismic, etc.). Understanding how each of these sectors impacts the lake is key, as is understanding how regulatory and voluntary best practices can be used to mitigate such impacts.
- *Climate Variability*: Climate variability is another factor that must be considered when understanding lake health as well as planning for development projects. While many of Alberta's municipal governments are preparing for climate events such as flood and drought, lake managers must also consider the impact of changing temperature and precipitation trends on lake water quality and quantity.

In implementing the watershed management plan, it is important to match priorities with available capacity. Hence an Implementation Committee might initially focus on improved communication and education, as this need was identified throughout the planning process. In particular, they might focus communication efforts on ensuring lake users understand existing rules and ensuring such rules are complied with. They might also ensure rules, such as building setback distances, are consistent between municipalities. Communicating the results of research and monitoring efforts is also important for building local knowledge and buy-in for plan actions.

Finally, the success of this plan will be dependent on the partnerships and collaborations generated to undertake implementation actions. Fortunately, there are few who would dispute the beauty and value of Baptiste and Island Lakes. Armed with the right information and tools, most are willing to take actions to protect the lakes, be they visitors, residents, governments or others. This plan helps identify these needed partnerships and the actions to be undertaken by each party, such that both lakes are healthy and sustained for current and future generations to enjoy.

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Acronyms and Abbreviations

ALIDP	Alberta Low Impact Development Partnership
ALMS	Alberta Lake Management Society
ALUS	Alternative Land Use Services Canada
ATV or OHV	All-terrain vehicle or Off-highway vehicle
AWC	Athabasca Watershed Council
AEP	Alberta Environment and Parks
AER	Alberta Energy Regulator
BAILS	Baptiste and Island Lakes Stewardship Society
°C	Degrees Celsius
dam^3	Cubic decameter, equivalent to 1,000 cubic metres
FMA	Forest Management Area
GOA	Government of Alberta
H2C	Highway 2 Conservation
IDP	Intermunicipal Development Plan
km or km^2	kilometres or square kilometres
LUB	Land Use Bylaw
m or m^3	Metres, cubic metres
mm	millimetres
MDP	Municipal Development Plan
NSWA	North Saskatchewan Watershed Alliance
RMA	Rural Municipalities of Alberta
SV	Summer Villages
WMP	Watershed Management Plan

1.0 Introduction

Baptiste Lake (named after an early Métis settler, Baptiste Majeau) is a moderate-sized lake located in the County of Athabasca in central Alberta, situated 165 kilometers (km) northwest of the City of Edmonton and 16 km west of the Town of Athabasca. The lake has a number of rural properties, lake communities, boat launches and campgrounds on it and is used for recreational fishing, boating and swimming. The Baptiste Lake watershed (i.e., the area of land that drains into the lake) is a mix of forested crown land and private agricultural lands.

About four km north of Baptiste Lake, Island Lake (so named because of the small islands scattered throughout the lake), is also valued by residents and visitors for its aesthetics and the recreational opportunities that it provides. The Island Lake watershed is also largely forested crown land, with some private agricultural lands and acreages. For a detailed description of both lakes, see the *Atlas of Alberta Lakes*, Baptiste and Island Lake pages, which provide descriptions as follows:

Baptiste Lake Physical Characteristics:

- Lake Surface Area = 9.81 km^2
- Max Length / Width = 7.48 km / 3.12 km
- Max / Mean Depth = 27.5 m / 8.6 m
- Lake Elevation = 579 m
- Lake Volume = ~85,500 dam^3
- Watershed Area = 288 km^2

Island Lake Physical Characteristics:

- Lake Surface Area = 7.81 km^2
- Max Length / Width = 6.2 km / 3.3 km
- Max / Mean Depth = 18 m / 3.7 m
- Lake Elevation = 600 m
- Lake Volume = ~29,066 dam^3
- Watershed Area = 63.2 km^2

Over the past several decades, growing concerns have been raised about Baptiste and Island lakes including issues such as blue-green algae (cyanobacteria) blooms, high or low lake levels, and poor fishing. Baptiste Lake has been the subject of many detailed research projects, and a great deal of technical information is available for this lake (for a short list of some of these resources, see Appendix 2). Island Lake is less well studied although water quality and lake level are measured regularly.

1.1 Previous Initiatives

Concerns about lake health are not new and Alberta has been looking at the issues affecting these resources for several decades, going back as early as 1943, when R.B. Miller[1] first surveyed Baptiste and many other Alberta lakes. A growing interest in lake management spurred a great deal of research work in the 1970s and 1980s in Alberta and elsewhere. These efforts focused on understanding lake

[1] Miller, R.B. 1943. Report of a survey of Baptiste Lake conducted July 1943. Report of the Provincial Fisheries Branch. 13 pp.

characteristics (e.g. size, depth, biota, etc.), water inputs and outputs (i.e. precipitation, evapotranspiration, etc.), and factors affecting water quality, quantity and other aspects of lake health.

A good place to access much of this research is the Athabasca University's Athabasca River Basin Research Institute Repository which identifies approximately 100 documents that reference Baptiste and/or Island Lakes. Concerns about the growing intensity of watershed and shoreline development around Baptiste Lake led to the formation of the Baptiste Lake Property Owners Association in the 1970s, as well as a number of studies, surveys and public hearings to examine this issue. To guide early development, a Baptiste Lake Preliminary Management Plan was created by Alberta Municipal Affairs in 1978 and an area structure plan was created by Athabasca County in 1979.

From 1976 – 1979, Baptiste Lake was intensively studied by Trew and others[2,3] in order to better understand its ability to withstand development pressure. This study determined the 'trophic status', or level of biological activity, of the lake by looking at the lake's limnology, annual phosphorus cycle, tributary and internal loading, sediment, groundwater, etc. The impact of existing and future shoreline and watershed development was also examined. With a solid understanding of the lake, later researchers such as Cooke and Prepas[4], continued to examine the impact of activities such as agriculture and forestry in the uplands surrounding the lake.

Throughout the 1990s and 2000s, researchers continued to study various aspects of these two lakes including paleolimnology, hydrology, groundwater, fisheries and other biota, nutrient loading, etc. Although there are fewer early studies for Island Lake, this lake has been a part of the ALMS LakeWatch Program for more than a decade, with water quality reports available on their website for 2005, 2012 and 2017. Summarizing these earlier works, a state of the lake report was completed for Baptiste Lake in 2008. Similarly, a state of the lake report was completed for Island Lake in 2011.

In 2014, the Baptiste and Island Lakes Stewardship Society (BAILS) was incorporated with the goal of addressing watershed management issues for both lakes.[5] A series of informal meetings was held during 2014 and 2015 to identify individuals willing to investigate a number of shared concerns. BAILS then approached the North Saskatchewan Watershed Alliance (NSWA) for assistance in developing a Watershed Management Plan (WMP) that would identify issues and propose solutions for both lakes.

1.2 Purpose

The Baptiste and Island Lakes Watershed Management Plan (i.e., this report) was prepared via a collaborative planning initiative conducted by BAILS, the six Summer Villages of both lakes, the County

[2] Trew, D.O., D.J. Beliveau and E.I. Yonge. 1978. The Baptiste Lake study summary report. Alta. Envir., Poll. Contr. Div., Water Qlty. Contr. Br., Edmonton.
[3] Trew, D.O., Beliveau, D.J. & Yonge, E.I. 1987. The Baptiste Lake Study: Technical Report. Alberta Environment, Pollution Control Division, Water Quality Control Branch. 381 pp
[4] Cooke, S.E. & Prepas, E.E. 1998. Stream phosphorus and nitrogen export from agricultural and forested watersheds on the boreal plain. Canadian journal of Fisheries and Aquatic Sciences, Vol. 55: 2292-2299.
[5] Note that in forming, BAILS was provided seed funding from a previous collaboration, the Baptiste, Island and Skeleton Lakes Stewardship Society.

of Athabasca, and other key partners and interested individuals who participated in the process. The North Saskatchewan Watershed Alliance provided secretariat and technical support.

Although naturally nutrient-rich, Baptiste and Island lakes are both affected by various human activities that may further contribute to the deterioration of desired natural and aesthetic features. Guidance is needed to balance these activities, taking into consideration the natural limits and resiliency of both lakes. The Baptiste and Island Lakes Watershed Management Plan strives to provide this guidance, providing long-term direction to maintain the quality of the lakes and their watersheds. This work is consistent with provincial goals for water management, as detailed in the Government of Alberta's *Water for Life* strategy.

A Lake Watershed Management Plan (WMP) is an action plan to protect, restore and/or enhance the features that make a lake special and that keep it healthy, for current and future users. Although watershed management plans are only advisory in Alberta, it is hoped that development and implementation of the plan will contribute to the following:

- Identifying and protecting lake values
- Promoting community discussion and action
- Knowledge-building of both residents and visitors
- Establishing environmental and social objectives
- Setting measurable indicators of lake health
- Recommending land use policies
- Guiding stewardship actions including restoration efforts

Plan goals will be achieved through a mix of individual, community, agricultural and industry stewardship, as well as local and provincial government policy and land use planning. It may also require regulatory bodies to clarify, harmonize and/or modify existing policies and practices, as well as implementation of best practices by all stakeholders. The Baptiste and Island Lakes Watershed Management Plan is a long range, living document (i.e. planning is an iterative and adaptive process) that will continue to evolve as circumstances and issues change. The scope of the plan includes the Baptiste and Island Lake watersheds, which includes the two lakes proper, as well as all the lands, streams and smaller waterbodies (e.g., Ghost Lake) draining into them.

1.3 Methodology

In developing this WMP, BAILS undertook a number of steps as follows:

- Developed a project terms of reference (approved by the BAILS Board Dec 9, 2015);
- Obtained the Alberta Community Partnership Intermunicipal Collaboration Grant ($25,000) to support this work;

- Organized volunteer Steering and Technical Committees from members of the community (November 2016), which in turn developed workplans and timelines;
- Engaged the lake community by sending out newsletters in June and July, 2015 and hosting community engagement sessions in May and June, 2017. These sessions documented issues as well as community aspirations/values for the enjoyment of both lakes and their watersheds;
- Identified several technical projects to address key issues of concern and to inform knowledge gaps identified in the state of the watershed reports (e.g. riparian health, stream water quality, status of fisheries, etc.). Working groups were then established to undertake several technical projects. Two working groups (Water Quality and Riparian Health) presented their findings at a Public Engagement Session in July 2017; all team results were shared with the public on June 9, 2018; and
- Drafted the watershed management plan including several goals, as well as the strategies and actions required to achieve goals. A five-year (2019-2024) action plan also identifies potential action leads, partners and preliminary performance measures.
- Sought feedback on the draft plan (by posting it on the BAILS website, sending a notice to the BAILS membership, as well as circulating it to the GOA, Indigenous communities in the general area and other interested parties) before preparing a final document.

1.4 Values and Vision

Throughout the process and again at the February 2018 BAILS Annual General Meeting, participants discussed their shared values that inform their stewardship actions at both Baptiste and Island lakes. These can be summarized as:

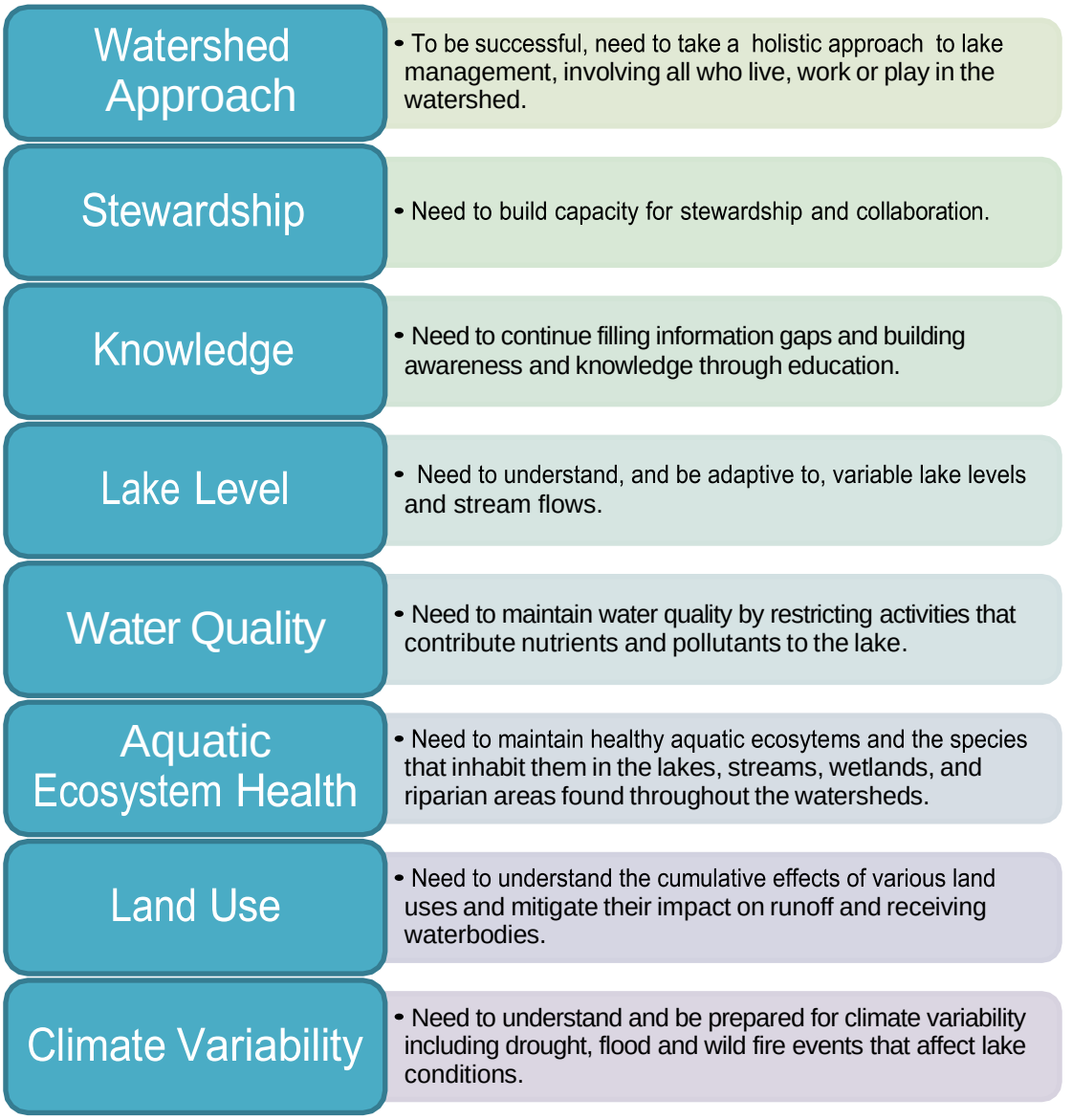
- Clean water / better water quality / slowing down 'eutrophication' (i.e. by limiting nutrients)
- Healthy riparian areas / stable, naturalized shoreline with less erosion and better resiliency to variable lake levels
- Healthy, sustainable fisheries and other biodiversity
- Responsible lake use by engaged stewards who are compliant with rules and regulations
- Easily accessible public information about what individuals can voluntarily do to protect the lakes
- A watershed management plan in place to guide actions

From this discussion, a vision to guide the watershed management plan was developed as follows:

> *Clear water and a natural shoreline in a clean, unpolluted lake that can sustain a variety of healthy plants and animals, with a balance of recreational use and development, in a well-managed watershed.*

1.5 Issues to be Addressed

Throughout their work, and via their public engagement sessions, the Steering and Technical committees identified a number of issues standing in the way of achieving their shared vision. These issues can be grouped into several key areas or themes as follows:



These key themes make up the body of the watershed management plan and are discussed in more detail in the next sections. For each theme, the plan looks at:

- What is the issue?
- What is known about it?
- What can be done about it? *Note that the goals, strategies and actions discussed below apply to both Baptiste and Island lakes, unless otherwise noted.*

2.0 Key Themes

2.1 A Watershed Approach

What is the issue?

Baptiste and Island lakes, like many Alberta waterbodies, are highly valued by the people who live at or visit these lakes, and for a variety of reasons such as aesthetics, recreation, rural living, connecting to nature, etc. Hence it is no surprise that lake users want to see these values maintained, both today and in perpetuity. That is, Albertans want to see the lake resource managed, with the same care and attention we manage our other natural resources.

Over the past several decades, lake managers have come to understand that lakes cannot be managed in isolation of what occurs around them. Hence, more and more, a watershed approach is required. The watershed of a lake includes all of the land that drains into it. Activities on the land can affect how water (via runoff, groundwater and tributary flows) drains to the lake, in turn, determining lake level, water quality, and other lake characteristics.

Jurisdiction for watershed management in Alberta is held by several land and water authorities, including municipal, provincial, and federal governments. The way in which Baptiste and Island Lakes are managed and protected is a concern to many area stakeholders. Concerns identified during stakeholder engagement related to a lack of policy alignment between jurisdictions, lack of long-term land use planning to maintain lake sustainability, limited enforcement of regulations and inadequate funding for lake watershed management.

What do we know about it?

Baptiste Lake is a moderate sized Alberta lake with a surface area of 9.81 square kilometers (km^2). It has two distinct basins joined by a shallow (less than 6 m) narrows (Figure 1). The basins are of similar size; the north basin is shallow (with a maximum depth of 16 m), whereas the south basin is deeper (27.5 m maximum depth). The Baptiste Lake watershed is about 30 times (288 km^2) the size of the lake (Figure 2). The watershed includes 12 tributary streams (sub-watersheds) which drain 92% of the watershed into the lake (the remaining 8% of the watershed drains directly from the land to the lake by way of diffuse runoff).

Island Lake is also a moderately sized Alberta Lake (Figure 3) with a surface area of a little less than 8 km^2. It also has two distinct basins: a fairly shallow main basin (6 – 12 m deep) and a smaller, deeper north basin (maximum depth 18 m). The Island Lake watershed is about eight times the size of the lake (about 63 km^2), mostly to the north and west of the lake (Figure 4).[6] Island Lake receives flows from Ghost Lake (which drains 37% of the watershed), as well as a number of smaller seasonal creeks that drain the remainder of the watershed.

[6] For more detailed descriptions of Baptiste and Island Lake watersheds, see the Atlas of Alberta Lakes.

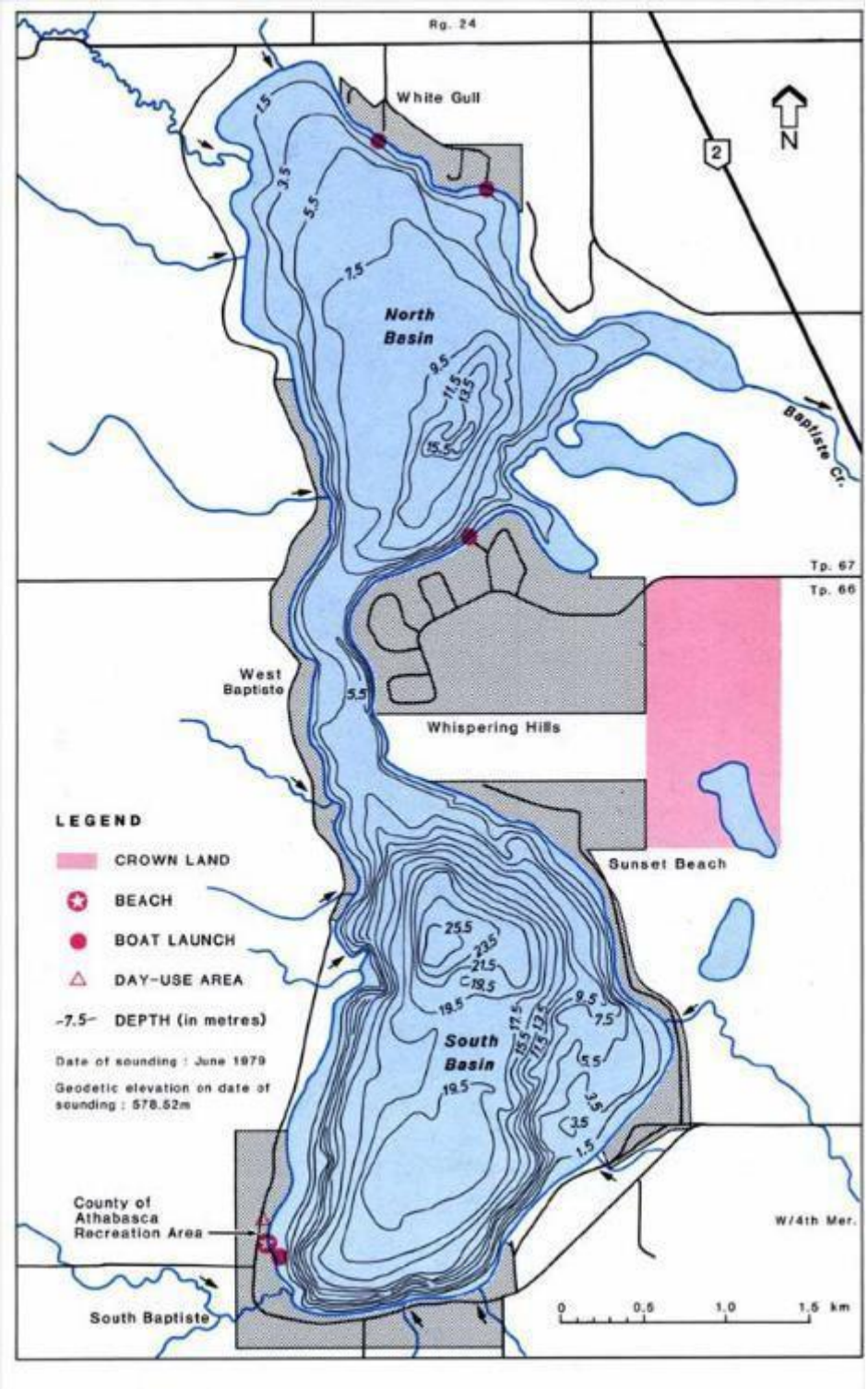


Figure 1. Baptiste Lake – Bathymetry (Source: Mitchell, P. and Prepas E. "Atlas of Alberta Lakes", University of Alberta Press, January 1990.

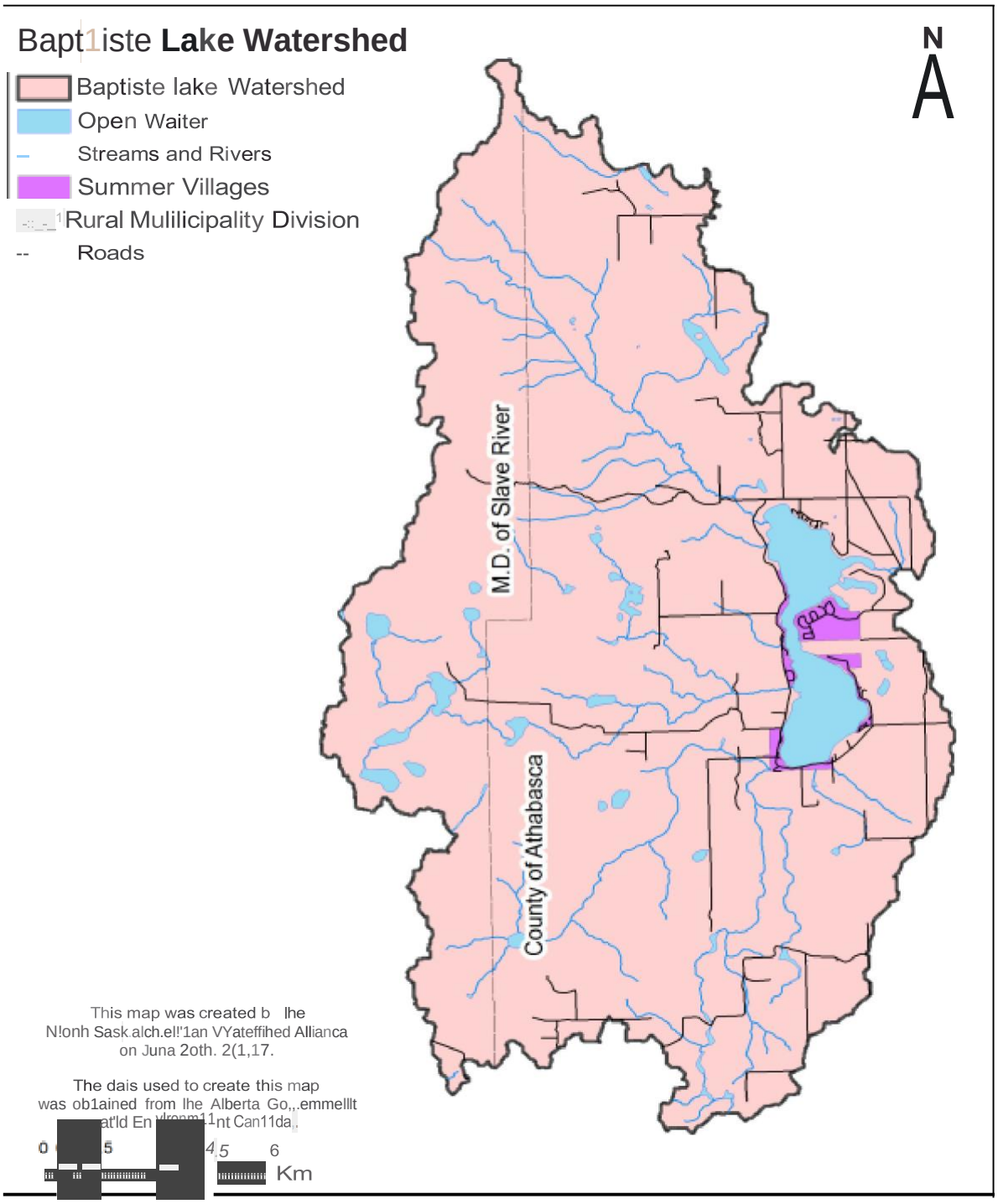


Figure 2. Baptiste Lake Watershed

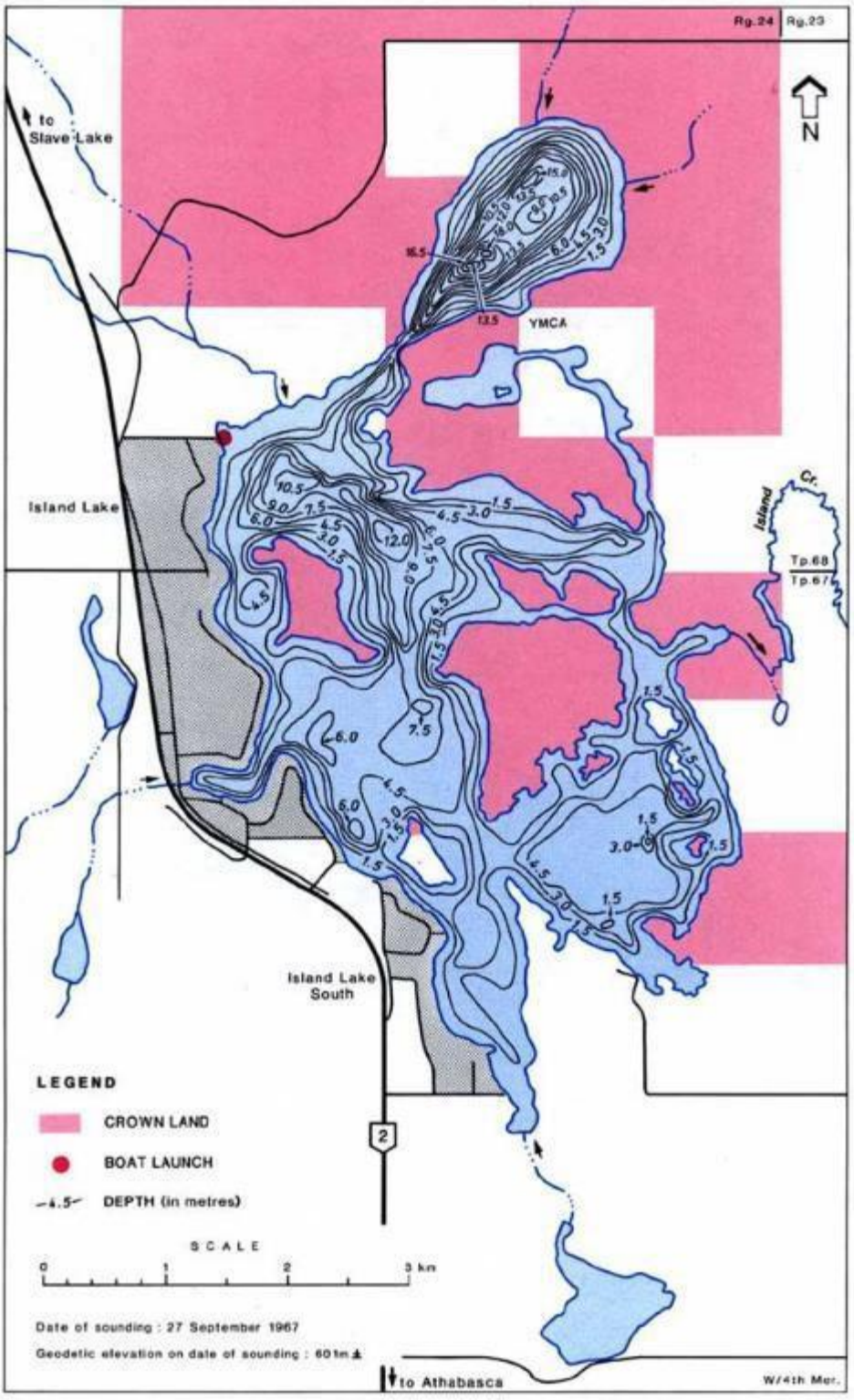


Figure 3. Island Lake – Bathymetry (Source: Mitchell, P. and Prepas E. "Atlas of Alberta Lakes", University of Alberta Press, January 1990.

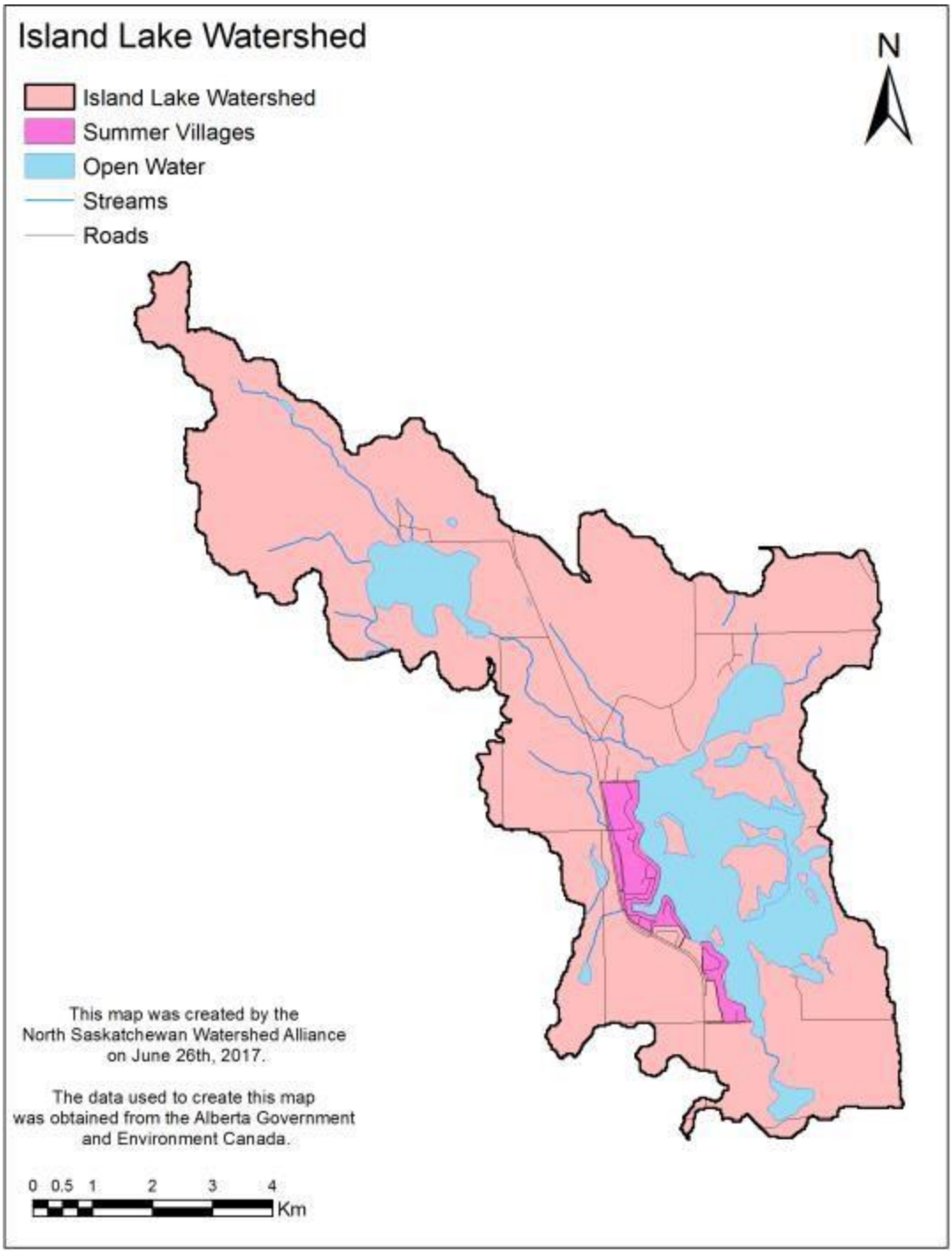


Figure 4. Island Lake Watershed

Both Baptiste and Island lakes outflow to the Athabasca River (via Baptiste and Island creeks, respectively), just before it flows through the Town of Athabasca. These two lake watersheds are located in the 'Upper Central Athabasca Sub-watershed', one of nine sub-watersheds that make up the Athabasca River watershed (Figure 5).[7] This area is a part of the Boreal Forest Natural Region, with a cold, sub-humid continental climate. Winters are long and cold. Summers are short and warm (Figure 6). Annual precipitation (1981 – 2010) is about 460 mm, although it has varied from 304 mm (2015) to 607 mm (1988). Most precipitation falls in June and July. About 25% falls as snow between late October through to mid-April (Figure 7).[8]

Provincially, there are a number of policies (e.g. *Water for Life*, Land Use Framework, Alberta's Wetland Policy, etc.), pieces of legislation (e.g. *Water Act*, *Public Lands Act*, *Environmental Protection and Enhancement Act*, *Municipal Governments Act*, etc.), and guidance documents (e.g. *Stepping Back from the Water*) that influence aspects of watershed management in Alberta.[9] The *Water for Life* strategy recognizes the need to take a watershed approach and promotes understanding through The Water Channel and Water Literacy survey. As a part of *Water for Life* work, Alberta Environment and Parks (AEP) engaged Albertans in a discussion about lake management via the 'Water Conversations'. They also sought advice on lake watershed management via the multi-stakeholder Alberta Water Council process (see their lake watershed management project page).

Regionally, the Athabasca Watershed Council (AWC) was formed to work towards achieving the *Water for Life* goals in the Athabasca River watershed. This multi-stakeholder, not-for-profit organization, formed in 2009, is one of 11 Watershed and Planning Advisory Councils created in the province to give sectors and people living, working and playing in each watershed an opportunity to participate in watershed assessment and management planning. The work of the AWC is guided by its vision: *The Athabasca watershed is ecologically healthy, diverse and dynamic.* The AWC has just (2018) initiated work on a watershed management plan that will further define what this vision means for surface and ground water quality and quantity, as well as for aquatic ecosystem health in the Athabasca watershed. In the meantime, the AWC has been, and will continue to be, supportive of sub-basin and lake watershed assessment and planning initiatives throughout the Athabasca basin.

Baptiste and Island Lakes also fall within Alberta's Land Use Framework's Upper Athabasca Region. As of yet (2018), there is no regional plan for this area. However, the Lower Athabasca Regional Plan provides guidance in that it has led to the development of management frameworks for surface and ground water quantity and quality. Similarly, work to date on the North Saskatchewan Regional Plan to the south recognizes the importance of lakes for recreation and other human uses, as well as for their role in maintaining hydrological function in the watershed.

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[7] For more information about the Athabasca watershed, see About the Athabasca River Basin on the Athabasca River Basin Research Institute (ARBRI) webpage.
[8] S. Figliuzzi and Associates. 2018. *Water Balance for Baptiste Lake, Alberta* , submitted to NSWA, April, 2018.
[9] For an overview of lake legislation, see the Recommendations for Lake Watershed Management in Alberta produced by the Alberta Water Council.

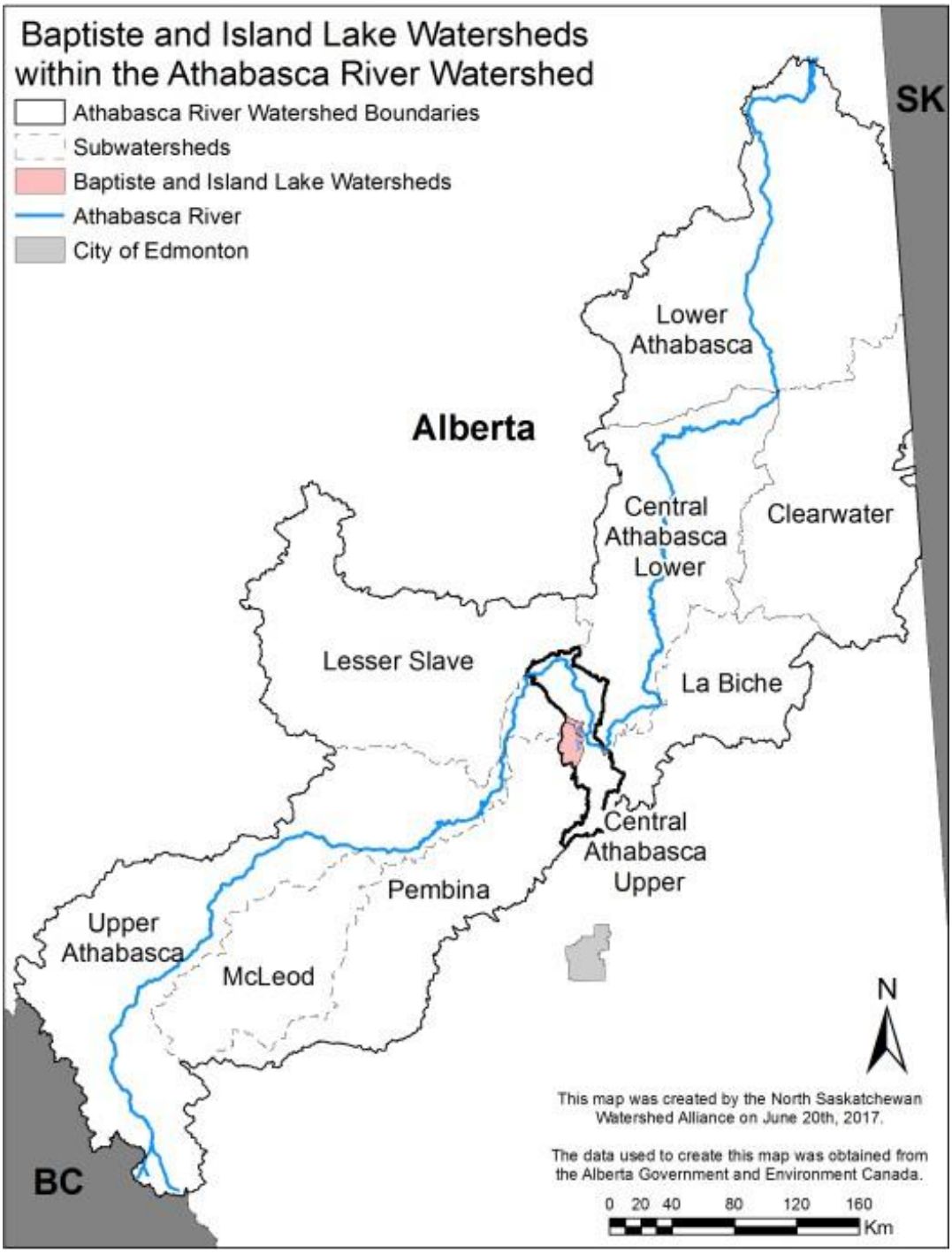


Figure 5. Baptiste and Island Lakes are in the Central Athabasca Upper Sub-watershed, one of nine sub-watersheds that contribute to the Athabasca River in Alberta.

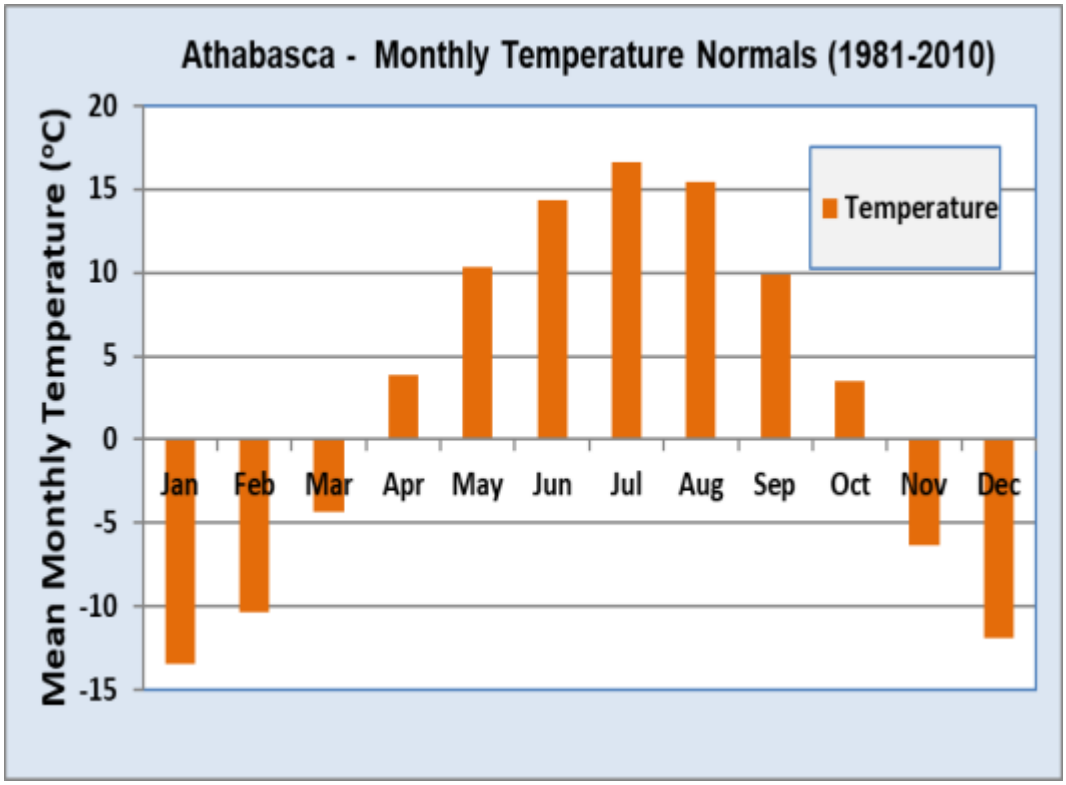


Figure 6. Monthly Temperature Normals, 1981 – 2010 (Source: S. Figliuzzi, April 2018)

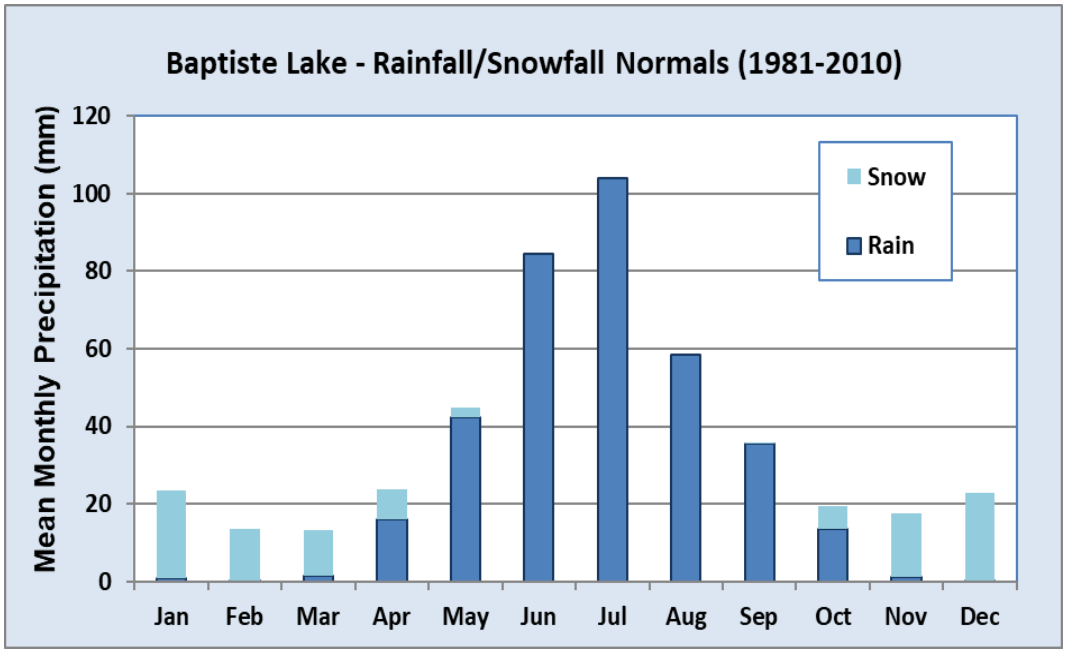


Figure 7. Monthly Precipitation Normals, 1981 – 2010 (Source: S. Figliuzzi, April 2018)

Recent provincial changes to the *Municipal Government Act* (MGA) support efforts by Alberta's municipalities to balance development around lakes and other waterbodies. For the most part, Baptiste and Island Lakes (and their watersheds) fall within the County of Athabasca and there are several properties, as well as the unincorporated communities of White Gull Beach and Poplar Point, under County jurisdiction around both lakes.

An objective of the Athabasca County Municipal Development Plan (2008) is to "*maintain the existing residential environments around those lakes in the County which have experienced extensive residential development in the past, and to not allow residential development around those lakes which would reduce the quality of the residential environments or change the natural environments (including trophic status) of those lakes.*"

The County has a number of policies and bylaws to govern development within its boundaries including a Municipal Development Plan (MDP) and a Land Use Bylaw (LUB). These documents include several statements favorable to balancing development, recreation and other activities around Baptiste, Island and other lakes in the county. In particular, they can take environmental reserve at the time of subdivision; limit building within 30 m of the lake shoreline; and require development applicants to minimize disturbance of the shoreline vegetation and aquatic life. Note that the far western portion of the Baptiste Lake watershed, where a number of tributary headwaters are located, falls within the Municipal District of Lesser Slave River.

Summer Villages also play an important role in managing development around Baptiste and Island lakes. Baptiste Lake has four summer villages around its shoreline. Island Lake has two summer villages (Table 1). Similar to the County, Summer Villages have a number of policy and regulatory documents that balance development and lake health. For example, most have the ability to designate environmental reserve at subdivision; require building setbacks from shore-facing property lines (although definitions and distances vary between summer villages); limit the percentage of the lot that can be developed and/or cleared of trees/vegetation (again, percentages vary); and some limit development in a floodplain or highly sloped area or that would have an adverse effect on lake water quality or on the aesthetics of the lakeshore.

Table 1. Municipalities in and around the Baptiste and Island Lake watersheds.

Municipality	Description	Key Documents:
Athabasca County	Incorporated as a county in 1945. Population 7,869 (2016). Responsible for county lands around the lake.	Municipal Development Plan (includes a Lakeshore Management Areas Policy), Land Use Bylaws, Town & County Intermunicipal Development Plan
Summer Village of Sunset Beach	Incorporated 1977. Located on the east shore of Baptiste Lake. 130 properties. Resident population 49 (2016).	Land Use Bylaw; draft sewage bylaw; OHV Bylaw
Summer Village of South Baptiste	Incorporated 1983. Located on the south shore of Baptiste Lake. 89 properties. Resident population 66 (2016).	Land Use Bylaw, Sewage Bylaw
Summer Village of Whispering Hills	Incorporated 1983. Located on the east shore of Baptiste Lake. 214 properties. Resident population 142 (2016).	Land Use Bylaw; Sewage Bylaw
Summer Village of West Baptiste	Incorporated 1982. 120 properties located along the west shore of Baptiste Lake. Resident population 38 (2016). The village has its own recreational building combined with a firehall.	Land Use Bylaw; Sewage Bylaw
Summer Village of Island Lake	Incorporated 1957. 287 residences. Accessible from Highway 2. Located on the west shore of Island Lake. Resident population 228 (2016).	Land Use Bylaw; Sewage Bylaw; Bylaw to Prohibit Clearing of Lots
Summer Village of Island Lake South	Incorporated 1983. 105 residences. Accessible from Highway 2 located on the south shore of Island Lake. Resident population 61 (2016).	Land Use Bylaw; Sewage Bylaw
White Gull (unincorporated)	Was previously a summer village: now administered by Athabasca County	Managed under Athabasca County's Municipal Development Plan and Land Use Bylaw
Town of Athabasca	Incorporated as a town in 1911. Population 2,965 (2016). No management authority but lake used by town residents for recreation.	Land Use Bylaw (2015); Municipal Development Plan

What can we do about it?

BAILS has taken an important first step in addressing the fragmented nature of lake management by recognizing the need to take a watershed approach. Going forward, they can continue to promote this approach to other land and water managers and decision-makers in the Baptiste and Island lake watersheds. A watershed management plan that is accepted by provincial and local governments will bring alignment as it is implemented. In turn, the WMP can also inform other municipal, regional and provincial planning initiatives.

The Issue: Watershed management roles and responsibilities are fragmented with limited integration between land and water. There is also limited policy and planning alignment between and among the provincial government and municipalities managing lakes and watersheds. To be successful, lake management requires land and water managers to take a holistic and integrated approach to managing cumulative impacts, involving all who live, work or play in the watershed.		
Goal: The Baptiste and Island watersheds are recognized as critical to lake health and managed in an integrated, collaborative manner by the provincial and municipal governments.		**Lead/ Partners**
Strategies:	Develop a watershed management plan implementation committee to oversee and report on WMP implementation progress.	BAILS / Stakeholders
	Submit the WMP to the GOA and the Athabasca Watershed Council and ask for recognition of this advisory plan, as well as recognition of the need for lake watershed management, in future planning documents including the Upper Athabasca Regional Plan and Athabasca Integrated Watershed Management Plan, when they are developed.	BAILS / GOA (AEP), AWC
	Submit the plan to M.D. of Lesser Slave River, Athabasca County and the 6 Summer Villages on Baptiste and Island lakes and ask them to formally acknowledge the plan in their policy and planning documents, as such documents are developed or renewed.	BAILS / Athabasca County, 6 Summer Villages, M.D. LSR
	Review and align Intermunicipal Development Plans, Municipal Development Plans, Land Use Bylaws and other policies such that development rules (e.g. setback distances, lot coverage, tree clearing policies, etc.), incorporate best management practices and are consistent around both lakes.	Athabasca County /6 Summer Villages

2.2 Stewardship

What is the issue?

Baptiste and Island Lakes already have a small engaged community of lake stewards willing to work towards maintaining lake health. The need for a strong stewardship community and collaboration with others were common themes heard throughout the WMP development process. However, maintaining and growing this stewardship community requires both financial and human capacity.

What do we know about it?

Long-time residents and users of Baptiste and Island lakes have significant knowledge and insight into the history and condition of the lakes and their watersheds and the problems both lakes experience. All residents and users of the two lakes should have a voice in determining the long-term future of the lakes; as well, they can play a meaningful role in lake watershed management. Currently, however, there is limited community involvement and participation in promoting environmentally-responsible stewardship. Additionally, BAILS has limited resources for implementing watershed management actions such as water quality monitoring, research, education and outreach, etc. to inform stewardship actions.

What can we do about it?

Going forward, it is important to recognize that lake watershed management is a long-term commitment and changes in behaviour and lake health won't occur overnight. Hence it is important that the WMP identify priorities and that the Implementation Committee and its partners choose a few key actions it can make progress on, versus a lot of things it doesn't have the capacity for. In the meantime, there are a number of provincial resources and water-related programs that the Committee can draw on to help leverage its efforts (some of these are listed in Appendix 2 – General Watershed Resources).

The Issue: Building and maintaining an engaged stewardship community takes human and financial capacity. Additionally, funding for research, monitoring and other management activities is required.		
Goal: The Implementation Committee is adequately resourced to undertake its work.		**Lead**
Strategies:	Solicit grants and in-kind support for studies, staffing, events, etc. via innovative community collaboration and funding initiatives, municipal and government grant programs (e.g. AEP Watershed Restoration and Resiliency Program, ECCC Environmental Damages fund), industry in-kind support, etc.	BAILS
	Leverage resources by partnering with existing programs such as Alberta Lake Management Society's Lake Watch, Living by Water, Cows and Fish, Highway 2 Conservation, AEP Respect our Lakes program, etc.	BAILS/ lake programs
Goal: Stewardship initiatives are well-supported by the community and other stakeholders in the watershed.		**Lead**
Strategies:	Increase participation in WMP implementation activities by engaging residents, industry, youth, etc. and celebrating successes. (See more actions to support this strategy in Appendix 3 – Five Year Implementation Strategy.)	BAILS

2.3 Knowledge

What is the issue?

A lack of information, knowledge and education was a common theme mentioned throughout the WMP process. Researchers have pointed out where there are data and information gaps. Stakeholders voiced concern over a lack of understanding within the community about how human activities affect the lakes and their watersheds, as well as misconceptions around what a healthy lake looks like. They also recognized the importance of education in improving awareness about lake health and management and towards creating an engaged local community of watershed stewards.

What do we know about it?

Throughout the WMP process, BAILS has worked to gather both existing and new information about Baptiste and Island Lakes, in order to improve understanding about lake health. BAILS has also shared this information with others, via its website, member meetings and public engagement sessions, in order to build knowledge and understanding, among those who live, work or play in the watershed.

What can we do about it?

When asked, stakeholder aspirations and solutions were overwhelmingly in support of increasing watershed and lake education (and information-sharing) within the community, including stakeholders and the general public. In particular, education should focus on what people can do to contribute to achieving and maintaining healthy lake ecosystems. As well, it should focus on educating stakeholders on the environmentally sustainable use of public lands surrounding Baptiste and Island Lakes. To do this, BAILS can tap into a number of existing online and other resources such as the GOA's Respect Our Lakes program.

The Issue: Information and knowledge about lake issues and how human activities affect lakes and their watersheds, is not always easily available or widely disseminated. As well, people have misconceptions about what a healthy lake looks like and what they can do to protect the lakes.		
Goal: Those that live, work or play in the Baptiste and Island Lake watersheds are knowledgeable about lake health and know what they can do to reduce their impact.		**Lead**
Strategies:	Educate targeted audiences (youth, property owners, etc.) about lake health and the WMP using existing programs such as ALMS, Respect Our lakes, AEP's Water Literacy program, etc. (See more about creating a communications committee and plan under actions in Appendix 3.)	BAILS
	Partner with academia and other lake/stewardship groups to promote education through citizen science projects.	
	Develop a Resident Information Kit and distribute to lake users via the Summer Villages, Town and County offices, realtor offices, etc.	

2.4 Lake Levels

What is the issue?

Lake water levels rise and fall throughout the seasons and over the years in response to the local weather and overall climate conditions. Water levels for a number of Alberta lakes, including Baptiste and Island lakes, were summarized by Buendia and Trew (2017)[10] for the period 1985 to 2016. This summary shows both Baptiste and Island lakes having periods where the lake level was below average, as well as periods above average. Despite this natural variability, water levels at Baptiste and Island Lakes are an ongoing concern for lake residents. In particular, water levels at Baptiste Lake, much below normal a decade ago, have been high in recent years, according to lake users. Water levels at Island Lake fell more than one metre in the late 1990s, but have been slowly returning to normal in recent years.

High water can erode the shore and increase the risk of wave and ice damage to shoreline properties and infrastructure built too close to the high-water mark.[11,12] This is why many subdivision developments either have a 30 m environmental reserve or require a minimum building setback from the shore-facing property line. High water levels can have both positive and negative impacts on water quality. In areas with healthy shorelines, flooding can revitalize biological productivity and diversity. However, in areas with shoreline degradation, flooding can increase erosion. Conversely, low water levels can affect water quality as lake flushing may occur more slowly in low water years.

What do we know about it?

Many factors contribute to fluctuating lake water levels. Water levels at Baptiste and Island lakes naturally vary a great deal between seasons. High water often occurs in the spring as the snow melts across the landscape and runoff is carried to the lakes via several small streams. At this time of year, the volume of water coming into a lake can exceed the volume exiting, resulting in high water and sometimes flooding of properties too close to the shoreline. High summer rainfall events can result in similar problems. Increasing summer temperatures with high evaporation usually draw down and resolve flooding issues, but can affect summer recreation and aesthetics if a lake becomes too low. Lake level can also affect water temperature and other aspects of water quality and aquatic ecosystem health.

The ratio of drainage basin area to lake area is an important factor influencing lake level. Lakes with proportionately large drainage basins usually receive more runoff, so the lake volume may exceed the capacity of the lake outflow, causing a rise in lake water levels. Baptiste Lake has a large drainage area of approximately 291 km^2 in relation to its lake surface area (about 9 km^2), more than 30 times the area of the lake. Hence it receives a large inflow of water from its 12 creeks and many diffuse runoff areas that drain directly into the lake. The lake has a re-filling time of about five years and is considered “well flushed’ compared to other Alberta Lakes (Figure 8). Island lake has a smaller watershed to lake ratio

[10] See C. Buendia and D. Trew. 2017. NSWA Technical Bulletin: Lake Level Trends in Alberta – Preliminary Results.

[11] For more information on what residents can do during and after high lake level events, please see Alberta Environment and Parks *High Water and Lakeshores* webpage.

[12] High Water Mark is defined in *Stepping Back from the Water* as “the usual or average level to which a body of water rises at its highest point and remains for sufficient time so as to change the characteristics of the land….”

(about 6:1), and fewer streams, but because it is relatively shallow (low lake volume), it also has a rapid re-filling time of about 4 to 5 years.

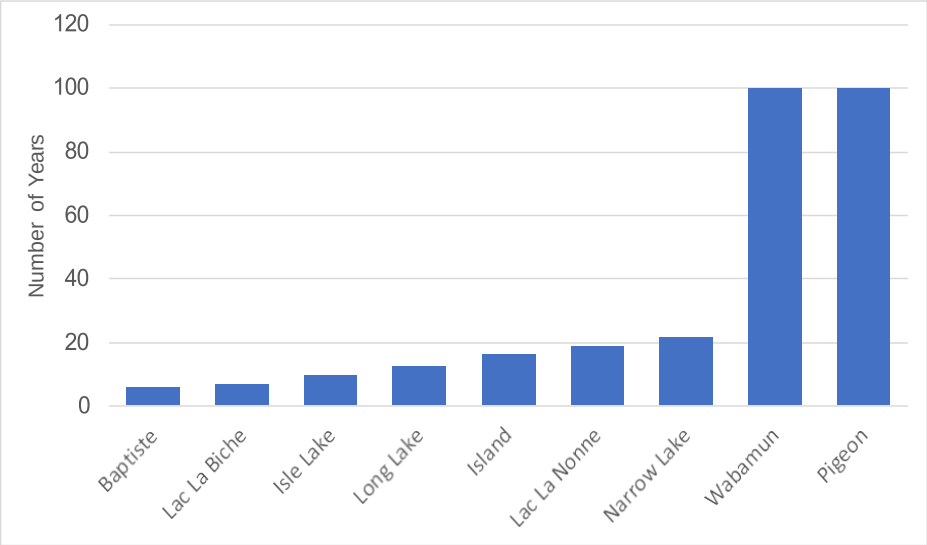


Figure 8. The average time required to completely replace the total volume of a lake with inflowing water. (Source: Mitchell, P. and E. Prepas. 1990. The Atlas of Alberta Lakes, University of Alberta Press.)

Precipitation patterns may change in the future depending on how climate change affects this region. In recent years, watersheds in Athabasca County have experienced higher than average precipitation. In particular, the County received an extreme level of precipitation in July 2017 (222.5 mm)[13], about three times the amount of rainfall normally received (~ 70 mm) in the area for that month. In general, however, gross evaporation exceeds precipitation during most of the year (Figure 9).[14]

Runoff can also be influenced by soil moisture. When the soil is saturated and rain continues to fall, the rainfall will immediately produce surface runoff. This was seen at Baptiste Lake in 2017, after the July precipitation event when soils became saturated, stream flow was high and lake water levels responded to these wet conditions. Natural features, such as wetlands and riparian areas, can help soak up excess waters, slowing water release over time.

Despite this natural variability, looking over the long term, data (from 1972 – 2009) suggests that water volumes have been fairly stable at Baptiste Lake. Average water level is 578.296 m, with a maximum of 579.199 m (July 1986) and a minimum of 577.842 m (October 2009): all told, a variance of 1.5 m. Note that when high water levels occur, the outlet is usually able to pass large quantities of water rapidly (if large amounts of debris and/or beaver dams are not present) and high-water periods are usually fairly short-lived (Figure 10). Lake level data is important for evaluating trends and developing lake water balances and outflow rating curves.

[13] For more information about high water levels, see this Information Sheet developed by the Summer Village of South Baptiste.
[14] S. Figluizzi *Water Balance Presentation* to the BAILS Technical Committee, April 13, 2018.

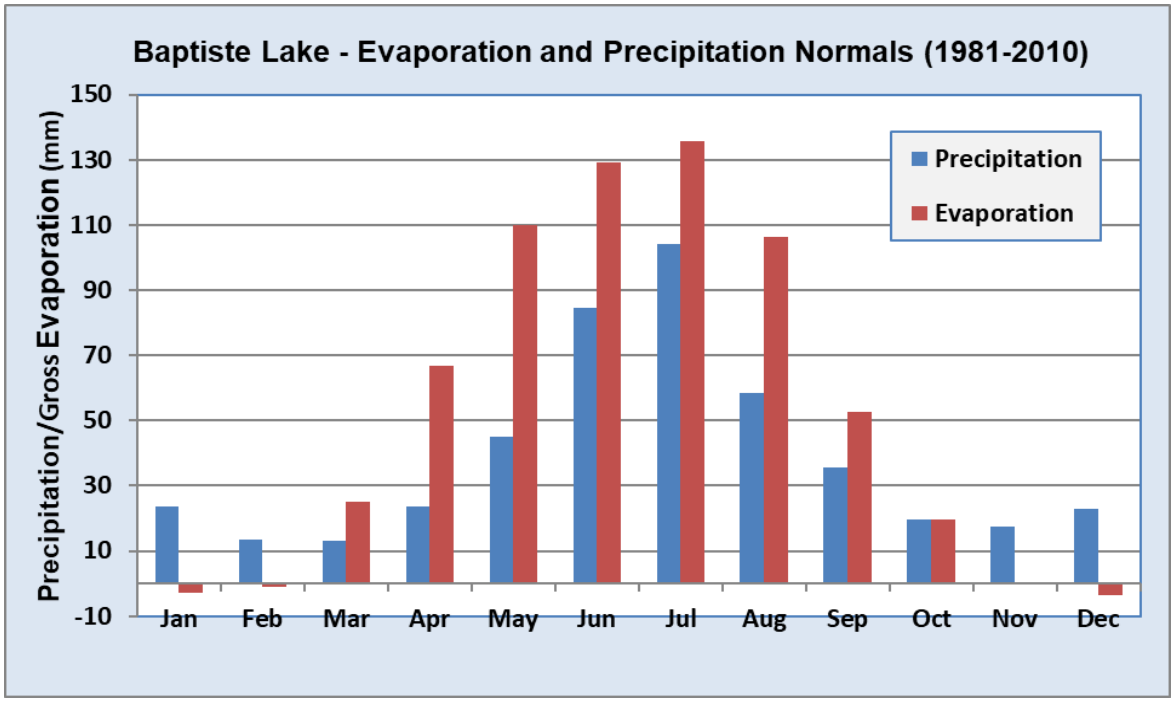


Figure 9. Baptiste Lake Evaporation and Precipitation, 1981 – 2010 (Source: S. Figliuzzi, April 2018)

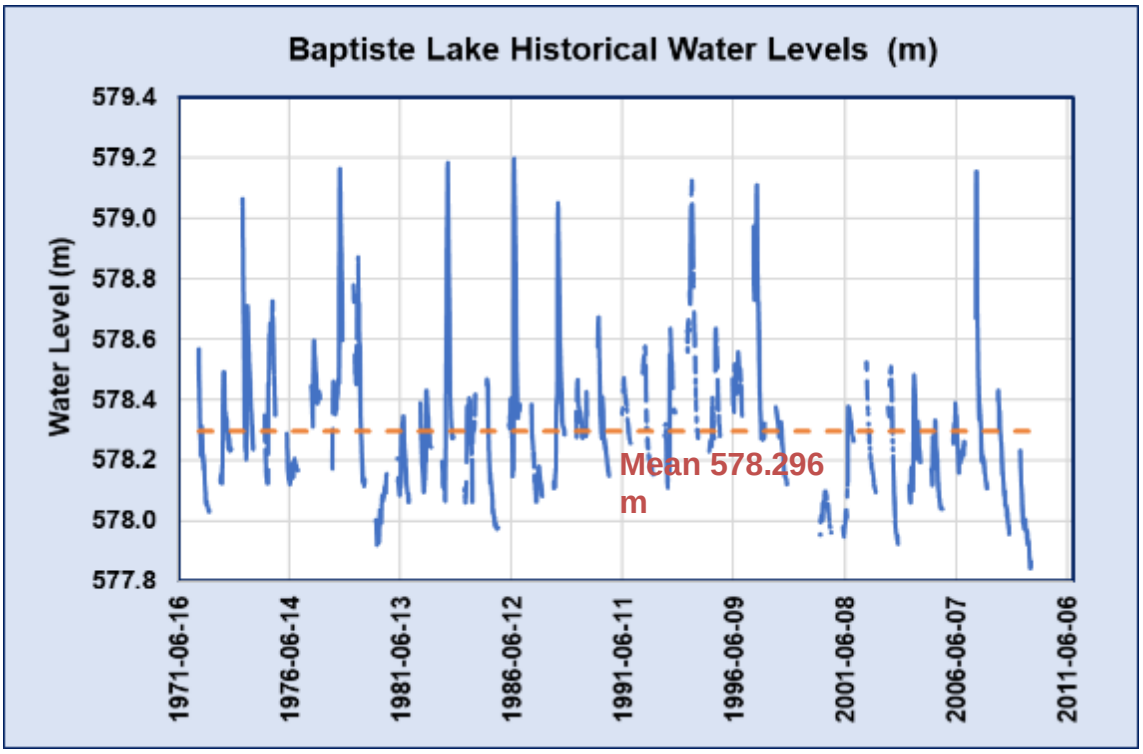


Figure 10. Baptiste Lake Historical Water Levels, 1971 – 2011 (Source: S. Figliuzzi, April 2018). Note that lake level monitoring was discontinued in 2011 but will be resumed in 2019.

Lake level data reviewed by Buendia and Trew (2017) for Island Lake (1968-2016) showed below average levels from 1998 – 2008, when the level dropped by almost a metre. This period seemed to

correspond with lower precipitation in the Athabasca region. Since then, lake levels have returned to normal, averaging about 601 m above sea level (minimum 600.7 m; maximum 601.6 m).

Lake levels can also be influenced by obstructions that slow water outflows, such as beaver dams, or plugged culverts. Beavers provide many ecological goods and services and are a natural part of aquatic ecosystems.[15] However, they can also slow flows at lake outlets that then back up lake levels (if the dam is higher than the lake level), in turn, affecting infrastructure. Alternatively, beaver dams can be beneficial on inflowing tributaries (holding back and then slowly releasing waters) and in periods of low lake levels, effectively acting as weirs and slowing the fall of lake levels in late summer.

Lake levels can also be affected by water withdrawals. At this time, there are only a few licenced water withdrawals in the Baptiste watershed. As well, there may be a small number of domestic users (not requiring a licence). Similarly, the Island Lake watershed has only a handful of licences for water withdrawals. Overall, water withdrawals are likely not a large issue at either lake at the present time but could warrant a closer look in the future, if it becomes a bigger portion of the overall water balance (Table 2) of either lake. A water balance was completed recently for Baptiste Lake (Sal Figliuzzi and Associates 2018). A full water balance has not been completed for Island Lake although some figures are available in the Island Lake state of the watershed report (see Carlson, 2011) and in Trew *et al*. 1987. Note that as well as receiving water from precipitation and surface flows, both lakes also have a groundwater connection.

Table 2 - Lake Water Balance Data

INPUTS	Baptiste Lake (average dam^3/year)	Island Lake (average dam^3/year)
Precipitation	4,408	3,990
Surface Inflow	19,109	2,830
Groundwater Inflow	2,766	Small; 4%
Sub-Total	26,283	6,720
OUTPUTS		
Evaporation	6,123	5,000
Surface Outflow	17,930	unknown
Groundwater Outflow	2,766	small
Allocation Diversion Use	21	Small
Sub-Total	26,840	

What can we do about it?

When asked, stakeholders indicated the importance of maintaining adequate lake water levels, ensuring the investment potential of their properties, and minimizing lake erosion. In order to be prepared for

[15] For more information, see Cows and Fish's Beavers- Our Watershed Partner or the AEP Beaver webpage.

and adaptive to variable lake levels, it is important to understand the hydrology of both Baptiste and Island lakes. It is also important to understand what can be controlled and what can't.

Looking at this issue, the BAILS Technical Committee examined potential solutions for mitigating lake levels. This includes maintaining an inventory of beaver dams upstream and downstream of the lakes and opening or removing them before flooding occurs. The Committee also looked at installing a weir on the outflow, however this option was considered too costly, requiring a comprehensive design and approval process. It is also challenging to predict yearly water precipitation levels to operate a weir effectively, which can be erosive downstream. Similarly, culvert placement and management were examined. Improperly functioning culverts can affect flow, erosion and sediment loading and the movement of fish and other wildlife. In general, culverts are cleaned and checked regularly by the County in order to divert flood waters. Maintaining healthy riparian areas and wetlands in the uplands and less developed areas of the lake is also effective at slowing the release of flood waters.

The Issue: Water levels fluctuate naturally but can be influenced by large precipitation events, increased temperature and evaporation, flow blockages and water withdrawals. Residents may not be prepared for flood/drought events which can damage infrastructure and impede recreational enjoyment.		
Goal: Lake levels are maintained within their range of natural variability (about 1.5 m).		**Lead**
Strategies:	Re-establish lake level monitoring on Baptiste Lake to provide range of variability and trend data. (Island Lake has a gauge and is measured by AEP 3 times a year.)	GOA/BAILS
	Understand factors affecting lake levels, including beaver dams and culverts, and mitigate where practical, particularly for larger volume streams such as Ghost River for Island Lake and streams E, F, and L for Baptiste Lake.	BAILS/ GOA (Public Lands)
	Improve understanding of the relationship between Island and Ghost lakes by undertaking a water balance study for this watershed.	
	Improve understanding of the role of riparian and wetlands in slowing the release of high waters; their presence/loss and need to protect/restore.	
Goal: Water withdrawals are managed sustainably and in concurrence with lake user values		**Lead**
Strategies:	Improve understanding of the impact of current and future water withdrawals in the watershed on both lakes.	GOA (AEP/AER)
Goal: Residents and other lake users are knowledgeable about lake level variability and are well prepared for flood and drought events.		**Lead**
Strategies:	Provide education/information on lake level variability (potential highs and lows), and flood and drought preparedness to residents and visitors using the Respect Our Lakes program and other existing materials.	BAILS/ SV, GOA
	Through land use planning and development permitting processes, ensure restrictions on unauthorized development on public lands, environmental reserves, and within development setbacks are complied with on existing and new development. Develop a strategy to address grandfathered properties that are below the highwater mark.	BAILS / SV, County

2.5 Water Quality

What is the issue?

Residents and users of both Baptiste and Island Lakes are concerned that frequent blue-green algae (cyanobacteria) blooms are adversely affecting fish and wildlife, and restricting recreational activity and aesthetic enjoyment on both lakes, particularly on the more nutrient rich Baptiste Lake. Blue-green algae are a natural part of ecosystems but can be exacerbated by increasing nutrient (phosphorus and nitrogen) loads from a number of human activities. Nutrient sources affecting lakes may include:

- residential use of cosmetic fertilizers for lawns and gardens
- septic seepage
- manure from livestock grazing near or in the water or manure spreading; runoff (carrying fertilizers and pesticides) from crops and pastures
- land uses (e.g. forestry, roads, oil and gas, residential development, transportation and utility infrastructure and other linear disturbances) that lead to increased surface runoff (containing sediment and nutrients), particularly during high precipitation events
- disturbance and sediment erosion from recreational activities
- air-borne dust and nutrient deposition
- lake-bottom sediments
- restricted outflows (e.g., beaver and culvert issues) that impede flows and lake flushing

What do we know about it?

Baptiste Lake has high nutrient (i.e. phosphorus) levels and is classified as a eutrophic, or even hyper-eutrophic lake (Casey, 2011). The shallow northern basin is slightly more fertile than the deeper southern basin. The lake experiences frequent blue green algae blooms during the summer months. Blooms can be influenced by nutrient inputs to the lake, internal nutrient loading, currents and weather patterns.

Paleolimnology studies that look at older sediments using lake cores indicate that Baptiste Lake has been eutrophic for at least 150 years, however, nutrient

'Trophic status' describes the level of biological productivity in a lake. *Oligo*trophic lakes are often colder and deeper with low productivity and slow growing aquatic vegetation and fish. Alternatively, *meso*trophic or *eu*trophic lakes are usually shallower and warmer, with faster growing fish and more plants. This is a spectrum and it is natural for an oligotrophic lake to become mesotrophic or eutrophic over geologic time. However, issues like man-made erosion and sedimentation, nutrient enrichment and climate change, can speed up this natural process.

concentrations have increased in the last 25 years.[16] Studies also show that blue-green algae were present in the lake 200 years ago but production of microcystin (the toxin produced by blue-green algae) has also increased in the last 25 years. Girhany (2006) used the BATHTUB computer model to improve understanding of nutrient loading (the quantity of nutrients entering an ecosystem in a given period of time) in Baptiste Lake. Similarly, Carlson (2008) used the ALCES model to update findings. Similar to most Alberta lakes, nutrient loading increased at Baptiste Lake when agricultural lands around the lake were first cleared for settlement around the turn of the 20th century. A second increase was seen in the 1950s to 1970s when local populations increased and there was a major effort to intensify agricultural production via inputs such as fertilizers and pesticides. Today, improved septic management and static growth in forestry and oil and gas sectors in this watershed, may have prevented further deterioration. However, agricultural practices, internal sediment loading, and residential management issues (e.g., cosmetic fertilizer use, impervious surfaces and stormwater management) around the lake, are potential future areas of focus for understanding current nutrient loading and associated water quality conditions in Baptiste Lake.

Island Lake has lower phosphorus and algal levels then Baptiste and is considered to be mesotrophic. No sediment cores have been examined for this lake. However, because Island Lake is shallower, internal phosphorus loading may play a greater role in water quality than it does at Baptiste Lake.

To improve our understanding of water quality, both lakes have been a part of monitoring programs. Baptiste Lake was a part of Alberta Environment and Park's "Long-Term Lake Network" and was sampled (both North and South basins) every two years. Island Lake is regularly sampled by volunteers in conjunction with the Alberta Lake Management Society's (ALMS) LakeWatch program. It was last sampled in 2017.[17]

Alberta Lake Management Society (ALMS) operates the ***LakeWatch*** program in Alberta. This volunteer-based water quality monitoring program has been running since 1996 and has seen 116 lakes sampled, some for multiple years. ALMS provide trained technicians who assist volunteers to test the lake 4-5 times over the summer. Parameters sampled for include water temperature, clarity, a suite of water chemistry parameters (oxygen, nutrients, cyanobacteria, chlorophyll a, etc.) metals (e.g. mercury), zooplankton and invasive species (zebra and Quagga mussels). Data is uploaded to the GOA water quality database and shared with the public via a report produced by ALMS and posted on their website (see https://alms.ca/reports/).

In the summer of 2016, an additional stream sampling project was conducted by BAILS as a cursory update on stream testing done in previous decades by government and academia. Five samples were taken, mostly during lower flows, between late June and late September 2016, on two agricultural inflow streams (A and D) and three forested inflow streams (E, F and L).

To help further pinpoint sources of nutrient loading, in September of 2017, both lakes were tested for shoreline pollution (from human and other animal waste) using bacterial DNA source tracking methods.

[16] See Trew *et al* 1987, Hickman et al. 1978; also, Adams et al, 2013.
[17] For more information, see the LakeWatch Island Lake Report, 2017.

A total of 31 (Baptiste) and 17 (Island) samples were collected and provided to Dr. P. Hannington, University of Alberta, for analysis. Additional (175) samples were collected from streams and lakes between April and August of 2018. Preliminary results detected some ruminant and human pollution, largely during spring stream runoff but also throughout the summer. Sites will be further investigated in 2019.

What can we do about it?

Stakeholder aspirations included maintaining or improving water quality conditions such that both Baptiste and Island Lakes continue to provide opportunities for recreation and fishing, are good investment opportunities (e.g. property values are maintained) and generally are sustained for future generations to enjoy.

To reduce nutrient concentrations and loading, the BAILS technical committee looked at the costs and benefits of various lake water quality treatment options currently on the market. This included several chemical treatments (e.g. herbicides, algicides, copper, iron chloride, lime, etc.) which tend to be temporary, require regulatory approval and may negatively impact lake ecology. It also included several mechanical treatment options such as diffused air bubblers and fountains.

The Summer Village of Whispering Hills has operated a Solar Bee on Baptiste Lake since 2008. This floating unit uses solar power to circulate water, thereby physically disrupting blue-green algae's preferred habitat of warm, stagnant water. These units are used by a number of communities on lakes in Alberta. The Village has been pleased with results in the bay where the unit is operated, a popular beach and swimming area next to the boat launch. Unfortunately, units are costly, and about 17 units would be needed to treat the entire lake (i.e. each unit is effective for about 12 hectares). Hence, the Solar Bee system may not be a water quality solution for the entire lake.

Photo: The solar bee operated by the Village of Whispering Hills. Credit: Dennis Irving.

While some of these options for reducing nutrient loading are successful on a small scale, most are largely experimental to this point, and none are plausible for treating an entire lake. Hence reducing nutrients before they enter the lake is the best course of action at this time. Potential means for reducing nutrients entering the lakes include wastewater (septic) management, mitigating agricultural impact, ensuring shoreline and other developments in the watershed do not affect water quality and flow in the lakes or their contributing streams, and looking for opportunities to restore and protect riparian, wetland and other environmentally significant areas throughout the watershed.

The Issue: Nutrient loading contributes to aquatic plant growth and blue-green algae blooms thus reducing water quality as well as recreational and aesthetic enjoyment of the lakes.		
Goal: Nutrient loading is reduced such that surface water quality is maintained or improved.		**Lead**
Strategies:	Continue to improve our understanding of lake nutrients as well as how to limit nutrient and other contaminant loading to both lakes and communicate this information to stakeholders.	BAILS / ALMS, academia
	Reduce point and non-point nutrients and contaminants from entering the lake by ensuring that a healthy riparian buffer protects the lake and its tributaries from lakeshore development and other land use activities in the uplands.	BAILS / multiple partners
Goal: Creek flows and lake outflow (and flushing rate) is not impeded by unnatural causes.		**Lead**
Strategies:	Improve our understanding of the relationship between water quality and water quantity (lake levels and hydrology) and the factors affecting outflows (e.g., beaver dams, bridges, culverts, etc.).	County, AEP, Summer Villages

2.6 Aquatic Ecosystem Health

What is the issue?

When asked, stakeholders stated that maintaining recreational fishing opportunities at both Baptiste and Island Lakes is an important issue to be addressed. Having opportunities for appreciating wildlife (e.g. birdwatching, nature hikes, etc.) are also important, as are maintaining biodiversity and a healthy shoreline (riparian area).

What do we know about it?

Although there are no longer any commercial fisheries in Alberta, fish populations are an important resource in Baptiste and Island Lakes and an issue of concern among area stakeholders. Catch limits are imposed on both lakes due to declining fish populations and recreational fishing pressures.[18]

Anecdotal evidence suggests angling success at both lakes has varied in recent years. At Baptiste Lake, catch rates for walleye appear to be improving but pike seem to be declining. At Island Lake, whitefish populations appear stable but Northern Pike have declined. To monitor walleye and pike populations, Alberta Environment and Parks undertake Fall Index Netting (FIN) approximately every 3 and 5 years (on both lakes) with the last survey conducted in 2016.

A decline in fisheries is likely a result of over-fishing as well as the loss of habitat. Emergent, floating and submerged plants of the 'littoral zone' (i.e. the near shore area where sunlight penetrates all the way to the sediment and allows aquatic plants to grow) provide spawning habitat and living space for young fish as well as food (e.g. plants, insects, crustaceans).

Riparian areas are also an important component of the watershed ecosystem, for a variety of reasons. A riparian area is an ecological zone bordering a river or lake. They are characterized by plants tolerant of water-logged soils. Riparian areas extend from where there are aquatic plants, across the shore and bank, and upwards to where soils are often saturated with water. In other words, a riparian area is a transition zone between aquatic and terrestrial habitats.

In northern Alberta, typical riparian vegetation includes cattails, rushes, sedges, grasses, dogwood and willows. In certain cases, riparian vegetation also includes trees such as Balsam and Aspen Poplar and Black Spruce. Depending upon topography, riparian areas may be less than a metre wide (e.g. a cliff bordering a stream) to hundreds of metres wide (e.g. a flat marshy area along a lake).

[18] For information about sport fishing, see the GOA Alberta Guide to Sportfishing Regulations or Angler's Atlas Baptiste and Island lakes pages.

The riparian areas surrounding a lake and its inflowing streams serve many important ecological functions including filtering sediment and nutrients and purifying water; stabilizing lake sediments and terrestrial soils to reduce shoreline erosion (i.e. loss of property) from wave action from wind or motor boats; storing water during wet periods (spring runoff and storms) and releasing it during dry periods.[19] As well, they provide habitat for a diversity of wildlife. Riparian trees provide shade, reduce erosion, reduce noise transmission and act as screens for privacy.

Riparian areas can be affected by lakeside development and activities such as clearing of aquatic and shoreline vegetation, construction of lawns and multiple docks, or the installation of concrete and riprap protection. For these reasons, many lakes have a 30 m environmental reserve placed around them by the province or local municipality to protect riparian benefits.

In order to better understand the state of riparian areas at Baptiste and Islands lakes, a study was commissioned in 2009. The study divided the riparian area into two zones: Emergent Vegetation Zone and Riparian Zone and added a third area, the Buffer Zone. They called the three zones the Riparian Management Area, i.e. the area where humans have the most impact on the lakes. These divisions are shown in the graphic below.

On 3 September 2009, videos of Baptiste and Island Lakes were made from a low-flying helicopter using a digital camera that also recorded GPS locations and times. Using a standardized scoring procedure, the entire shorelines of both lakes were analyzed. The assessment scores were used to classify relatively

[19] For more information about the benefits of a healthy riparian buffer, see Cows and Fish webpage.

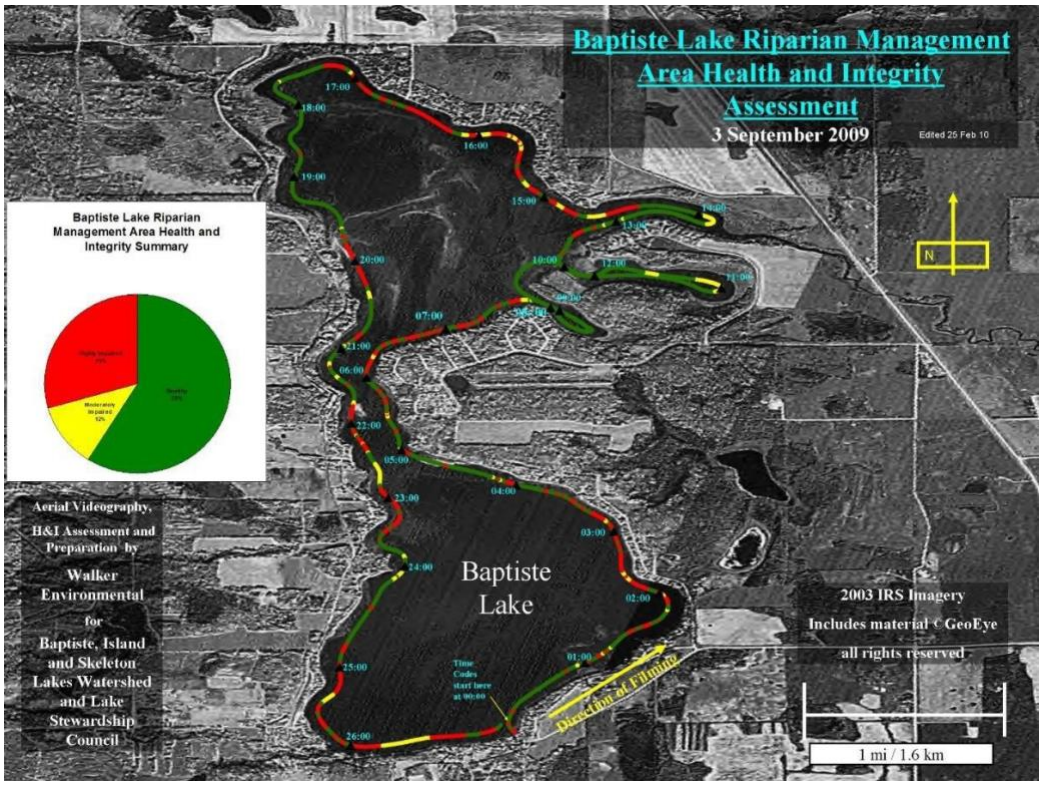
short lengths of shoreline as 'healthy', 'moderately impaired' or 'highly impaired'. The scoring procedure included the following criteria:

- Proportion of each area covered by vegetation.
- Presence of cattail or rushes in the emergent vegetation zone.
- Presence or abundance of trees or shrubs.
- Amount of human caused change to or disturbance of native plants.
- Amount of human caused physical alteration or disturbance of natural surfaces (e.g., addition or removal of sand or rock, retaining walls, boat houses, ATV trails, livestock impacts, cabins, etc.).

Colour-coded shoreline classifications and their locations were shown on maps and pie charts (Figures 11 and 12). The complete videos and a summary report (slide show) are available from Athabasca University Library.[20] In their report, Walker Environmental summarized their findings as follows:

1. Where humans have developed access to the lakes and built structures of various kinds, the riparian areas are affected but this human impact can be repaired.
2. For Baptiste Lake, 59% of the riparian management area was classified as "Healthy", 29% "Highly Impaired", and 12% "Moderately Impaired".
    a. Most of the Riparian Management Areas under the jurisdiction of the County of Athabasca were relatively undisturbed and classified as "Healthy".
    b. The summer villages of Baptiste Lake had over 50% of the Riparian Management Zones classified as "Highly Impaired" or "Moderately Impaired".
3. For Island Lake shorelines, 60% of the Riparian Management Area was classified as "Healthy", 29% "Highly Impaired", and 11% "Moderately Impaired".
    a. The north-eastern and island riparian areas of Island Lake were mostly ranked as "Healthy".
    b. The south-western riparian areas of Island Lake, where the summer villages are located, were ranked mostly as "Highly Impaired" or "Moderately Impaired".

[20] See Walker, G. 2009. The Baptiste Lake and Island Lake Riparian Health and Integrity Study. Report prepared for Baptiste, Island and Skeleton Lakes Watershed and Stewardship Council.



- Healthy (Green)
- Moderately Impaired (Yellow)
- Highly Impaired (Red)

Figure 11. Riparian health rankings for the shoreline of Baptiste Lake in 2009.

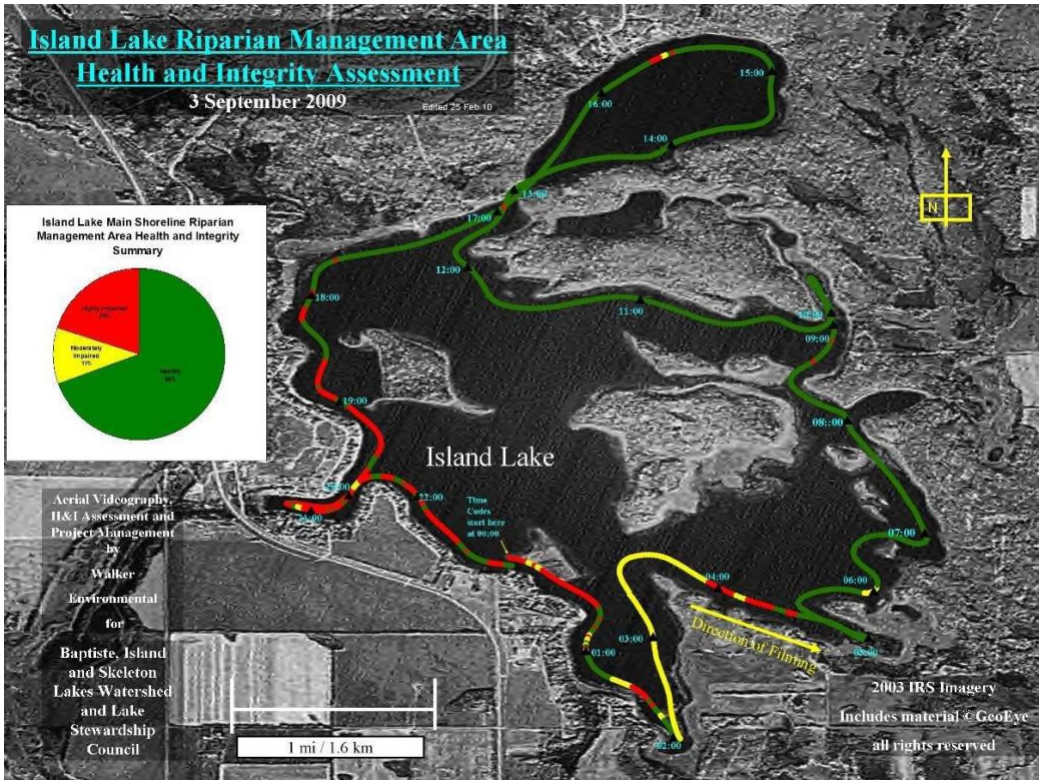


Figure 12. Riparian health rankings for the shoreline of Island Lake in 2009.

What can we do about it?

Stakeholder aspirations for aquatic ecosystem health included maintaining and/or restoring healthy fisheries, riparian areas, and biodiversity around both lakes. While fishing regulations are largely the purview of the GOA, local lake residents can contribute by adhering to fisheries regulations and by not clearing or otherwise encroaching on riparian areas and littoral zones.

Additionally, BAILS can work with its partners to identify priority riparian areas for restoration, map and put signage on environmental reserves, and provide information and incentives for landowners to maintain a healthy shoreline by planting native species (e.g. willows) rather than engineered (e.g. concrete blocks or rip rap) solutions.

Finally, BAILS can promote healthy shorelines as 'biological hotspots', encouraging lake users to be more aware of wildlife populations, biodiversity and existing wildlife habitat on these lakes. By maintaining healthy shorelines, improving water quality and limiting boat wake and other disturbance, residents can increase wildlife presence on the lake.

The Issue: Recreational fisheries are affected by angling pressure, declining water quality and loss of habitat.		
Goal: Fish populations are sustainable and support recreational fishing opportunities.		**Lead**
Strategies:	Promote compliance with fishing regulations via education and use of the Report a Poacher hotline to report anglers that are not following fishing regulations.	BAILS / GOA
	Identify opportunities for improving fish habitat connectivity by encouraging voluntary participation in the GOA Roadway Watercourse Crossing Program and working with the County to fix improperly hung culverts.	County / Industry, GOA
	Continue to monitor and assess fisheries as part of the Index Netting monitoring program.	GOA /
Goal: Shorelines (riparian areas) and littoral zones are healthy.		**Lead**
Strategies:	Discourage the cutting of aquatic plants, beach clearing and "sand dumping" on Crown bed and shore, environmental reserves and property setbacks. Report unauthorized removal of riparian/littoral vegetation through the Energy and Environmental Response Line.	BAILS / Summer Villages
	Increase awareness of the importance of healthy shorelines and compliance with buffer regulations through the Respect Our Lakes, Living by Water, Cows and Fish and other programs.	BAILS/ GOA, County, Summer Villages
Goal: A diversity of native plants and animals is maintained.		**Lead**
Strategies:	Increase awareness about the variety of species in and around the lake and their habitat needs.	BAILS / ABMI, ALMS, Cows & Fish
	Educate lake users about invasive species prevention through the GOA Aquatic Invasive Species program and available resources.	BAILS / SV

Healthy Shorelines Make Healthy Lakes!

The following recommendations for lake residents to maintain riparian areas were derived from a number of publications and are summarized as follows:

1. As much as possible, leave your shoreline, semi-aquatic and aquatic vegetation in a natural state.
   - It is illegal to remove such living vegetation without prior written approval from Alberta Environment and Parks.
   - The vast majority of lake-front properties do NOT extend to the edge of the water. Nearly all properties have a set-back, exclusion or conservation zone extending upwards from the high-water mark (i.e. the bank). In Alberta, this area is called an Environmental Reserve (ER) and is meant to protect the lake and to allow public access to the lake and the shore. The locations and sizes of ERs are set by the local municipality (i.e. County or Summer Villages). Alberta municipalities are required to provide Environmental Reserves for any subdivision bordering a body of water. Such set-backs may be as little as two metres from the high-water mark or as much as 30 metres or more.
   - The Alberta *Municipal Government Act* states that an environmental reserve is to remain in its natural state or to be used as a public park. Reserves are owned by the local municipality. Consequently, due to legal, safety and liability concerns, residents cannot legally undertake any work on these lands. Therefore, clearing environmental reserves, shoreline stabilization, or any construction on those lands, including temporary structures, requires prior approval.
   - Making a sand beach also requires permission as the sand will kill natural vegetation and introduce nutrients into the lake. A permanent sand beach requires a continuous supply of sand as well as substantial wave action to prevent plant growth. If you try to make a sand beach where there is none, you will usually end up with a mud beach followed by plant re-growth. An alternative to a “wet” sand beach is to make a “dry” sand beach on your property above the set-back area.
   - People adding rocks or retaining walls to shorelines usually indicates the previous removal of protective vegetation that would have prevented the erosion they are trying to control.

2. If your shoreline has been cleared of vegetation, re-plant with native herbs and shrubs.
   - Some members of BAILS are willing to help selected owners of lake-front property to re-plant or they have provided demonstration areas to encourage others to repair riparian areas.

3. Do not cut vegetation/mow close to the water.
   - Leave such areas as wild grass and flower areas to absorb nutrient runoff and stabilize the soil (and reduce maintenance costs – both time and money).

4. Trim rather than cut down obstructing trees and shrubs
   - Tree and shrub roots are very effective at preventing soil erosion.

5. Human sewage from lake lots, including grey-water, is best stored in water-tight tanks that are pumped out by a vacuum service and trucked to a place designed for sewage treatment.
   - Sewage (as well as fertilizers and nutrients from erosion) can overwhelm the filtering capacities of riparian areas and lead to excessive populations of algae and cyanobacteria.

6. Avoid use of fertilizers, especially near water.
   - If you do use fertilizers, use slow release ones such as well-rotted manure and stay at least 30 m from the water. Note the Agricultural Operation Practices Act (AOPA) includes setbacks and requirements for spreading manure or compost in Alberta. For more information see http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/epw9846).

7. Do not apply cosmetic pesticides, especially near water.
   - Although pesticide companies try to only target certain organisms (e.g. broad-leafed weeds, certain insects, certain fungi), pesticides may also kill non-target organisms. All pesticides are really biocides (i.e. killers of living organisms).

8. If you use a motor boat, keep the wake as small as possible near shore to avoid erosion of the shoreline and re-suspending nutrients buried in the lake sediments. Note that when boating in Alberta, you must observe a speed limit of 10 km/hr (6 mph) within 30 metres (100 feet) of the shore. This limit applies to all waters within Alberta, except where other limits are posted.
   - Don't throw anything overboard (e.g. garbage, wastewater, etc.).

9. If you use your watercraft, boots, waders, life jackets, beach toys, etc. in different water bodies, clean, drain and dry them **before** transport.
   - Water, mud and sand can transport undesirable seeds, animals (e.g. mussels) and disease organisms into your lake.

10. Watch for invasive (exotic) aquatic plants and animals and report them to the appropriate authority.
   - Alberta Environment and Parks have brochures and websites describing such invasive species.

11. Do not wash vehicles, pets, etc. in any lake. It is illegal to have any wheeled/tracked vehicle in a water body without a permit due to risks to habitat and damage to bed and shore.
   - Washing adds nutrients and pollutants into the water, especially from the cleaning agents.

12. Make paths to the water as meanders rather than as straight lines and slope the paths so that runoff tends to go into terrestrial vegetation.
   - This helps reduce erosion and nutrient additions.

13. Talk to your neighbors about best practices. Join or otherwise support lake stewardship groups, such as BAILS, to promote best practices for lake watershed management.

2.7 Land Use

What is the issue?

Land use for various purposes has changed the natural land cover within the Baptiste and Island Lake watersheds over time. Agriculture, roads, residential development, industrial activity and utility corridors have reduced the amount of forests, wetlands and other natural features that once dominated the area. These changes have an effect on the rates of surface runoff within the watershed, as well as the sediment and nutrient loading carried by this flow. Legislation, policy and management practices, however, guide land use activities in a manner that strives to minimize disturbance and associated impacts. Stakeholders concerns under this category centered on the continued residential development and recreational use on and around the lakes, as well as the impact of agriculture and industry.

What do we know about it?

The Baptiste Lake watershed is still about three-quarters deciduous and mixed wood forest. However, agriculture, country residential and lakeshore development surround much of the lake. In total, human disturbance exists on 29% of the Baptiste watershed (ABMI Human footprint Inventory 2014). This number increased by 2% between 2007 and 2014. Disturbance in 2014 included agriculture (range and forage crops), forest cutblocks, seismic and pipelines, roads and rural residential development.

The Island Lake watershed is also about half forest (deciduous and mixed wood), with some agriculture (pasture and forage crops) on the northwest side of the watershed (Figure 13). Urban development is mainly on the southwest side of the lake. Total human footprint is 36% of the watershed (ABMI Human Footprint Inventory 2014); up 2% from 2007. Disturbance in this watershed in 2014 included agriculture, forestry cutblocks, seismic lines, roads and country residential development.

As a renewable resource, forests in the Baptiste and Island Lake watersheds are managed, for the most part, under a Forest Management Agreement with Alberta Pacific Forest Industries (ALPAC), quota holders (e.g. Ed Bobocel Lumber) and timber permits under the administration of Alberta Agriculture and Forestry. While cutblock plans can change depending on a number of factors, ALPAC is currently scheduled to harvest a small area in the stream F drainage area west of Baptiste lake, largely for deciduous trees, in 2018-20.[21] ALPAC and others follow a number of operational practices (e.g. buffers) in order to limit their impact during harvest (from erosion, sedimentation, herbicides, etc.) on small streams in the watershed.

[21] ALPAC's individual harvest site plans can be viewed online at https://alpac.ca/forest-sustainability/forest-planning under the forest harvest plan tab. For more information about ALPAC planning and operations, see https://alpac.ca/forest-sustainability/forest-planning or the GOA Forest Management webpage.

Generally determined by soils in the area, agriculture in the Baptiste and Island Lake watersheds is largely limited to livestock operations and forage crops. While most of the areas suitable for these activities have been utilized, land clearing still occurs to a small degree. The conversion of forested lands to agriculture can have a negative impact on local streams via erosion and run-off of sediments, fertilizers and pesticides. The introduction of livestock can also be a source of nutrients (i.e. manure) if not managed properly.

Oil and gas, seismic and other linear disturbances are also present in the Baptiste and Island Lake watersheds. According to the Island Lake state of report (Carlson, 2011), Island Lake watershed was estimated to contain approximately 130 km of seismic lines and 23 km of pipelines, with a total area of oil and gas infrastructure in the watershed estimated to equal 94 ha (1.5% of the watershed). Similarly, Baptiste Lake watershed had 921 km of seismic lines, 77 km of pipelines, for approximately 712 ha of oil and gas infrastructure (2.5% of the watershed) (Carlson, 2008). In general, these activities are not expected to increase much in the near future.

Looking at residential lake development, Baptiste Lake is more developed than Island Lake; however, both lakes have experienced increasing growth since 1985 (Figure 13). A large portion of this population is seasonal, but some is permanent. Along with population growth comes the potential for altered shorelines, more docks and other waterfront infrastructure, the use of cosmetic fertilizers and pesticides, a need for water and septic infrastructure, road access, stormwater run-off, etc. County subdivisions away from the lake also have the potential to impact streams and wetlands, producing diffuse polluted runoff that can affect stream and lake health.

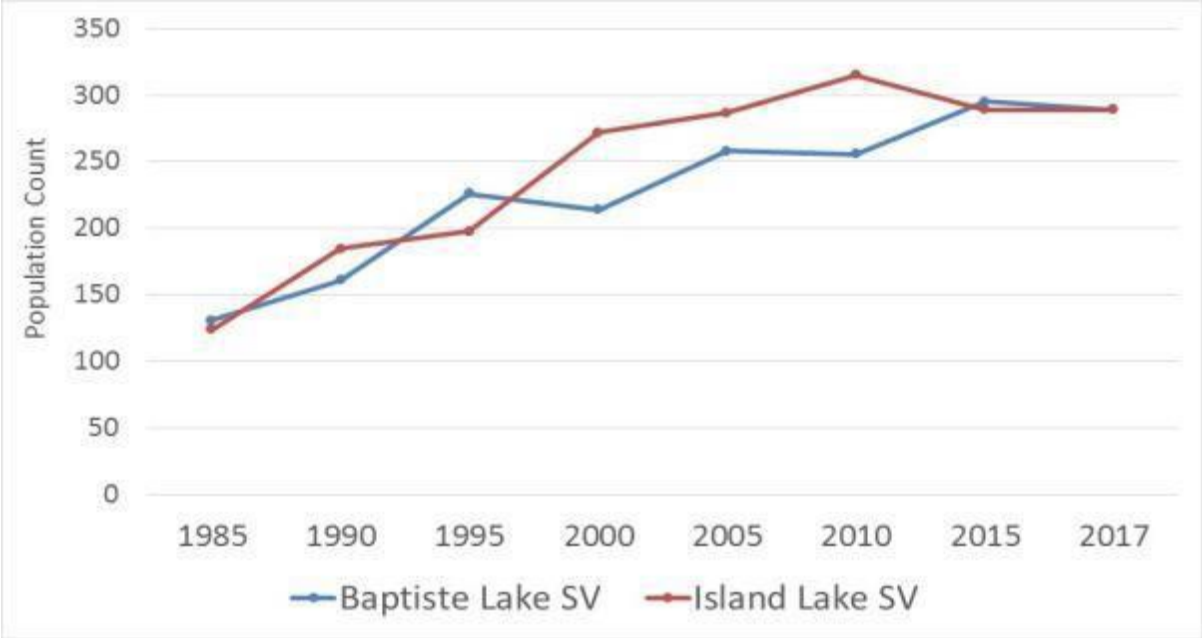


Figure 13. Full-time residential population growth at Baptiste and Island Lakes, 1985 – 2017.

Baptiste and Island Lakes and the surrounding uplands are important recreational areas for residents and visitors alike. Activities include off-highway vehicle (OHV) use, fishing, motorized and non-motorized boating, swimming, picnicking, etc. Island Lake, with its many bays and islands, is also attractive for canoeing. Both lakes have a number of boat launches, private campgrounds and public day use areas.

While stakeholders expressed a desire to maintain the recreational value of both lakes for future generations, recreational activities can affect both lake and watershed health. Concerns surrounding recreation include the increased use of motorized vehicles (e.g. boats and OHVs) on and around the two lakes, the associated harm to wildlife and shoreline from boat noise and wake, and increased pressure for access to the lake and crown land, while still maintaining naturalized areas and trails.

What can we do about it?

While land use is a complex issue, many actions can be taken to limit its cumulative impact on Baptiste and Island lakes.

The Issue: Changes to natural land cover in the watershed from land uses such as residential development, agriculture, forestry, oil and gas, and recreation, may affect lake health.		
Goal: Land use is congruent with a healthy watershed and disturbance is mitigated.		**Lead**
Strategies:	Work with forestry, oil and gas and other industries to align planning and practices with the goals of the WMP to safe guard lake and watershed health.	BAILS/GOA industry
	Work with the agricultural sector to promote beneficial management practices (e.g. offsite watering and manure management, fertilizer application, conservation tillage, etc.) to reduce nutrients from reaching waterways.	BAILS/AAF, Highway2 Conservation
	Work within existing planning and operational initiatives to build understanding of the relationship between cumulative disturbance and hydrology in the watershed. If beneficial, utilize models (e.g. ALCES, RAVEN, etc.) and scenarios.	BAILS/GOA, Industry, academia
Goal: Residential development around both lakes is sustainable.		**Lead**
Strategies:	Identify and implement residential development practices and strategies (e.g., density limits, clustering development, low impact design principles, construction and engineering standards, environmental reserves, setbacks, fertilizer and pesticide bans, stormwater management, etc.) that can mitigate impacts to shorelines and improve water quality.	County, SV, ALIDP, RMA, AUMA
	Improve awareness of and compliance with regulations / bylaws where they exist (setbacks, sewer, tree removal, fishing, boating, etc.).	BAILS/ GOA, County, SV
Goal: Recreation is compatible with lake health and available to future generations.		**Lead**
Strategies:	Promote responsible boating by allowing reasonable access to the lakes, ensuring that proper boat launch and other facilities are provided and discouraging informal boat launches. Pursue wake /motor boat management though federal government regulations.	BAILS / SV, GOA (AEP)
	Encourage responsible Off Highway Vehicle (OHV) use on public lands.	SV, County, GOA (AEP)
	Work with AEP to conduct an inventory of the roads, OHV access and walking trails around the lakes and to identify areas where i) OHVs can be redirected to reduce sedimentation and disturbance to wildlife habitat and ii) where OHVs typically cross streams that could be mitigated by bridge development through the GOA's Keep Wheels out of Water campaign.	

2.8 Climate Variability

Along with their natural seasonal variability, lakes may also be affected by longer-term directional climate change which may affect water quantity and quality. Changes in air temperature and the precipitation-evapotranspiration regime that accompany climate change, may have direct effects on the physical, chemical, and biological characteristics of lakes as well as their inflow and outflow streams. Climate change also impacts lakes indirectly via modifications in the surrounding watershed, e.g., through shifts in hydrological flow pathways, stream erosion rates and catchment erosion.

Improving our understanding of the potential implications of climate change and the interaction of this stressor with the lakes is key for all stakeholders. In particular, lakeshore property owners should recognize that climate change and global warming may have an impact on water levels and should take steps to cope with these impacts, especially during extreme low (i.e., drought) and high lake level (i.e., flood) events. Additionally, climate change may affect the frequency and intensity of forest fires in the future. Hence lake communities should ensure their residents are aware of and take steps to reduce their risk from such an event.

The Issue: Climate variability, now and in the future, may be affecting water quality and quantity in Baptiste and Island lakes.		
Goal: The impact of climate variability on Baptiste and Island lakes is understood.		**Lead**
Strategies:	Provide information to the community about opportunities to learn more about the potential impacts of climate change.	BAILS
	Develop flood and drought mitigation strategies.	SV, County, AWC, GOA
	Promote the FireSmart community program.	BAILS, SV, County

3.0 Plan Implementation

Lake watershed management is complex and there are many activities that can be undertaken to protect lake health. A five-year WMP Action Plan, provided in Appendix 3, provides a further breakdown of potential actions that may be undertaken to support the achievement of the goals identified in this WMP. However, resourcing and capacity issues also have to be considered and often constrain plan implementation. Hence it is important that:

- a sound implementation governance structure is put in place;
- priorities are carefully weighed and matched with capacity (e.g. money, people, time, etc.); and
- performance measures are used to ensure priority actions are effective over time.

A sound governance structure includes the establishment of an Implementation Committee (IC), made up of key parties identified as potential leads and partners for the various goals, strategies and actions in the plan. Roles and responsibilities of the IC should be spelled out in a Terms of Reference. The IC might also strike a fundraising sub-committee to start looking at how to resource actions.

In thinking about priorities, education and awareness were identified as needs across several of the themes discussed. Hence the Implementation Committee might strike a Communications Sub-committee to flesh out an education and outreach plan and begin implementing this aspect of the WMP. This work should focus on giving lake lot owners and lake users the knowledge and tools required to be good stewards of the lakes, targeting the stakeholders that can have the most impact and can affect the greatest change based on their actions at the shoreline and use of the lake. This could be coupled with the shoreline inventory program where a shoreline naturalization inventory and management plan could be created based on areas where issues exist, and areas where issues could be avoided or mitigated. This sub-committee might also focus on extending communications to other levels of government and other stakeholders impacting the watershed (e.g. agriculture, forestry, oil and gas, etc.).

A second potential priority area that often came up was the need for people to be aware of existing rules (e.g. not encroaching on reserves, building setbacks, fishing regulations); for decision-makers to think about new rules that are needed to address emerging issues (e.g. use of cosmetic fertilizers, invasive species, boating speeds); and for all rules to be complied with or enforced where necessary. The Summer Villages and County have already shown the ability to work together to align policies (i.e. septic bylaws). Continuing this cooperation, they should be encouraged to also work together to build consistency in managing development around the lake and to find compliance and enforcement solutions. This could include measures such as briefing property owners regarding property lines and where ownership starts and ends – what that means – and what they can / cannot do – and what they can do to be a good steward (e.g., dock sharing). It might also include collaboration across municipalities in the development of a cosmetic fertilizer and pesticide bylaw.

Successful watershed management planning relies heavily on using the best available information in a dynamic and iterative process. The IC may continue to utilize a Technical Sub-committee, which in turn can continue to reach out to the academic/research community for advice on what science is needed to better understand lake health and how impacts can be mitigated.

As a part of this technical work, performance measures should also be identified and reported on regularly to ensure WMP actions are leading to success. Additionally, the IC should revisit the plan from time to time (e.g. every 5 years) to ensure actions are still relevant to prevailing issues or adjusted to meet changing conditions. Reporting can include BAILS successes and challenges in implementing the plan, as well as actual improvements to the lake's ecological integrity.

In Closing

Identifying the shared values of those living, working and recreating in the Baptiste and Island Lake watersheds, as well as what is known about the issues affecting these values, is an important first step in the adaptive management approach utilized by lake stewardship groups. With this information in hand, BAILS has moved forward with developing a watershed management plan that identifies strategies and actions to address these issues.

The success of the plan will be dependent on the partnerships and collaborations generated to undertake implementation actions. Fortunately, there are few who would dispute the beauty and value of Baptiste and Island Lakes. Armed with the right tools and information, most are willing to take actions to protect the lakes, be they visitors, residents, governments or others. This plan helps identify these needed partnerships and the actions to be undertaken by each party, such that both lakes are maintained for current and future generations to enjoy.

Appendix 1. WMP Steering and Technical Committee Members (2018)

BAILS Board of Directors and WMP Steering Committee:

Wendy	Appleby	Secretary and Communications
Lori	Barr	Treasurer
Dennis	Irving	President
Kendra	Gilbert	Director
Jim	Montague	Director
Morris	Nesdole	Vice – President; Director, Athabasca Watershed Council
Gord	Shopland	Director

WMP Technical Committee:

Wendy	Appleby	Secretary and Communication
Dave	Beecroft	Member
Linda	Cargil	Member
Rick	Cargill	Member
Paula	Evans	Member
Kendra	Gilbert	Director
Robert	Holmberg	Member; Director Athabasca Watershed Council
Dennis	Irving	President
Darlene	Marling	Member
Morris	Nesdole	Vice – President; Director, Athabasca Watershed Council
Gord	Shopland	Member
Karen	Sliwkanich	Member
Ken	Stashko	Member
Dave	Trew	North Saskatchewan Watershed Alliance
Ron	Wasel	Member

Appendix 2. Resources

Resources Specific to Baptiste and/or Island Lakes:

Adams, Katrina, Zofia E. Taranu, Ron Zurawell, Brian F. Cumming & Irene Gregory-Eaves (2013). *Insights for lake management gained when paleolimnological and water column monitoring studies are combined: A case study from Baptiste Lake*. Lake and Reservoir Management, 30:1, 11-22. See https://www.tandfonline.com/doi/full/10.1080/10402381.2013.865687?scroll=top&needAccess=true

Alberta Lake Management Society. *Lake Watch Program*. Island Lake reports (2005, 2012, 2017) https://alms.ca/reports/

Alberta Municipal Affairs. 1978. *Baptiste Lake: Preliminary Management Plan.* https://albertaonrecord.ca/alberta-municipal-affairs-planning-services-division-regional-planning-section-baptiste-lake-preliminary-management-plan-fonds

Athabasca County. 2008. Municipal Development Plan at https://athabascacounty.civicweb.net/filepro/documents/166?preview=138008

Athabasca River Basin Research Institute http://arbri.athabascau.ca/ (Approx. 100 scientific papers that reference Baptiste Lake and /or Island Lake.) Also see *About the Athabasca River Basin* (ARBRI) http://arbri.athabascau.ca/About-the-Athabasca-River-basin/Index.php.

Athabasca Watershed Council Interactive Atlas https://awc-wpac.ca/our-watershed/interactive-atlas/

Mitchell, P. and Prepas E. "Atlas of Alberta Lakes", University of Alberta Press, January 1990. See the Baptiste http://albertalakes.ualberta.ca/?page=lake&region=1&lake=29 and Island http://albertalakes.ualberta.ca/?page=lake&region=1&lake=33 lakes pages

Baptiste and Island Lakes Stewardship Society website http://bails.ca/

Baptiste Lake High Water Levels Info Sheet http://www.southbaptiste.com/download_files/2017%20Baptiste%20Lake%20-%20Info%20Content.pdf

Buendia, C. and D. Trew. 2017. *NSWA Technical Bulletin: Lake Level Trends in Alberta – Preliminary Results* http://www.nswa.ab.ca/content/lake-level-trends-alberta

Carlson, M. 2008. *State of the Baptiste Lake Watershed*, ALCES Group http://www.bails.ca/index.php/documents-info/13-baptiste-lake-watershed-report-final/file

Carlson, M. 2011. *State of the Island Lake Watershed* (BISL), ALCES Group http://www.bails.ca/index.php/documents-info/10-state-of-the-island-lake-watershed/file

Casey, R. 2011. *Water Quality Conditions and Long-term Trends in Alberta*. Government of Alberta http://www.wwmc.ca/images/pdf/StudiesandReports/WaterQualityConditionsTrends-AlbertaLakes.pdf

Cooke, S.E. & Prepas, E.E. 1998. *Stream phosphorus and nitrogen export from agricultural and forested watersheds on the boreal plain.* Canadian Journal of Fisheries and Aquatic Sciences, Vol. 55: 2292-2299.

S. Figliuzzi, April 2018. Presentation to the BAILS Technical Committee. Westlock, Alberta.

Hickman, M., D.M. Klarer, C. Schweger and T. Habgood. 1978. *The paleoenvironmental history of Baptiste Lake, Alberta.* Alta. Envir., Poll. Contr. Div., Water Qlty. Contr. Br. Unpubl. rep., Edmonton.

Miller, R.B. 1943. *Report of a survey of Baptiste Lake conducted July 1943*. Report of the Provincial Fisheries Branch. 13 pp.

Mitchell, P. and E. Prepas. 1990. *The Atlas of Alberta Lakes*, University of Alberta Press. (online version) http://albertalakes.ualberta.ca/?page=lake&lake=29&region=1

Trew, D.O., Beliveau, D.J. and Yonge, E.I. 1978. *Baptiste Lake study summary report*. Pollution Control Division, Alberta Environment. 117 pp. http://www.barbau.ca/content/baptiste-lake-study-summary-report

Trew, D.O., Beliveau, D.J. and Yonge, E.I. 1987. *The Baptiste Lake study technical report*. Pollution Control Division, Alberta Environment. Report # W8517, 442 pp. http://www.barbau.ca/content/baptiste-lake-study-technical-report-0 or https://archive.org/details/baptistelakestud00trew

Taranu, Zofia E. 2013. *Tracking changes in water quality due to catchment land-use and lake morphometry across spatial and temporal scales*. University of Montreal https://www.researchgate.net/publication/30002102_Tracking_changes_in_water_quality_due_to_catchment_land-use_and_lake_morphometry_across_spatial_and_temporal_scales

General Watershed Management Resources:

Alberta Environment. 2000. Framework for Water Management Planning. http://environment.alberta.ca/documents/Framework_for_water_management_planning.pdf

Alberta Environment. 2008. Indicators for Assessing Environmental Performance of Watersheds in Southern Alberta. http://environment.gov.ab.ca/info/library/7945.pdf

Alberta Environment. *Stepping Back from the Water: A Beneficial Management Practices Guide for New Development near Alberta's Waterbodies in the Settled Region*. See https://open.alberta.ca/publications/9781460100592

Alberta Environment and Parks links of interest:

- Aquatic Invasive Species http://aep.alberta.ca/fish-wildlife/invasive-species/aquatic-invasive-species/default.aspx
- Beaver http://aep.alberta.ca/fish-wildlife/human-wildlife-conflict/beavers.aspx
- Handbook for State of Watershed Reporting: A Guide for Developing State of the Watershed Reports in Alberta. http://environment.gov.ab.ca/info/library/8044.pdf

- High Water Lakeshores http://aep.alberta.ca/water/education-guidelines/high-water-lakeshores.aspx
- Keep Wheels out of Water campaign http://aep.alberta.ca/recreation-public-use/recreation-on-public-land/motorized.aspx
- The Water Channel and Water Literacy survey https://talkaep.alberta.ca/the-water-channel?tool=forum_topic
- Respect our Lakes http://environment.alberta.ca/03036.*html*
- Water Conversations http://aep.alberta.ca/water/water-conversation/default.aspx
- Guide to Watershed Management Planning in Alberta http://www.nswa.ab.ca/sites/default/files/documents/Guide%20to%20Watershed%20Planning%20in%20AB%5B1%5D%20(1).pdf
- *Water for Life* http://aep.alberta.ca/water/programs-and-services/water-for-life/default.aspx

Alberta Lake Management Society (ALMS). 2013. Workbook for Developing Lake Watershed Management Plans in Alberta. http://alms.ca/wp-content/uploads/2014/02/ALMS_WMPWorkbook.pdf

Alberta Lake Management Society. The Swim Guide. https://www.theswimguide.org/beach/346?set_language=en

ALPAC https://alpac.ca/forest-sustainability/forest-planning

Alberta Regional Dashboard https://regionaldashboard.alberta.ca/#/

Alberta Water Council. 2016. Recommendations to Improve Lake Watershed Management in Alberta. https://awchome.ca/LinkClick.aspx?fileticket=aLhhA4fUijw%3D&tabid=59

Alternative Land Use Services Canada (ALUS) https://alus.ca/

Association of Summer Villages of Alberta http://www.asva.ca/; ASVA *Lake Stewardship Reference Guide* http://www.asva.ca/summer-villages/lakestewardship/

Cows and Fish http://cowsandfish.org/

Cows and Fish Beavers- Our Watershed Partner http://cowsandfish.org/whatsnew/documents/BeaverOurWatershedPartnerforWEB.pdf

Government of Alberta Land Use Framework https://www.landuse.alberta.ca/Pages/default.aspx

GOA Forest Management https://www.agric.gov.ab.ca/app21/forestrypage?cat1=Forest%20Management&cat2=Forest%20Management%20Plans

Green Acreages Guide http://www.landstewardship.org/green-acreages-guide/

Highway 2 Conservation https://www.highway2conservation.com/

Lac la Biche County. Protect our Lakes and Shorelines (brochure). http://www.laclabichecounty.com/home/showdocument?id=4404

Nature Alberta. Living by Water http://naturealberta.ca/programs/living-by-water/

North Saskatchewan Watershed Alliance www.nswa.ab.ca

Pigeon Lake Model Land Use Framework

Trew, D.O. 2013. Lake Water Quality Management. Presentation to Pigeon Lake Watershed Association Annual General Meeting
http://files.townlife.com/public/uploads/documents/5294/PLWA_AGM_Water_Quality_Mngt.pdf

Trew, D.O. 2013. Presentation to Lake Management Workshop, Landuse Knowledge Network
https://www.youtube.com/watch?v=e0s60KR68lg

Appendix 3. Five Year Workplan (2019-2024)

GOAL	STRATEGIES	ACTIONs	METRIC	LEAD/ POTENTIAL PARTNERS	2019	2020	2021	2022	2023
Goal: The Baptiste and Island watersheds are recognized as critical to lake health and managed in an integrated collaborative manner by the provincial and municipal governments.	Develop a watershed management plan implementation committee to oversee and report on WMP implementation progress.	Invite local and provincial governments, industry and other stakeholders to participate in an Implementation Committee.	# of government and industry documents referencing the WMP	BAILS / stakeholders					
	Submit the WMP to the GOA and the Athabasca Watershed Council and ask for recognition of this advisory plan, as well as recognition of the need for lake watershed management, in future planning documents including the Upper Athabasca Regional Plan and Athabasca Integrated Watershed Management Plan, when they are developed.	Ask AEP for a letter acknowledging the plan. Share with AER, AAF and other GOA departments through the BAILS AEP rep. Share with the Athabasca Watershed Council by making a presentation to the board.		BAILS / GOA (AEP), AWC					
	Submit the plan to M.D. of Lesser Slave River, Athabasca County, and 6 Summer Villages on Baptiste and Island lakes and ask them to formally acknowledge	As municipal documents (ICF, IDP, MDP, LUB, etc.) are renewed, include reference to the plan and its goals.		BAILS / Municipalities					

GOAL	STRATEGIES	ACTIONs	METRIC	LEAD/ POTENTIAL PARTNERS	2019	2020	2021	2022	2023
	the plan in their policy and planning documents, as such documents are developed or renewed.								
	Review and align IDP, MDP, LUB and other policies such that development rules (e.g. setback distances, lot coverage, tree clearing policies, etc.), incorporate best management practices and are consistent around both lakes.	Review current policies to identify differences, gaps, etc.		County, Summer Villages					
The WMP Implementation committee is adequately resourced to undertake its work.	Solicit grants and in-kind support for studies, staffing, events, etc. via innovative community collaboration and funding initiatives, municipal and government grant programs (e.g. Watershed Restoration and Resiliency Program, Environmental Damages fund),	Strike a finance sub-committee to develop a 5-year WMP action plan budget; identify potential sources of funding and in-kind support/collaborations.	BAILS annual total revenues and in-kind support	BAILS	As needed.				

GOAL	STRATEGIES	ACTIONs	METRIC	LEAD/ POTENTIAL PARTNERS	2019	2020	2021	2022	2023
	industry in-kind support, etc.								
	Leverage resources by partnering with existing programs such as Alberta Lake Management Society's Lake Watch, Living by Water, Cows and Fish, Highway 2 Conservation, AEP Respect our Lakes program, etc.			BAILS / conservation groups	As needed.				
Stewardship initiatives are well-supported by the community and other stakeholders in the watershed.	Increase participation in WMP implementation by engaging residents, industry, youth, etc. and celebrating successes.	Include activities in the communications plan such as: / youth photo contest/ steward awards / hosting public presentations, workshops, industry forums, etc.	# of event attendees	BAILS	Activities and schedule to be determined in a communications plan.				
Those that live, work or play in the Baptiste and Island Lake watersheds are knowledgeable about lake health and know what	Educate targeted audiences (youth, property owners, etc.) about lake health and the WMP using existing programs such as ALMS, Respect Our lakes, AEP's	Strike a communications sub-committee to develop an education and outreach plan that could include: - Web links to existing resources	% of residents who feel they are somewhat knowledgeable about lake watershed management (as measured by a periodic survey)	BAILS	draft	Survey (baseline)	Implement	Implement	Survey (compare)

GOAL	STRATEGIES	ACTIONs	METRIC	LEAD/ POTENTIAL PARTNERS	2019	2020	2021	2022	2023
they can do to reduce their impact.	Water Literacy program, etc.	- Developing and circulating new educational materials - door-to-door canvassing, etc.							
	Partner with academia and other lake/stewardship groups to promote education through citizen science projects.				As needed.				
	Develop a Resident Information Kit and distribute to lake users via the Summer Villages, Town and County offices, realtor offices, etc.								
Lake levels are maintained within their range of natural variability.	Re-establish lake level monitoring on Baptiste Lake to provide improved range of variability and trend information.	Install lake level gauge and organize volunteers to collect data to supplement AEP staff gauge readings. Include graphed trend data in an annual report on WMP progress.	Lake levels and withdrawals are monitored and graphed annually and information is publicly available.	GOA/ BAILS	Install	Monitor	Monitor	Monitor	Monitor
	Improve understanding of the relationship between Island and Ghost lakes by undertaking a			BAILS / GOA					

GOAL	STRATEGIES	ACTIONs	METRIC	LEAD/ POTENTIAL PARTNERS	2019	2020	2021	2022	2023
	water balance study for this watershed.								
	Understand factors affecting lake levels, including beaver dams and culverts, and mitigate where practical, particularly for larger volume streams such as Ghost River for Island Lake and streams E, F, and L for Baptiste.	Improve water balance information by studying stream and lake outlet flows.				Stream monitor	Baptiste study	Island study	
	Improve understanding of the role of riparian and wetlands in slowing the release of high waters; their presence/loss and need to protect/restore.	See watershed model in land use goal below.		BAILS					

GOAL	STRATEGIES	ACTIONs	METRIC	LEAD/ POTENTIAL PARTNERS	2019	2020	2021	2022	2023
Water withdrawals are managed sustainably and in concurrence with lake user values (e.g. recreation, water quality, etc.).	Improve understanding of the impact of current and future water withdrawals in the watershed and on both lakes.	Encourage licensees to report actual water use (via the online water use reporting website). Provide the WMP to appropriate authorities to inform water withdrawal regulatory processes. Review water allocation and use in the next state of the watershed reports.		GOA (AEP, AER)					
Residents and other lake users are knowledge-able about lake level variability and are well prepared for flood and drought events.	Provide education/information on lake level variability (potential highs and lows), and flood and drought preparedness to residents and visitors, using the Respect our Lakes program and other existing materials.	Commission mapping of public land, setbacks, and flood plains.	Resident prepared-ness for flood measured by estimated $$ value of infrastructure damage (inverse metric).	BAILS/ GOA					
		Resolve unauthorized development on public lands and municipal setbacks.							
	Through land use planning and development permitting processes, ensure restrictions on unauthorized development on public lands, environmental	Make flood plain maps and other flood and drought information available to residents and the public (via communications plan)		BAILS/ SV, County					

GOAL	STRATEGIES	ACTIONs	METRIC	LEAD/ POTENTIAL PARTNERS	2019	2020	2021	2022	2023
	reserves, and within development setbacks are complied with on existing and new development. Develop a strategy to address grandfathered properties that are below the highwater mark.								
Nutrient loading is reduced such that surface water quality is maintained or improved.	Continue to improve our understanding of nutrient levels as well as how to limit nutrient and other contaminant loading to both lakes and communicate this information to stakeholders.	Collect new data to fill information gaps (lake and stream sampling, etc.)	Levels of N, P, etc. remain within existing level of variability or decline. Nutrient concentrations are maintained or decrease over time.	BAILS, ALMS, academia					
		Analyze nutrient data to determine trend, if any.							
		Identify point source discharges of nutrients that could be contributing to nutrient loading.							
	Reduce point and non-point nutrients and contaminants from entering the lake by ensuring a healthy riparian buffer protects the lake from lakeshore development and	Promote shore restoration on both public and private lands. (i.e. include info in Communications plans)		BAILS, multiple partners					

GOAL	STRATEGIES	ACTIONs	METRIC	LEAD/ POTENTIAL PARTNERS	2019	2020	2021	2022	2023
	other activities in the uplands.								
Creek flows and lake outflow (and flushing rate) is not impeded by unnatural causes.	Improve our understanding of the relationship between water quality and water quantity (lake levels and hydrology) and the factors affecting outflows (e.g., beaver dams, bridges, culverts, etc.).		Natural flushing flows are not impeded.	County, SV	As needed.				
Fish populations are sustainable and support recreational fishing opportunities.	Promote compliance with fishing regulations via education and use of the Report a Poacher hotline to report anglers that are not following fishing regulations.	Include fishery key messages in communications plan.	Fish populations are stable or increasing.	BAILS/GOA					
	Identify opportunities to for improving fish habitat connectivity by encouraging voluntary participation in the GOA Roadway Watercourse Crossing Program and working with the County to fix improperly hung culverts.	Identify culvert locations, issues with and mediate…		County / Industry, GOA	As needed.				

GOAL	STRATEGIES	ACTIONs	METRIC	LEAD/ POTENTIAL PARTNERS	2019	2020	2021	2022	2023
	Continue to monitor and assess fisheries as part of the Index Netting monitoring program.	Identify Baptiste and Island Lake for consideration for future creel surveys subject to resource availability and prioritization.		GOA /					
Shorelines (riparian areas) and littoral zones are healthy.	Discourage the cutting of aquatic plants, beach clearing and "sand dumping" on Crown bed and shore, environmental reserves and property setbacks. Report unauthorized removal of riparian/littoral vegetation through the Energy and Environmental Response Line.	Include information about the importance of healthy shores and how cabin owners and boaters can reduce their impact in the communications plan. Conduct and communicate results of a stream riparian assessment; wetland assessment.	Riparian statistics are stable or improving (re-assess every 5 years)	BAILS					
	Increase awareness of the importance of healthy shorelines and compliance with buffer regulations through the Respect Our Lakes, Living by Water, Cows and Fish and other programs.			BAILS/ GOA, County, SV					
A diversity of native plants	Increase awareness about the variety of species in and around	In the communications plan, include development of bird,	# of *At Risk* species; # of	BAILS / ABMI, ALMS, Cows and Fish					

GOAL	STRATEGIES	ACTIONs	METRIC	LEAD/ POTENTIAL PARTNERS	2019	2020	2021	2022	2023
and animals is maintained.	the lake and their habitat needs	mammal, plant, insect and invasive lists, and provide experiential activities such as nature walks, biodiversity counts or weed pulls, signage, brochures, presentations, etc.	invasive species (inverse metrics)						
	Educate lake users about invasive species prevention through the GOA Aquatic Invasive Species program and available resources.			BAILS / SV, GOA					
Land use is congruent with a healthy watershed and disturbance is mitigated.	Work with forestry, oil and gas and other industries to align planning and practices with the goals of the WMP to safe guard lake and watershed health.	Provide WMP to local ag societies, producers and industry (i.e. AFPA, ALPAC) with a letter encouraging them to consider it in their planning and operational practices. Work with AWC to hold a bi-annual forum with ag and industry to discuss plan uptake.	# of landowners in the watershed aware of the WMP # of BMPs adopted	BAILS / Industry					
	Work with the agricultural sector to promote beneficial management practices (e.g. offsite watering and manure management, fertilizer application, conservation tillage, etc.) to reduce nutrients from reaching waterways.	Work with agriculture, Cows and Fish, and other programs to reduce nutrient loading from livestock wintering/ watering sites, fertilizer-use and tillage practices.		BAILS / AAF, Highway2Conservation					

GOAL	STRATEGIES	ACTIONs	METRIC	LEAD/ POTENTIAL PARTNERS	2019	2020	2021	2022	2023
	Work within existing planning and operational initiatives to build understanding of the relationship between cumulative disturbance and hydrology in the watershed. If beneficial, utilize models (e.g. ALCES, RAVEN, etc.) and scenarios to build understanding.	Use model to inform development scenarios, plans (Upper Athabasca Regional Plan, municipal forest and industry plans, etc.) and decision-making such as where to limit development, protect or restore habitat, reduce sources of erosion, etc.	A model is available for running scenarios.	BAILS / ALCES, academia, GOA, industry, stakeholders					
Residential development around both lakes is sustainable.	Identify and implement residential development practices and strategies (e.g., density limits, clustering development, low impact design principles, construction and engineering standards, environmental reserves, setbacks, fertilizer and pesticide bans, stormwater management, etc.) that can mitigate impacts to shorelines.	Run scenarios for shoreline development densities (current, growth at 5%, 10% etc.) and use to inform municipal policy and planning.		County, SV, ALIDP, RMA					

GOAL	STRATEGIES	ACTIONs	METRIC	LEAD/ POTENTIAL PARTNERS	2019	2020	2021	2022	2023
	Improve awareness of and compliance with regulations / bylaws where they exist (setbacks, sewer, tree removal, fishing, boating, etc.).	Develop a fertilizer and pesticide bylaw. Meet annually to discuss/resolve other policy gaps.	# of shared policies	BAILS/County, SV, GOA, Highway 2 Conservation					
		Hire a qualified bylaw officer to conduct a lake-wide compliance audit. Issue first-time offenders a warning followed by fines for subsequent offences.	# of warnings/fines (inverse metric)	SV/County					
Recreation is compatible with lake health and available to future generations.	Promote responsible boating by allowing reasonable access to the lakes, ensuring that proper boat launch and other facilities are provided and discouraging informal boat launches. Pursue wake /motor boat management though federal government regulations.	Include safe boating and other recreational information in communications plan materials. Consider bylaws/ restrictions/ signage on motorized boats or OHVs in sensitive areas or at certain times of the day or year.	# of complaints received by SVs (inverse metric)	BAILS / SV, GOA (AEP)					
	Encourage responsible Off Highway Vehicle (OHV) use on public lands.			SV, County, GOA (AEP)					

GOAL	STRATEGIES	ACTIONs	METRIC	LEAD/ POTENTIAL PARTNERS	2019	2020	2021	2022	2023
	Work with AEP to conduct an inventory of the roads, OHV access and walking trails around the lakes and to identify areas where i) OHVs can be redirected to reduce sedimentation and disturbance to wildlife habitat and ii) where OHVs typically cross streams that could be mitigated by bridge development through the GOA's Keep Wheels out of Water campaign.								
The impact of climate change on Baptiste and Island lakes is understood.	Provide information to the community about opportunities to learn more about the potential impacts of climate change.			BAILS					
	Develop flood and drought mitigation strategies.			SV, County, AWC, GOA					
	Promote the FireSmart community program.								